



# BRIDGES GRADE 4 SUPPLEMENT

## CCSS Supplement Sets

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### Bridges Correlations to Common Core State Standards, Grade 4

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## **Bridges in Mathematics Grade 4 Supplement**

Common Core State Standards Sets

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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# Bridges in Mathematics Grade 4 Supplement

## Common Core State Standards Sets

### Introduction

The *Bridges Grade Four Supplement* is a collection of activities written to help teachers address the Common Core State Standards published in 2010. These materials are available for free as downloadable files on The Math Learning Center Web site at [www.gotomlc.org/ccss](http://www.gotomlc.org/ccss). This supplement will continue to be refined and subsequent versions will also be available online at no charge.

The activities included here are designed to be used in place of selected sessions in *Bridges Grade Four* starting near the beginning of Unit Two. All of the activities are listed on pages 2–5 in the order in which they appear in the Supplement. They are listed in recommended teaching order on pages 6–9. On pages 11–22, you'll also find a set of sheets designed to replace the Planning Guides found at the beginning of Units 2, 3, 4, 5, and 6 in the *Bridges Teacher's Guides*. These sheets show exactly how the Supplement activities fit into the flow of instruction. We suggest you insert these sheets into your *Bridges* guides so you can see at a glance when to teach the Supplement activities through the school year.

The majority of activities and worksheets in this supplement come in sets of three or more, providing several in-depth experiences around a particular grade level expectation or cluster of expectations. Many of the activities will take an hour of instructional time, though some are shorter, requiring 30–45 minutes.

Almost all of the activities are hands-on and require various math manipulatives and/or common classroom supplies. The blacklines needed to make any overheads, game materials, and/or student sheets are included after each activity. Some of the supplement sets in this collection include independent worksheets, designed to be completed by students in class or assigned as homework after related activities. See pages 23 & 24 for a complete list of materials required to teach the activities in each Supplement set.

**Note** Fourth grade standards not listed on pages 2–5 are adequately addressed in *Bridges* and/or *Number Corner* sessions. For a full correlation of *Bridges* Grade Four to the Common Core State Standards, see pages i–xiv.

## Activities & Common Core State Standards

(Activities Listed in Order of Appearance in the Supplement)

SET A3 NUMBER & OPERATIONS: PLACE VALUE TO MILLIONS		
Page	Name	Common Core State Standards
A3.1	Activity 1: Target Five	4.NBT 1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. 4.NBT 2. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using $>$ , $=$ , and $<$ symbols to record the results of comparisons.
A3.5	Activity 2: Charting One Million	
A3.9	Activity 3: Millions of Sport Spectators	
A3.15	Independent Worksheet 1: The Dodgers & the Yankees	
A3.19	Independent Worksheet 2: Big Numbers	
A3.21	Independent Worksheet 3: Another Look at Big Numbers	

SET A4 NUMBER & OPERATIONS: ESTIMATING TO MULTIPLY & DIVIDE		
Page	Name	Common Core State Standards
A4.1	Independent Worksheet 1: Using Compatible Numbers	4.OA 3c. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. 4.NBT 3. Use place value understanding to round multi-digit whole numbers to any place. 4.NBT 5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. 4.NBT 6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.
A4.3	Independent Worksheet 2: More Compatible Numbers	
A4.5	Independent Worksheet 3: Reasonable Estimates	

## Activities &amp; Common Core State Standards (cont.)

SET A5 NUMBER & OPERATIONS: MULTI-DIGIT MULTIPLICATION		
Page	Name	Common Core State Standards
A5.1	Activity 1: Multi-Digit Multiplication Pre-Assessment	<p>4.OA 3a. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted.</p> <p>4.OA 3c. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.</p> <p>4.NBT 1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.</p> <p>4.NBT 5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations.</p> <p>4.MD 2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.</p> <p>4.MD 3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems.</p>
A5.17	Activity 2: Multiplying by 10, 100, and 1000	
A5.23	Activity 3: Multiplying Single Digits by Multiples of Ten	
A5.29	Activity 4: Single-Digit Multiplication with Pictures and Numbers	
A5.35	Activity 5: Introducing the Standard Multiplication Algorithm	
A5.39	Activity 6: Think before You Multiply	
A5.45	Activity 7: Splat!	
A5.55	Activity 8: Sketching Arrays & Partial Products	
A5.61	Activity 9: Double-Digit Multiplication with Pictures and Numbers	
A5.67	Activity 10: Multiplication Menus	
A5.73	Activity 11: Introducing a Two-Part Area Model	
A5.81	Activity 12: Extending the Standard Multiplication Algorithm	
A5.87	Activity 13: Reviewing and Evaluating Multiplication Strategies	
A5.95	Activity 14: Multi-Digit Multiplication Post-Assessment	
A5.105	Independent Worksheet 1: More Practice Multiplying by 10, 100, and 1000	
A5.107	Independent Worksheet 2: More Tens, Hundreds, and Thousands	
A5.109	Independent Worksheet 3: Double-Digit by Single-Digit Multiplication	
A5.111	Independent Worksheet 4: Using the Standard Algorithm for 2-Digit by 1-Digit Multiplication	
A5.113	Independent Worksheet 5: Choose Your Strategy	
A5.115	Independent Worksheet 6: Multiplying Multiples of 10 and More	
A5.117	Independent Worksheet 7: Using 4 Partial Products to Multiply 2-Digit Numbers	
A5.119	Independent Worksheet 8: More Multiplication Menus	
A5.121	Independent Worksheet 9: Pine Cones and School Supplies	

SET A6 NUMBER & OPERATIONS: FRACTIONS & MIXED NUMBERS		
Page	Name	Common Core State Standards
A6.1	Activity 1: Fractions & Mixed Numbers	<p>4.OA 4a. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors.</p> <p>4.NF 1. Explain why a fraction <math>a/b</math> is equivalent to a fraction <math>(n \times a)/(n \times b)</math> by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.</p> <p>4.NF 2. Compare two fractions with different numerators and different denominators.</p> <p>4.NF 3. Understand a fraction <math>a/b</math> with <math>a &gt; 1</math> as a sum of fractions <math>1/b</math>.</p> <p>4.NF 3d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.</p>
A6.7	Activity 2: Simplify & Compare	

## Activities &amp; Common Core State Standards (cont.)

**SET A9 NUMBER & OPERATIONS: ADDING & SUBTRACTING FRACTIONS**

Page	Name	Common Core State Standards
A9.1	Independent Worksheet 1: Fractions through the School Day	4.NF 3. Understand a fraction $a/b$ with $a > 1$ as a sum of fractions $1/b$ . 4.NF 3c. Add and subtract mixed numbers with like denominators. 4.NF 3d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.
A9.5	Independent Worksheet 2: Fractions on the Trail	
A9.9	Independent Worksheet 3: Adding & Subtracting Fractions	

**SET B1 ALGEBRA: EQUATIONS & OPERATIONS**

Page	Name	Common Core State Standards
B1.1	Activity 1: Bowling for Equations	4.OA 3. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these multistep word problems posed with whole numbers using equations with a letter standing for the unknown quantity
B1.6	Activity 2: Order of Operations	
B1.13	Activity 3: Variables & Expressions	
B1.21	Activity 4: Writing & Solving Equations	
B1.31	Independent Worksheet 1: Bowling for Equations	
B1.33	Independent Worksheet 2: Expressions, Variables & Situations	
B1.35	Independent Worksheet 3: Solving & Writing Equations	

**SET C1 GEOMETRY: PARALLEL, PERPENDICULAR & INTERSECTING**

Page	Name	Common Core State Standards
C1.1	Activity 1: Dots & Lines	4.G 1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
C1.9	Independent Worksheet 1: Lines & Designs	
C1.11	Independent Worksheet 2: Alphabet Lines	

**SET C2 GEOMETRY: 2- AND 3-D SHAPES**

Page	Name	Common Core State Standards
C2.1	Independent Worksheet 1: Analyzing Quadrilaterals & Drawing Figures	4.G 1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. 4.G 2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.
C2.5	Independent Worksheet 2: Quadrilaterals & Transformations	
C2.9	Independent Worksheet 3: Nets & Quadrilaterals	
C2.11	Independent Worksheet 4: Illustrating Paths & Angles	

**SET C3 GEOMETRY: CIRCLES & ANGLES**

Page	Name	Common Core State Standards
C3.1	Activity 1: Pattern Block Angles	4.MD 5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement. 4.MD 6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. 4.G 1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. 4.G 2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.
C3.7	Activity 2: Human Angles	
C3.13	Activity 3: Measuring Circles	
C3.21	Independent Worksheet 1: Measuring Interior Angles of Polygons	
C3.23	Independent Worksheet 2: Angles in the Classroom	
C3.25	Independent Worksheet 3: Drawing Polygons	
C3.27	Independent Worksheet 4: Drawing Angles of Rotation	
C3.29	Independent Worksheet 5: Drawing & Measuring Circles	

## Activities &amp; Common Core State Standards (cont.)

SET D1 MEASUREMENT: WEIGHT & MASS		
Page	Name	Common Core State Standards
D1.1	Activity 1: The Bread Dough Dilemma	4.MD 1a. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. 4.MD 2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.
D1.5	Activity 2: Estimate, Measure & Compare the Mass	
D1.11	Activity 3: No Screamin' Over Ice Cream	
D1.15	Activity 4: The Sack of Groceries	
D1.19	Activity 5: Kitten & Cat Weights	
D1.21	Activity 6: Line Them Up by Weight	

SET D3 MEASUREMENT: CAPACITY IN METRIC UNITS		
Page	Name	Common Core State Standards
D3.1	Activity 1: Estimate, Order & Measure: Milliliters & Liters	4.MD 1a. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. 4.MD 2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.
D3.5	Activity 2: Which Container is Best?	
D3.9	Independent Worksheet 1: Capacity in Daily Life	

SET D6 MEASUREMENT: AREA & PERIMETER		
Page	Name	Common Core State Standards
D6.1	Activity 1: Measuring Area	4.MD 3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems.
D6.9	Activity 2: Measuring Perimeter	
D6.15	Activity 3: The Ladybug's Garden	
D6.21	Activity 4: Hexarights	
D6.29	Independent Worksheet 1: Area & Perimeter Review	
D6.33	Independent Worksheet 2: Measuring Rectangles	

SET D9 MEASUREMENT: AREA OF POLYGONS		
Page	Name	Common Core State Standards
D9.1	Activity 1: Area of Parallelograms, Part 1	4.MD 3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. 4.G 2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.
D9.9	Activity 2: Area of Parallelograms, Part 2	
D9.19	Activity 3: Area of Right Triangles	
D9.25	Activity 4: Polygons to Order	
D9.31	Independent Worksheet 1: Geoboard Polygons	
D9.33	Independent Worksheet 2: Finding Perimeter & Area of Quadrilaterals	
D9.35	Independent Worksheet 3: Finding the Area of Right Triangles	
D9.37	Independent Worksheet 4: Rectangles, Parallelograms, and Right Triangles	

## Activities & Recommended Timings

(Activities Listed in Recommended Teaching Order)

REPLACE AND ADD TO SELECTED SESSIONS IN BRIDGES, UNIT 2			
Page	Set, Strand & Topic	Name	Recommended Timing
A3.1	Set A3 Number & Operations: Place Value to Millions	Activity 1: Target Five	Replaces Unit 2, Session 1 (Inserted between Sessions 5 & 6 in Unit 2)
A3.5	Set A3 Number & Operations: Place Value to Millions	Activity 2: Charting One Million	Replaces Unit 2, Session 2 (Inserted after Set A3, Activity 1)
A3.9	Set A3 Number & Operations: Place Value to Millions	Activity 3: Millions of Sport Spectators	Inserted after Set A3, Activity 2
A3.15	Set A3 Number & Operations: Place Value to Millions	Independent Worksheet 1: The Dodgers & the Yankees	Inserted as homework after Set A3, Activity 3
A3.19	Set A3 Number & Operations: Place Value to Millions	Independent Worksheet 2: Big Numbers	Inserted as homework Unit 2, Session 8
A3.21	Set A3 Number & Operations: Place Value to Millions	Independent Worksheet 3: Another Look at Big Numbers	Inserted as homework Unit 2, Session 11
D6.1	Set D6 Measurement: Area & Perimeter	Activity 1: Measuring Area	Replaces Unit 2, Session 17 (Appears at the end of Unit 2)
D6.9	Set D6 Measurement: Area & Perimeter	Activity 2: Measuring Perimeter	Replaces Unit 2, Session 18 (Appears after Set D6, Activity 1)
D6.15	Set D6 Measurement: Area & Perimeter	Activity 3: The Ladybug's Garden	Inserted after Set D6, Activity 2
D6.29	Set D6 Measurement: Area & Perimeter	Independent Worksheet 1: Area & Perimeter Review	Inserted as homework after Set D6, Activity 3
D6.21	Set D6 Measurement: Area & Perimeter	Activity 4: Hexarights	Inserted after Set D6, Activity 3
D6.33	Set D6 Measurement: Area & Perimeter	Independent Worksheet 2: Measuring Rectangles	Inserted as homework after Set D6, Activity 4

REPLACE AND ADD TO SELECTED SESSIONS IN BRIDGES, UNIT 3			
Page	Set, Strand & Topic	Name	Recommended Timing
A9.1	Set A9 Number & Operations: Adding & Subtracting Fractions	Independent Worksheet 1: Fractions through the School Day	Inserted between Sessions 11 and 12 in Unit 3 as a whole class lesson
A9.5	Set A9 Number & Operations: Adding & Subtracting Fractions	Independent Worksheet 2: Fractions on the Trail	Inserted as homework after Unit 3, Session 13
A9.9	Set A9 Number & Operations: Adding & Subtracting Fractions	Independent Worksheet 3: Adding & Subtracting Fractions	Inserted as homework after Unit 3, Session 15
D1.1	Set D1 Measurement: Weight & Mass	Activity 1: The Bread Dough Dilemma	Inserted after Unit 3, Session 20
D1.5	Set D1 Measurement: Weight & Mass	Activity 2: Estimate, Measure & Compare the Mass	Inserted after Set D1, Activity 1
D1.11	Set D1 Measurement: Weight & Mass	Activity 3: No Screamin' Over Ice Cream	Inserted after Set D1, Activity 2
D1.15	Set D1 Measurement: Weight & Mass	Activity 4: The Sack of Groceries	Inserted after Set D1, Activity 3
D1.19	Set D1 Measurement: Weight & Mass	Activity 5: Kitten & Cat Weights	Inserted after Set D1, Activity 4
D1.21	Set D1 Measurement: Weight & Mass	Activity 6: Line Them Up by Weight	Inserted after Set D1, Activity 5



## Activities &amp; Recommended Timings (cont.)

<b>REPLACE AND ADD TO SELECTED SESSIONS IN BRIDGES, UNIT 4</b>			
<b>Page</b>	<b>Set, Strand &amp; Topic</b>	<b>Name</b>	<b>Recommended Timing</b>
C3.1	Set C3 Geometry: Circles & Angles	Activity 1: Pattern Block Angles	Replaces Unit 4, Session 13 (Inserted between Sessions 4 and 5 in Unit 4)
C3.21	Set C3 Geometry: Circles & Angles	Independent Worksheet 1: Measuring Interior Angles of Polygons	Inserted as homework after Set C3, Act. 1
C3.7	Set C3 Geometry: Circles & Angles	Activity 2: Human Angles	Replaces Unit 4, Session 14 (Inserted after Set C3, Activity 1)
C3.23	Set C3 Geometry: Circles & Angles	Independent Worksheet 2: Angles in the Classroom	Inserted as homework after Set C3, Act. 2
C3.13	Set C3 Geometry: Circles & Angles	Activity 3: Measuring Circles	Replaces Unit 4, Session 15 (Inserted after Set C3, Activity 2)
C3.25	Set C3 Geometry: Circles & Angles	Independent Worksheet 3: Drawing Polygons	Inserted as homework after Set C3, Act. 3
C1.1	Set C1 Geometry: Parallel, Perpendicular, and Intersecting	Activity 1: Dots & Lines	Replaces Unit 4, Session 16 (Inserted after Set C3, Activity 3)
C1.9	Set C1 Geometry: Parallel, Perpendicular, and Intersecting	Independent Worksheet 1: Lines & Designs	Inserted as homework after Set C1, Activity 1
C1.11	Set C1 Geometry: Parallel, Perpendicular, and Intersecting	Independent Worksheet 2: Alphabet Lines	Inserted as homework after Unit 4, Session 4
C3.27	Set C3 Geometry: Circles & Angles	Independent Worksheet 4: Drawing Angles of Rotation	Inserted as homework after Unit 4, Session 8
C3.29	Set C3 Geometry: Circles & Angles	Independent Worksheet 5: Drawing & Measuring Circles	Inserted as homework after Unit 4, Session 11
D9.1	Set D9 Measurement: Area of Polygons	Activity 1: Area of Parallelograms, Part 1	Replaces Unit 4, Session 17
C2.1	Set C2 Geometry: 2- and 3-D Shapes	Independent Worksheet 1: Analyzing Quadrilaterals and Drawing Figures	Inserted as homework after Set D9, Activity 1
D9.9	Set D9 Measurement: Area of Polygons	Activity 2: Area of Parallelograms, Part 2	Replaces Unit 4, Session 18
C2.5	Set C2 Geometry: 2- and 3-D Shapes	Independent Worksheet 2: Quadrilaterals and Transformations	Inserted as homework after Set D9, Activity 2
D9.19	Set D9 Measurement: Area of Polygons	Activity 3: Area of Right Triangles	Replaces Unit 4, Session 19
C2.9	Set C2 Geometry: 2- and 3-D Shapes	Independent Worksheet 3: Nets & Quadrilaterals	Inserted as homework after Set D9, Activity 3
D9.25	Set D9 Measurement: Area of Polygons	Activity 4: Polygons to Order	Replaces Unit 4, Session 20
C2.11	Set C2 Geometry: 2- and 3-D Shapes	Independent Worksheet 4: Illustrating Paths & Angles	Inserted as homework after Set D9, Activity 4
D9.25	Set D9 Measurement: Area of Polygons	Independent Worksheet 1: Geoboard Polygons	Inserted as homework after Unit 4, Session 21

<b>REPLACE PROBLEM SOLVING WORKOUTS IN MARCH NUMBER CORNER</b>			
<b>Page</b>	<b>Set, Strand &amp; Topic</b>	<b>Name</b>	<b>Recommended Timing</b>
D3.1	Set D3 Measurement: Capacity in Metric Units	Activity 1: Estimate, Order & Measure: Milliliters & Liters	Replaces one of the Problem Solving workouts in March Number Corner
D3.5	Set D3 Measurement: Capacity in Metric Units	Activity 2: Which Container is Best?	Replaces another one of the Problem Solving workouts in March Number Corner
D3.9	Set D3 Measurement: Capacity in Metric Units	Independent Worksheet 1: Capacity in Daily Life	Assign as homework after most students have had a chance to do Set D3, Activities 1 & 2.

## Activities &amp; Recommended Timings (cont.)

REPLACE ALL SESSIONS IN BRIDGES, UNIT 5			
Page	Set, Strand & Topic	Name	Recommended Timing
A5.1	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 1: Multi-Digit Multiplication Pre-Assessment	Replaces Unit 5, Session 1
D9.33	Set D9 Measurement: Area of Polygons	Independent Worksheet 2: Finding Perimeter & Area of Quadrilaterals	Inserted as homework after Set A5, Activity 1
A5.17	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 2: Multiplying by 10, 100, and 1000	Replaces Unit 5, Session 2
A5.105	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 1: More Practice Multiplying by 10, 100, and 1000	Inserted as homework after Set A5, Activity 2
A5.23	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 3: Multiplying Single Digits by Multiples of Ten	Replaces Unit 5, Session 3
A5.107	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 2: More Tens, Hundreds, and Thousands	Inserted as homework after Set A5, Activity 3
A5.29	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 4: Single-Digit Multiplication with Pictures and Numbers	Replaces Unit 5, Session 4
A5.109	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 3: Double-Digit by Single-Digit Multiplication	Inserted as homework after Set A5, Activity 4
A5.35	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 5: Introducing the Standard Multiplication Algorithm	Replaces Unit 5, Session 5
A5.111	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 4: Using the Standard Algorithm for 2-Digit by 1-Digit Multiplication	Inserted as homework after Set A5, Activity 5
A5.39	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 6: Think before You Multiply	Replaces Unit 5, Session 6
A5.113	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 5: Choose Your Strategy	Inserted as homework after Set A5, Activity 6
A5.45	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 7: Splat!	Replaces Unit 5, Session 7
D9.35	Set D9 Measurement: Area of Polygons	Independent Worksheet 3: Finding the Area of Right Triangles	Inserted as homework after Set A5, Activity 7
A5.55	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 8: Sketching Arrays & Partial Products	Replaces Unit 5, Session 8
A5.115	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 6: Multiplying Multiples of 10 and More	Inserted as homework after Set A5, Activity 8
A5.61	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 9: Double-Digit Multiplication with Pictures and Numbers	Replaces Unit 5, Session 9
A5.117	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 7: Using 4 Partial Products to Multiply 2-Digit Numbers	Inserted as homework after Set A5, Activity 9
A5.67	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 10: Multiplication Menus	Replaces Unit 5, Session 10
A5.119	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 8: More Multiplication Menus	Inserted as homework after Set A5, Activity 10
A5.73	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 11: Introducing a Two-Part Area Model	Replaces Unit 5, Session 11
D9.37	Set D9 Measurement: Area of Polygons	Independent Worksheet 4: Rectangles, Parallelograms, and Right Triangles	Inserted as homework after Set A5, Activity 11
A5.81	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 12: Extending the Standard Multiplication Algorithm	Replaces Unit 5, Session 12

## Activities &amp; Recommended Timings (cont.)

<b>REPLACE ALL SESSIONS IN BRIDGES, UNIT 5</b>			
<b>Page</b>	<b>Set, Strand &amp; Topic</b>	<b>Name</b>	<b>Recommended Timing</b>
A5.121	Set A5 Number & Operations: Multi-Digit Multiplication	Independent Worksheet 9: Pine Cones and School Supplies	Inserted as homework after Set A5, Activity 12
A5.87	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 13: Reviewing and Evaluating Multiplication Strategies	Replaces Unit 5, Session 13
A5.95	Set A5 Number & Operations: Multi-Digit Multiplication	Activity 14: Multi-Digit Multiplication Post-Assessment	Replaces Unit 5, Session 14
A4.1	Set A4 Number & Operations: Estimating to Multiply & Divide	Independent Worksheet 1: Using Compatible Numbers	Inserted as homework after Set A5, Activity 14
B1.1	Set B1 Algebra: Equations & Operations	Activity 1: Bowling for Equations	Replaces Unit 5, Session 15
B1.6	Set B1 Algebra: Equations & Operations	Activity 2: Order of Operations	Replaces Unit 5, Session 16
B1.31	Set B1 Algebra: Equations & Operations	Independent Worksheet 1: Bowling for Equations	Inserted as homework after Set B1, Activity 2
B1.13	Set B1 Algebra: Equations & Operations	Activity 3: Variables & Expressions	Replaces Unit 5, Session 17
B1.33	Set B1 Algebra: Equations & Operations	Independent Worksheet 2: Expressions, Variables & Situations	Inserted as homework after Set B1, Activity 3
B1.21	Set B1 Algebra: Equations & Operations	Activity 4: Writing & Solving Equations	Replaces Unit 5, Session 18
B1.35	Set B1 Algebra: Equations & Operations	Independent Worksheet 3: Solving & Writing Equations	Inserted as homework after Set B1, Activity 4

<b>REPLACE SELECTED SESSIONS IN BRIDGES, UNIT 6</b>			
<b>Page</b>	<b>Set, Strand &amp; Topic</b>	<b>Name</b>	<b>Recommended Timing</b>
A4.1	Set A4 Number & Operations: Estimating to Multiply & Divide	Independent Worksheet 1: Using Compatible Numbers	Inserted as homework after Unit 6, Session 1
A4.3	Set A4 Number & Operations: Estimating to Multiply & Divide	Independent Worksheet 2: More Compatible Numbers	Inserted as homework after Unit 6, Session 3
A6.1	Set A6 Number & Operations: Fractions & Mixed Numbers	Activity 1: Fractions & Mixed Numbers	Replaces Unit 6, Session 5
A4.5	Set A4 Number & Operations: Estimating to Multiply & Divide	Independent Worksheet 3: Reasonable Estimates	Inserted as homework after Set A6, Activity 1
A6.7	Set A6 Number & Operations: Fractions & Mixed Numbers	Activity 2: Simplify & Compare	Replaces Unit 6, Session 5



## Unit Two Planner (Bridges & CCSS Grade 4 Supp. Sets A3 & D6)

SESSION 3	SESSION 4	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT
<p><b>Problems &amp; Investigations</b> Metric Measuring</p> <p><b>Note</b> Sessions 1 &amp; 2 have been omitted to make room for Supplement activities.</p>	<p><b>Problems &amp; Investigations</b> The Great Wall of Base Ten</p> <p><b>Home Connection 12</b> Measuring in Centimeters</p>	<p><b>Supplement Set A3</b> <b>Number &amp; Operations: Place Value to Millions</b> Activity 1: Target Five</p>	<p><b>Supplement Set A3</b> <b>Number &amp; Operations: Place Value to Millions</b> Activity 2: Charting One Million</p>	<p><b>Supplement Set A3</b> <b>Number &amp; Operations: Place Value to Millions</b> Activity 3: Millions of Sports Spectators</p> <p><b>Home Connection</b> <b>Supp Set A3 Ind. Worksheet 1: The Dodgers &amp; the Yankees</b></p>
SESSION 5	SESSION 6	SESSION 7	SESSION 8	SESSION 9
<p><b>Problems &amp; Investigations</b> Metric Units of Linear &amp; Area Measurement</p> <p><b>Assessment</b> Unit Two Pre-Assessment</p>	<p><b>Problems &amp; Investigations</b> Multiplying by 10</p> <p><b>Home Connection 13</b> Multiplying by Ten</p>	<p><b>Problems &amp; Investigations</b> Building Multiplication Arrays, Part 1 of 2</p>	<p><b>Problems &amp; Investigations</b> Building Multiplication Arrays, Part 2 of 2</p> <p><b>Home Connection</b> <b>Supp Set A3 Ind. Worksheet 2: Big Numbers</b></p>	<p><b>Problems &amp; Investigations</b> Sketching Multiplication Arrays</p> <p><b>Home Connection 14</b> Spin &amp; Multiply</p>
SESSION 10	SESSION 11	SESSION 12	SESSION 13	SESSION 14
<p><b>Problems &amp; Investigations</b> Skeleton Arrays</p>	<p><b>Problems &amp; Investigations</b> Quick Sketches &amp; Strategies</p> <p><b>Home Connection</b> <b>Supp Set A3 Ind. Worksheet 3: Another Look at Big Numbers</b></p>	<p><b>Problems &amp; Investigations</b> Once Upon a Dime</p>	<p><b>Problems &amp; Investigations</b> Moolah on My Mind</p> <p><b>Home Connection 15</b> Coins &amp; Arrays</p>	<p><b>Problems &amp; Investigations</b> Another Look at Multiplication Strategies</p> <p><b>Work Sample</b></p>
SESSION 15	SESSION 16	SESSION 19	SESSION 20	SESSION 21
<p><b>Problems &amp; Investigations</b> More or Less Multiplication</p> <p><b>Home Connection 16</b> Design a Floor Pattern</p>	<p><b>Work Places</b> Work Places 2A, 2B, &amp; 2C</p> <p><b>Note</b> Sessions 17 &amp; 18 have been omitted to make room Supplement activities.</p>	<p><b>Problems &amp; Investigations</b> What Makes a Good Story Problem?</p> <p><b>Work Sample</b></p> <p><b>Home Connection 18</b> Moolah on My Mind</p>	<p><b>Problems &amp; Investigations</b> What Makes a Good Solution?</p>	<p><b>Assessment</b> Unit Two Post-Assessment</p>
SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	
<p><b>Supplement Set D6</b> <b>Measurement: Area &amp; Perimeter</b> Activity 1: Measuring Area</p>	<p><b>Supplement Set D6</b> <b>Measurement: Area &amp; Perimeter</b> Activity 2: Measuring Perimeter</p>	<p><b>Supplement Set D6</b> <b>Measurement: Area &amp; Perimeter</b> Activity 3: The Ladybugs' Garden</p> <p><b>Home Connection</b> <b>Supp Set D6 Ind. Worksheet 1: Area &amp; Perimeter Review</b></p>	<p><b>Supplement Set D6</b> <b>Measurement: Area &amp; Perimeter</b> Activity 4: Hexarights</p> <p><b>Home Connection</b> <b>Supp Set D6 Ind. Worksheet 2: Measuring Rectangles</b></p>	



## Unit Three Planner (Bridges &amp; CCSS Grade 4 Supp. Sets A9 &amp; D1)

SESSION 1	SESSION 2	SESSION 3	SESSION 4	SESSION 5
<b>Problems &amp; Investigations</b> Exploring Halves  <b>Home Connection 19</b> Doubles & Halves	<b>Assessment</b> Unit Three Pre-Assessment	<b>Problems &amp; Investigations</b> Fractions of a Foot  <b>Home Connection 20</b> Comparing Fractions of a Foot	<b>Problems &amp; Investigations</b> Introduction to Egg Carton Fractions	<b>Problems &amp; Investigations</b> Exploring Egg Carton Fractions  <b>Home Connection 21</b> Modeling Egg Carton Fractions
SESSION 6	SESSION 7	SESSION 8	SESSION 9	SESSION 10
<b>Problems &amp; Investigations</b> Equivalent Egg Carton Fractions	<b>Problems &amp; Investigations</b> Egg Carton Fraction Posters  <b>Home Connection 22</b> Eggsplorations	<b>Problems &amp; Investigations</b> Combining Egg Carton Fractions	<b>Problems &amp; Investigations</b> Fractions on a Clock  <b>Home Connection 23</b> Clock Fractions	<b>Work Places</b> 3A Dozens of Eggs 3B Fractions of a Foot Scavenger Hunt
SESSION 11	SUPPLEMENT	SESSION 12	SESSION 13	SESSION 14
<b>Problems &amp; Investigations</b> Colored Tile Fractions  <b>Work Places</b> 3C Colored Tile Fractions	<b>Supplement Set A9</b> <b>Number &amp; Operations: Adding &amp; Subtracting Fractions</b> Independent Worksheet 1, Fractions through the School Day (do this sheet as a whole group).	<b>Problems &amp; Investigations</b> A Remainder of One  <b>Home Connection 24</b> Fractions in the Kitchen	<b>Problems &amp; Investigations</b> What Can You Do with the Remainder?  <b>Work Sample</b>  <b>Home Connection Supplement Set A9, Ind. Worksheet 2:</b> Fractions on the Trail	<b>Problems &amp; Investigations</b> Remainders Win  <b>Home Connection 25</b> Fractions of a Foot Scavenger Hunt
SESSION 15	SESSION 16	SESSION 17	SESSION 18	SESSION 19
<b>Problems &amp; Investigations</b> Line 'Em Up!  <b>Work Places</b> 3D Remainders Win 3E Line 'Em Up!  <b>Home Connection Supplement Set A9, Ind. Worksheet 3:</b> Adding & Subtracting Fractions	<b>Work Places</b> Work Places 3D & 3E  <b>Home Connection 26</b> Remainders Win	<b>Problems &amp; Investigations</b> Larger Division with Money  <b>Work Sample</b>	<b>Problems &amp; Investigations</b> Larger Division with Base Ten Pieces  <b>Home Connection 27</b> Fraction Stories	<b>Problems &amp; Investigations</b> Dividing Larger Numbers: The 120 Series





Unit Three Planner (Bridges & CCSS Grade 4 Supp. Sets A9 & D1) (cont.)

SESSION 20	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT
<p><b>Assessment</b> Unit Three Post-Assessment</p>	<p><b>Supplement Set D1 Measurement: Weight &amp; Mass</b> Activity 1: The Bread Dough Dilemma</p>	<p><b>Supplement Set D1 Measurement: Weight &amp; Mass</b> Activity 2: Estimate, Measure &amp; Compare the Mass</p> <p><b>Note:</b> Introduce this activity as a Work Place. Then run the rest of the math period as a Work Places Session in which students choose from Work Places 3C, 3D, 3E, and Estimate, Measure &amp; Compare the Mass.</p>	<p><b>Supplement Set D1 Measurement: Weight &amp; Mass</b> Activity 3: No Screamin' over Ice Cream</p> <p><b>Note:</b> Introduce this activity as a Work Place. Then run the rest of the math period as a Work Places Session in which students choose from Work Places 3C, 3D, 3E, Estimate, Measure &amp; Compare the Mass, and No Screamin' over Ice Cream</p>	<p><b>Supplement Set D1 Measurement: Weight &amp; Mass</b> Activity 4: The Sack of Groceries</p>
SUPPLEMENT				
<p><b>Supplement Set D1 Measurement: Weight &amp; Mass</b> Activities 5 &amp; 6: Kitten &amp; Cat Weights and Line Them up by Weight</p> <p><b>Note:</b> Introduce one or both of these activities as Work Places. Then run the rest of the math period as a Work Places Session in which students choose from Work Places 3C, 3D, 3E, and all the mass and weight Work Places you have introduced over the past few sessions.</p>				



## Unit Four Planner (Bridges & CCSS Grade 4 Supp. Sets C1, C2, C3 & D9)

SESSION 1	SESSION 2	SESSION 3	SUPPLEMENT	SUPPLEMENT
<b>Problems &amp; Investigations</b> Types of Angles	<b>Problems &amp; Investigations</b> Paper Folding  <b>Home Connection 29</b> Clock Making Puzzle	<b>Assessment</b> Unit Four Pre-Assessment	<b>Supplement Set C3 Geometry: Circles &amp; Angles</b> Activity 1: Pattern Block Angles  <b>Home Connection Supplement Set C3, Ind. Worksheet 1:</b> Measuring Interior Angles of Polygons	<b>Supplement Set C3 Geometry: Circles &amp; Angles</b> Activity 2: Human Angles  <b>Home Connection Supplement Set C3, Ind. Worksheet 2:</b> Angles in the Classroom (Ask students to complete the assignment with objects at home instead of in the classroom.)
SUPPLEMENT	SUPPLEMENT	SESSION 4	SESSION 5	SESSION 6
<b>Supplement Set C3 Geometry: Circles &amp; Angles</b> Activity 3: Measuring Circles  <b>Home Connection Supplement Set C3, Ind. Worksheet 3:</b> Drawing Polygons	<b>Supplement Set C1 Geometry: Parallel, Perpendicular, and Intersecting</b> Activity 1: Dots & Lines  <b>Home Connection Supp Set C1, Ind. Worksheet 1:</b> Lines & Designs	<b>Problems &amp; Investigations</b> Coordinate Grids  <b>Home Connection Supp Set C1, Ind. Worksheet 2:</b> Alphabet Lines	<b>Problems &amp; Investigations</b> Reflections  <b>Work Sample</b>	<b>Problems &amp; Investigations</b> Translations
SESSION 7	SESSION 8	SESSION 9	SESSION 10	SESSION 11
<b>Problems &amp; Investigations</b> Congruent Figures  <b>Work Sample</b>  <b>Home Connection 30</b> Drawing 2-Dimensional Figures	<b>Problems &amp; Investigations</b> Rotational Symmetry  <b>Work Sample</b>  <b>Home Connection Supplement Set C3, Ind. Worksheet 4:</b> Drawing Angles of Rotation	<b>Problems &amp; Investigations</b> Pattern Block Symmetry  <b>Home Connection 31</b> Plotting Points	<b>Problems &amp; Investigations</b> Introducing Missouri Squares & Area Bingo  <b>Work Places</b> 4A Missouri Squares 4B Area Bingo	<b>Work Places</b> Work Places 4A & 4B  <b>Home Connection Supplement Set C3, Ind. Worksheet 5:</b> Drawing & Measuring Circles
SESSION 12	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT
<b>Problems &amp; Investigations</b> Introducing the Mosaic Game  <b>Work Places</b> 4C Mosaic Game  <b>Home Connection 35</b> Letter Symmetry	<b>Supplement Set D9 Measurement: Area of Polygons</b> Activity 1: Area of Parallelograms, Part 1  <b>Home Connection Supp Set C2 Ind. Worksheet 1:</b> Analyzing Quadrilaterals & Drawing Figures	<b>Supplement Set D9 Measurement: Area of Polygons</b> Activity 2: Area of Parallelograms, Part 2  <b>Home Connection Supp Set C2 Ind. Worksheet 2:</b> Quadrilaterals & Transformations	<b>Supplement Set D9 Measurement: Area of Polygons</b> Activity 3: Area of Right Triangles  <b>Home Connection Supp Set C2 Ind. Worksheet 3:</b> Nets & Quadrilaterals	<b>Supplement Set D9 Measurement: Area of Polygons</b> Activity 4: Polygons to Order  <b>Home Connection Supp Set C2 Ind. Worksheet 4:</b> Illustrating Paths & Angles
SESSION 21				
<b>Assessment</b> Unit Four Post-Assessment				
<b>Supp Set D9 Ind. Worksheet 1:</b> Geoboard Polygons				



## Unit Five Planner (CCSS Grade 4 Supp. Sets A5, B1, D3 & D9)

**Reminder:** Introduce Activities 1 & 2 from Supplement Set D3, Capacity in Metric Units, in place of two of the Problem Solving workouts during Number Corner in March. Set up the materials for both activities somewhere in the room so that each student can complete them sometime in March or April. Once most students have had a chance to do these activities, assign Independent Worksheet 1 as homework.

SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT
<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 1: Multi-Digit Multiplication Pre-Assessment  <b>Home Connection</b> <b>Supp Set D9 Ind. Worksheet 2:</b> Finding Perimeter & Area of Quadrilaterals	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 2: Multiplying by 10, 100, and 1000  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 1:</b> More Practice Multiplying by 10, 100, and 1000	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 3: Multiplying Single Digits by Multiples of 10  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 2:</b> More Tens, Hundreds, and Thousands	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 4: Single-Digit Multiplication with Pictures and Numbers  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 3:</b> Double-Digit by Single-Digit Multiplication	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 5: Introducing the Standard Algorithm  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 4:</b> Using the Standard Algorithm for 2-Digit by 1-Digit Multiplication
SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT
<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 6: Think before You Multiply  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 5:</b> Choose Your Strategy	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 7: Splat!  <b>Home Connection</b> <b>Supp Set D9 Ind. Worksheet 3:</b> Finding the Area of Right Triangles	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 8: Sketching Arrays & Partial Products  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 6:</b> Multiplying Multiples of Ten and More	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 9: Double-Digit Multiplication with Pictures and Numbers  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 7:</b> Using Four Partial Products	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 10: Multiplication Menus  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 8:</b> More Multiplication Menus
SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT
<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 11: Introducing a Two-Part Area Model  <b>Home Connection</b> <b>Supp Set D9 Ind. Worksheet 4:</b> Rectangles, Parallelograms & Right Triangles	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 12: Extending the Standard Algorithm  <b>Home Connection</b> <b>Supp Set A5 Ind. Worksheet 9:</b> Pine Cones & School Supplies	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 13: Reviewing and Evaluating Multiplication Strategies	<b>Supplement Set A5</b> <b>Number &amp; Operations: Multi-Digit Multiplication</b> Activity 14: Multi-Digit Multiplication Post-Assessment  <b>Home Connection</b> <b>Supp Set A4 Ind. Worksheet 1:</b> Using Compatible Numbers	<b>Supplement Set B1</b> <b>Algebra: Equations &amp; Operations</b> Activity 1: Bowling for Equations
SUPPLEMENT	SUPPLEMENT	SUPPLEMENT		
<b>Supplement Set B1</b> <b>Algebra: Equations &amp; Operations</b> Activity 2: Order of Operations  <b>Home Connection</b> <b>Supp Set B1 Ind. Worksheet 1:</b> Bowling for Equations	<b>Supplement Set B1</b> <b>Algebra: Equations &amp; Operations</b> Activity 3: Variables & Expressions  <b>Home Connection</b> <b>Supp Set B1 Ind. Worksheet 2:</b> Expressions, Variables & Situations	<b>Supplement Set B1</b> <b>Algebra: Equations &amp; Operations</b> Activity 4: Writing & Solving Equations  <b>Home Connection</b> <b>Supp Set B1 Ind. Worksheet 3:</b> Solving & Writing Equations		



## Unit Six Planner (Bridges &amp; CCSS Grade 4 Supp. Sets A4 &amp; A6)

SESSION 1	SESSION 2	SESSION 3	SESSION 4	SUPPLEMENT
<b>Assessment</b> Unit Six Pre-Assessment & Geoboard Figures with an Area of 2	<b>Problems &amp; Investigations</b> Exploring Fractions on the Geoboard  <b>Home Connection 42</b> The Relationship between Multiplication & Division	<b>Problems &amp; Investigations</b> Revisiting & Recording Geoboard Discoveries  <b>Work Sample</b>  <b>Home Connection</b> <b>Supp Set A4 Ind. Worksheet 3:</b> Reasonable Estimates	<b>Problems &amp; Investigations</b> Shifting the Unit of Area on the Geoboard  <b>Work Sample</b>  <b>Home Connection 43</b> Fraction Relationships  <b>Note</b> Sessions 5–8 and Home Connections 44 & 45 have been omitted to make room for Supplement activities.	<b>Supplement Set A6</b> <b>Number &amp; Operations: Fractions &amp; Mixed Numbers</b> Activity 1: Fractions & Mixed Numbers
<b>Home Connection</b> <b>Supp Set A4 Ind. Worksheet 2:</b> More Compatible Numbers				
SUPPLEMENT	SESSION 9	SESSION 10	SESSION 11	SESSION 12
<b>Supplement Set A6</b> <b>Number &amp; Operations: Fractions &amp; Mixed Numbers</b> Activity 2: Simplify & Compare	<b>Problems &amp; Investigations</b> Introducing Decimal Numbers in Base Ten  <b>Work Sample</b>	<b>Problems &amp; Investigations</b> Comparing Decimal Numbers  <b>Work Sample</b>	<b>Problems &amp; Investigations</b> Decimal More or Less	<b>Problems &amp; Investigations</b> Using Money Models for Decimals
SESSION 13	SESSION 14	SESSION 15	SESSION 16	SESSION 17
<b>Problems &amp; Investigations</b> Decimal & Fraction Relationships  <b>Work Sample</b>  <b>Home Connection 46</b> Decimals Are Fractions	<b>Work Places</b> 6A Decimal More or Less 6B Fractions, Decimals & Dollars  <b>Home Connection 47</b> Money, Fraction & Decimal Showdown	<b>Problems &amp; Investigations</b> Adding Decimal Numbers  <b>Home Connection 48</b> Adding Money & Decimals	<b>Problems &amp; Investigations</b> Subtracting Decimal Numbers	<b>Problems &amp; Investigations</b> Adding & Subtracting Decimal Numbers  <b>Work Sample</b>  <b>Home Connection 49</b> Decimal Problems
SESSION 18	SESSION 19	SESSION 20	SESSION 21	SESSION 22
<b>Problems &amp; Investigations</b> Ordering Decimals on a Number Line	<b>Work Places</b> Work Places 6A & 6B 6C Round & Add Tenths	<b>Problems &amp; Investigations</b> Decimal Race to Three  <b>Work Places 6D</b> Decimal Race to Three	<b>Work Places</b> Work Places 6A–6D	<b>Assessment</b> Unit Six Post-Assessment





## Grade 4 CCSS Supplement Materials List

MANIPULATIVES	ITEM #	A3	A4	A5	A6	A9	B1	C1	C2	C3	D1	D3	D6	D9
Base 10 area pieces (class set)*	PGT			√		√								√
Base 10 linear pieces (class set)*	PLT			√										
Geoboards and bands (class set)*	GEOS2							√					√	√
Pattern Blocks (several sets)*	PPBT									√				
Dice (15 sets)*	D45NUM	√		√	√	√								
Game Markers (100)*	M100			√				√						
Single Transparent Spinner overlays (15)*	SPOHS			√		√								
Overhead double spinner overlay (1)*	SPOH-TEMP				√			√						
Overhead base ten area pieces (1 set)*	OH10			√		√								
Calculators (class set)	T101	√		√							√		Opt	
Balance Scales (4–6)	BAL										√			
Geoblocks (3 sets)*	GEOS2										√			
Measuring tapes (3 sets)*	MTC												√	
1-cup liquid measuring cup (1)*	QZ77											√		

\*All manipulatives available from Math Learning Center. Those items marked with an asterisk are included in the Grade 4 Bridges Grade Level Package.

GENERAL MATERIALS (PROVIDED BY THE TEACHER)	A3	A4	A5	A6	A9	B1	C1	C2	C3	D1	D3	D6	D9
Computers/Internet Access						Opt							
Overhead or document camera	√		√	√		√	√		√			√	√
Blank overhead transparencies if you are using an overhead projector rather than a doc camera	5		13	1		6	2		7			5	4
8.5" x 11" white copy paper, sheets per student	15	6	55	3	11	8	6	11	14	6	4	13	16
8.5" x 11" pastel copy paper, sheets per student			1										1
8.5" x 11" lined or grid paper, sheets per student	1		5			4							
9" x 12" and 12" x 18" construction paper				√								√	
12" x 18" newsprint													√
3" x 3" sticky notes						√							
6" x 9" manila or legal size envelopes (1 per student)				√									
Overhead pens (black, blue, red)	√		√			√	√					√	
Dry-Erase markers			√										
Red and blue colored pencils or fine-tipped felt pens for student use			√			√	√						
Crayons			√										
Scissors, class set	√			√					√				√
Glue sticks, class set													√
Scotch tape	√								√				
Masking Tape												√	√
Protractors (class set, optional)									Opt				
String (2 feet for each student pair)									Opt				
Rulers marked in inches & centimeters				√								√	
Yardstick(s)												√	
Timer						√							

## Grade 4 CCSS Supplement Materials List (cont.)

<b>GENERAL MATERIALS (PROVIDED BY THE TEACHER)</b>	<b>A3</b>	<b>A4</b>	<b>A5</b>	<b>A6</b>	<b>A9</b>	<b>B1</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>D1</b>	<b>D3</b>	<b>D6</b>	<b>D9</b>
Helper jar containing a stick for each student labeled with his or her name						√							
Individual whiteboards, pens, and erasers (class set)						Opt							
Gram masses or 6 boxes of 100 2" paperclips										√			
A pound of modeling clay or playdough										√			
A table knife and a cutting board covered with plastic or oilcloth										√			
20–24 cans and/or packages of food										√			
2 grocery sacks with handles										√			
2–3 bathroom scales										√			
2–3 scales that weighs in ounces										√			
12 resealable sandwich bags										√			
Items to fill the resealable sandwich bags (e.g., paperclips, macaroni, rice, beans, unpopped popcorn, and so on)										√			
6 plastic containers of different sizes											√		
Pitcher that holds about 2 liters											√		
Cafeteria tray											√		
Towel											√		
An assortment of 8 or more beverage containers											√		

<b>CHILDREN'S BOOKS (PROVIDED BY THE TEACHER)</b>	<b>A3</b>	<b>A4</b>	<b>A5</b>	<b>A6</b>	<b>A9</b>	<b>B1</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>D1</b>	<b>D3</b>	<b>D6</b>	<b>D9</b>
<i>How Much is a Million?</i> by David Schwartz	Opt												
<i>If You Made a Million</i> by David Schwartz	Opt												
<i>On Beyond a Million</i> by David Schwartz	Opt												
<i>Can You Count to a Google?</i> by Robert E. Wells	Opt												
<i>Is a Blue Whale the Biggest Thing There Is?</i> by Robert E. Wells	Opt												



# GRADE 4 SUPPLEMENT

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## Set A3 Number & Operations: Place Value to Millions

### Includes

Activity 1: Target 5	A3.1
Activity 2: Charting One Million	A3.5
Activity 3: Millions of Sport Spectators	A3.9
Independent Worksheet 1: The Dodgers & The Yankees	A3.15
Independent Worksheet 2: Big Numbers	A3.19
Independent Worksheet 3: Another Look at Big Numbers	A3.21

### Skills & Concepts

- ★ read, write, order, and compare whole numbers to one million and beyond
- ★ use expanded notation to represent numbers in different forms
- ★ understand place value to millions in various contexts

**Bridges in Mathematics Grade 4 Supplement**

**Set A3** Numbers & Operations: Place Value to Millions

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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# Set A3 ★ Activity 1



## ACTIVITY

### Target 5

#### Overview

Students play a game in which they build 5-digit numbers using dice, arranging them to form a number closest to a target. Then they read, write, compare, and order these whole numbers.

#### Skills & Concepts

- ★ read, write, order, and compare whole numbers
- ★ use expanded notation to represent numbers in different forms
- ★ understand place value to 99,999 in various contexts

#### You'll need

- ★ Target 5 Record Sheet (page A3.3, run 1 copy on a transparency and a class set.)
- ★ 2 dice marked 1–6
- ★ 3 dice marked 4–9
- ★ Student Math Journals or 1 piece of lined or grid paper per student

#### Instructions for Target 5

1. Let students know that you're going to play a game with big numbers today. They will work as a team against you to see who can get closest to a 5-digit target number. Then select a student to roll 5 dice, one at a time. As the dice are rolled, line them up, left to right, to form a 5-digit target number. Write the target number at the top of the Target 5 Record Sheet overhead. Read the number with the class.

Set A3 Numbers & Operations: Place Value Blackline Run a class set and 1 copy on a transparency.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Target 5 Record Sheet

49,251

Target Number

	Digits We Rolled	Number We Made
Team 1		

2. Give students each a copy of the Target 5 Record Sheet and ask them to write the target number at the top of the sheet. Explain that they'll be keeping track of the numbers for both teams on their sheet as you do so at the overhead.

3. Decide who will go first, you or the students. Team 1 rolls all 5 dice and records the numbers. Team 1 then finds the combination of numbers that is closest to the 5-digit target number.

**Activity 1** Target 5 (cont.)

**Amy** We rolled a 3, 5, 9, 2, 1.

**Bryan** The target number is 49,251. That means we'll want the 3 in the ten thousands place.

**Tamika** But 5 is just as close to 4 as a 3.

**Chae** She's right. I think we have to figure out the first two numbers together. Like 51 would be a lot closer to the 49 in our target number than the closest we could get with a 3...just 39.

**Jen** I agree. 39,000 is a lot further from 49,000 than 51,000 is.

After Team 1 settles on a number closest to the target, they need to say the number aloud so that you can record their answer for round one. Then, Team 2 (you, in this case) takes a turn.

Set A3 Numbers & Operations: Place Value Blackline Run a class set and 1 copy on a transparency.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Target 5 Record Sheet**

49,251

Target Number

	Digits We Rolled	Number We Made
Team 1	3, 5, 9, 2, 1	51,239

4. After both teams have finished the first round, work together to determine which team came the closest to the target number. That team wins round 1. Circle the winning number for the round. Take turns rolling the dice and recording solutions until each team has taken five turns. The team that gets closest to the target number in the most rounds, wins.

5. After the game is finished, ask the students to put their team's 5 numbers in order, from least to greatest, recording their answers in their math journals. Ask them to read the numbers to their neighbors when they're done to check their work.

**Extensions**

- Run multiple copies of the record sheet for students to play the game again with a partner. If some pairs finish early, provide them with extra dice and challenge them to play the game to the hundred thousands place or higher.
- Check your school library to see if you have any of the books listed below. If so, read one or more to the class to further explore place value with large numbers.
  - *Can You Count to a Googol?* by Robert E. Wells
  - *How Much is a Million?* by David Schwartz
  - *If You Made a Million* by David Schwartz
  - *Is a Blue Whale the Biggest Thing There Is?* by Robert E. Wells
  - *Millions to Measure* by David Schwartz
  - *On Beyond a Million* by David Schwartz

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Target 5 Record Sheet

Target Number

	Digits We Rolled	Number We Made
Team 1		
Team 2		
Final Score	Team 1	Team 2





# Set A3 ★ Activity 2



## ACTIVITY

### Charting One Million

#### Overview

Students work together to make a chart of one million tiny squares. This activity is designed to help students understand some of the relationships between hundreds, thousands, ten thousands, hundred thousands, and millions.

#### Skills & Concepts

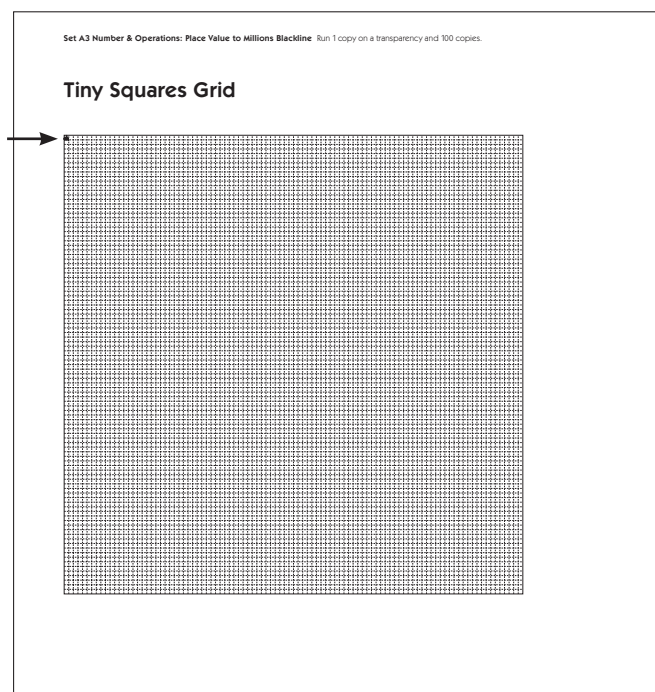
- ★ read, write, order, and compare whole numbers to one million and beyond
- ★ use expanded notation to represent numbers in different forms
- ★ understand place value to millions in various contexts

#### You'll need

- ★ Tiny Squares Grid (page A3.8, run 1 copy on a transparency and 100 copies)
- ★ several blank transparencies
- ★ overhead pens
- ★ tape
- ★ scissors

#### Instructions for Charting One Million

1. Place the Tiny Squares Grid on the overhead. Call students' attention to the smallest square in the top left-hand corner. Ask them to think privately about how many of these tiny squares there are on the entire grid and give them about 15–20 seconds to examine the overhead quietly.



**Activity 2** Charting One Million (cont.)

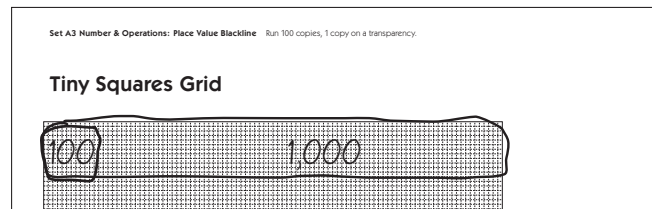
2. Turn off the overhead and ask them to pair-share their estimates. Invite volunteers to share their estimates with the class as you record them at the board.

How many tiny squares are there on the grid? Estimates:			
1,000	5,000	3,000	10,000
1,000,000	7,500	9,000	25,000
2,500	2,000,000	6,000	20,000

3. Ask students to pair up, or assign partners. Give each pair 1 copy of the Tiny Squares Grid and ask them to work together to find out how many tiny squares there are. Encourage students to use efficient but accurate counting strategies. Let them know it's fine to loop groups of squares or make other marks on the grids if that seems helpful. After they've had a few minutes to work, ask volunteers to share their answers as well as their counting methods. Place a blank transparency on top of the grid overhead so students can demonstrate their methods for the class.

**Devon** When we first looked at the grid, we saw that the tiny square in the corner was part of a 10-by-10 square, like a hundreds mat in the base 10 pieces.

**Brittany** Then we saw there were 10 of those little mats across the top, so that made 1,000.



**Devon** After that, we counted the rows of 1,000 all the way down and it made 10,000 in all.

**Ravi** We did kind of the same thing but we found 1,000 going down and then counted across. There are 10 lines of 1,000 so it's 10,000 in all.

4. Divide the class into 10 groups. Some groups may have two students while others have three or even four depending on the size of your class. Ask them to keep their grids, and distribute enough extra copies so that each group has 10 grids in all. Have them cut out the 10 grids and tape them together to create one long strip. How many tiny squares are there in the strip of 10 grids? How do they know?

**Jose** It's 100,000 because each grid is 10,000. That's 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 thousand.

5. Have each group bring their grid to the bulletin board as you pin or tape them side-by-side to form a large square. How many tiny squares are there in this giant square? Ask students to pair-share their ideas and then invite volunteers to share and explain their answers. It may not be obvious to some students that the total is 1,000,000. Some may count by hundreds to determine that there are "a thousand thousands." If, after some discussion, students haven't mentioned a million, explain that a thousand thousands, or  $1,000 \times 1,000$ , is the same as one million. You might also ask students to identify the dimensions of the giant square (1,000 by 1,000) and multiply the numbers on their calculators to see the result.

**Activity 2** Charting One Million (cont.)

6. Ask students to pair-share any observations they can make about the completed square of one million. Then have volunteers share their observations with the class. You may want to record some of their observations, print them out, and add them to the display. You might also have each student write an observation to post near the giant grid.

Every grid we cut out had 10,000 tiny squares

Every grid was a 100 by 100 squares

$100 \times 100 = 10,000$

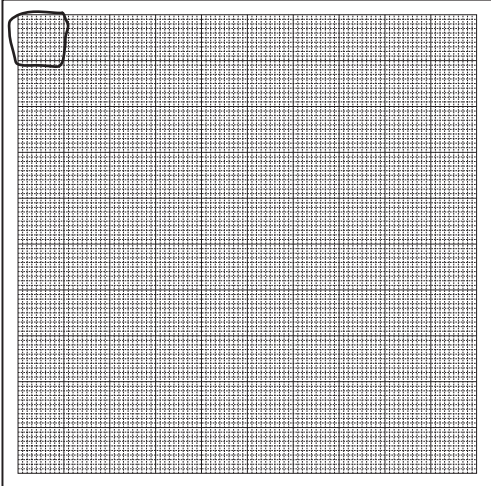
There are 100,000 tiny squares in each row going up and down

Our city has about a million people

If you had a million dollars, this shows how many dollar bills you'd have.

There are one hundred thousand tiny squares in each row of grids

That's 100,000



If you count the rows, you get 100, 200, 300, 400, 500, 600, 700, 800, 900, 1,000 thousands

A thousand thousand is the same as a million

There are one million tiny squares on this grid

If you look really close, you can see 1,000 tiny squares along the side of the square and 1,000 along the top

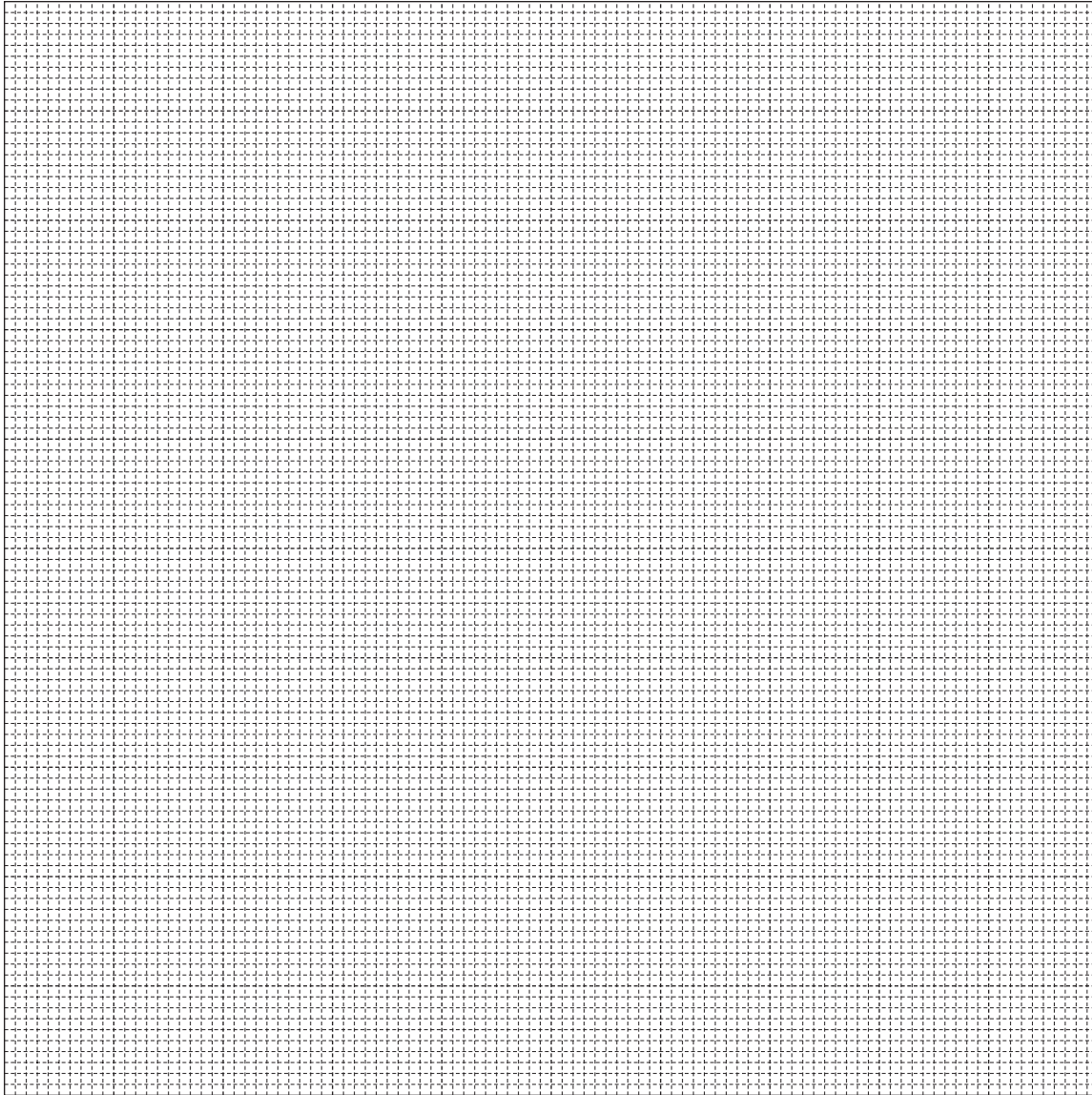
$1,000 \times 1,000 = 1,000,000$

One million is a really big number

**Extensions**

- Glue the giant grid, along with students' comments to butcher paper. Display on a classroom wall or in the hall.
- Read *How Much is a Million?* or *If You Made a Million* by David Schwartz to your class after you conduct this activity. Other books your students might enjoy include:
  - *Can You Count to a Googol?* by Robert E. Wells
  - *Is a Blue Whale the Biggest Thing There Is?* by Robert E. Wells
  - *On Beyond a Million* by David Schwartz
- Ask students to imagine the size and shape of a grid that had 10 million tiny squares, 100 million tiny squares, or even 1 billion tiny squares. Would a grid of a billion fit on your classroom wall? Why or why not? If not, where would it fit?

# Tiny Squares Grid



# Set A3 ★ Activity 3



## ACTIVITY

### Millions of Sport Spectators

#### Overview

Students explore place value into the millions during this activity.

#### Skills & Concepts

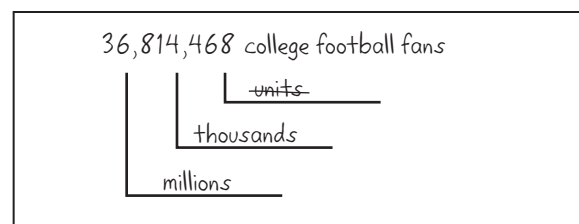
- ★ read, write, order, and compare whole numbers to one million and beyond
- ★ use expanded notation to represent numbers in different forms
- ★ understand place value to millions in various contexts

#### You'll need

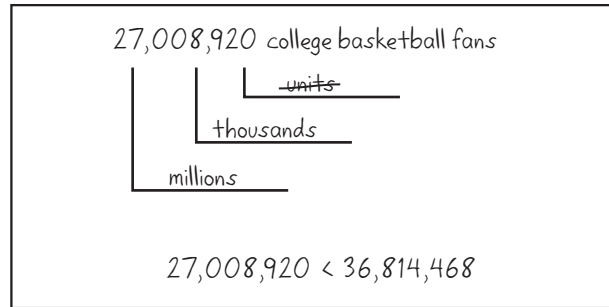
- ★ Sports Fans the World Over (pages A3.11–A3.13, run a class set)
- ★ calculators (class set)
- ★ overhead pens
- ★ Student Math Journals or 1 piece of lined or grid paper per student

#### Instructions for Millions of Sports Spectators

1. Open the activity with a brief discussion about sports. Which sports do the students in your class play? Which sports do they like to watch? Do they watch sports on TV or go to live games?
2. Explain that people enjoy sporting events the world over, and surprisingly large numbers attend live sporting events each year. Invite students to estimate how many people they think go to live college football games in the United States each year. Then write 36,814,468 on the whiteboard without reading the number to the class. Explain that this is the number of people who attended live college football games in 2006. Ask students to pair-share their ideas about what the number says. Then work with input from the class to label the number as shown below. Explain that the word “units” is crossed out because we know it but we don’t say it.



3. Read the number with your students and have them copy it into their journals. To help them get some sense of just how large this number is, tell them that the Astrodome in Houston, Texas, holds 62,439 football fans. About how many times would 36,814,468 people fill the Astrodome? Have them pair-share estimates and then ask them to use their calculators to find out. (36,814,468 football fans would fill the Astrodome almost 590 times!)
4. Now write the number 27,008,920 on the board without reading it to the class. Explain that this is the number of people who attended college basketball games in 2006. Work with student input to label the number. Then ask them to compare 36,814,468 and 27,008,920. Which number is greater? How do they know?

**Activity 3** Millions of Sport Spectators (cont.)

5. Give each student a copy of Sports Fans the World Over. Review the instructions with the class and let them go to work. Encourage them to share and compare their answers. Circulate to provide help as needed.

**INDEPENDENT WORKSHEET**

See Set A3 Independent Worksheets 1–3 for more practice reading, writing, comparing, and ordering numbers to 999,999,999.

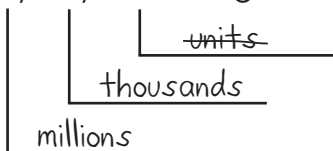
NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Sports Fans the World Over page 1 of 3

Many people around the world enjoy going to sporting events such as baseball, soccer, and football games. In the United States 36,814,468 people went to college football games during the 2006–2007 season. You can use place value to help understand this number.

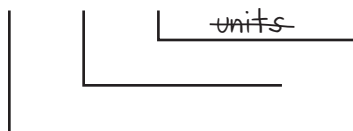
38,814,468 college football fans



If you were to read this number to someone over the phone, you'd say,  
 "Thirty-six million, eight hundred fourteen thousand, four hundred sixty-eight."

**1** In the United States, 7,686,275 people went to women's college basketball games during the 2006–2007 season. Label this number with its place values.

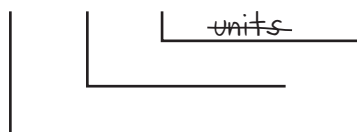
7,686,275 women's college basketball fans



**2** Write the number 7,686,275 out in words, the way you'd read it over the phone.

**3** Soccer is one of the most popular games in the world. 5,501,381 people went to see the World Cup games in 2006. Label this number with its place values.

5,501,381 World Cup soccer fans



**4** Write the number 5,501,381 out in words, the way you'd read it over the phone.

(Continued on back.)

## Sports Fans the World Over page 2 of 3

**5** Every 4 years, people from around the world gather to watch the Summer Olympics. The Olympics are held in a different country each year. The chart below shows the estimated populations of some of the countries that have hosted the Olympics. Use the information to solve the problems below.

Name of Country	Year They Hosted the Summer Olympics	Estimated Population in 2006
Greece	2004	10,688,058
Australia	2000	20,264,082
United States	1996	300,000,000
Spain	1992	40,397,842
South Korea	1988	48,846,823

**a** Which country on the chart had the largest estimated population in 2006? Which had the smallest?

**b** Compare the populations of some of these countries by writing the numbers and putting a greater than (>) or less than (<) sign between them.

Greece and Australia $10,688,058 < 20,264,082$	South Korea and Spain
Spain and Greece	The United States and Australia

**c** Write the populations of the 5 countries in order from least to greatest on the lines below. Write the name of each country below its population number. Use abbreviations if you need to.

\_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_  
 \_\_\_\_\_

(Continued on next page.)



## Sports Fans the World Over page 3 of 3



### CHALLENGE

**6** Go online to find out what the estimated population of the world is right now. Record the answer here.

The population of the world on \_\_\_\_\_ is \_\_\_\_\_.  
(month, day, year)



NAME \_\_\_\_\_

DATE \_\_\_\_\_

**Set A3** ★ Independent Worksheet 1**INDEPENDENT WORKSHEET****The Dodgers & The Yankees**

20,137,408 people went to see the Los Angeles Dodgers play baseball between 2001 and 2006. That's twenty million, one hundred thirty-seven thousand, four hundred eight baseball fans!

**1** Here's a chart that shows the place value of every digit in the number 20,137,408. Use the information on the chart to answer questions a–i below.

100 Millions	10 Millions	Millions	100 Thousands	10 Thousands	Thousands	Hundreds	Tens	Ones
	2	0	1	3	7	4	0	8

- a** The digit in the millions place is:
- b** The digit in the ten thousands place is:
- c** The digit in the hundred thousands place is:
- d** The digit in the ten millions place is:
- e** Are there any hundred millions in this number?
- f** The digit in the hundreds place is:
- g** The digit in the thousands places is:
- h** The digit in the ones place is:
- i** The digit in the tens place is:

(Continued on back.)

**Independent Worksheet 1** The Dodgers & The Yankees (cont.)

**2** The chart below shows the number of people who went to see the New York Yankees play baseball between 2001 and 2006. Use the information on the chart to answer questions a–d below.

100 Millions	10 Millions	Millions	100 Thousands	10 Thousands	Thousands	Hundreds	Tens	Ones
	2	2	2	6	2	5	6	4

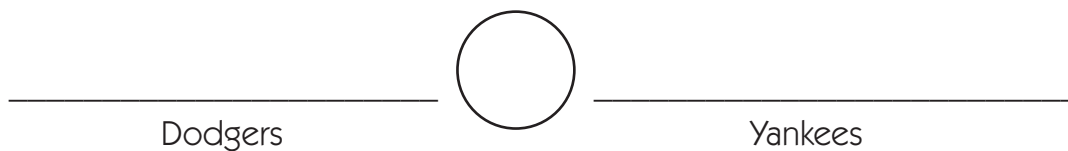
**a** How many people watched the New York Yankees play baseball between 2001 and 2006? Write the number here with the commas placed correctly.

**b** Now write the number out in words, the way you'd read it over the phone.

**c** Are there any ten millions in this number? If so, how many?

**d** The digit in the hundreds place is

**3** Did more people go to Dodgers or Yankees games between 2001 and 2006? Write the numbers on the lines below. Then put a greater than ( $>$ ) or less than ( $<$ ) symbol between them to compare the two.



(Continued on next page.)

NAME \_\_\_\_\_

DATE \_\_\_\_\_

**Independent Worksheet 1** The Dodgers & The Yankees (cont.)

**4** Complete the chart to write and name some other very large numbers. The first one is done for you.

Number	Number Written Out in Words
<b>example</b> 724,589,743	Seven hundred twenty-four million, five hundred eighty-nine thousand, seven hundred forty-three
<b>a</b> 658,902,456	
<b>b</b>	Nine hundred forty-three million, three hundred twenty-seven thousand, one hundred seventy-six
<b>c</b> 426,113,042	
<b>d</b>	Five hundred sixty-two million, three hundred twenty-nine thousand, two hundred fifty-one

**5** Write the five numbers above in order from least to greatest on the lines below.

\_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_ < \_\_\_\_\_



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set A3 ★ Independent Worksheet 2



## INDEPENDENT WORKSHEET

### Big Numbers

**1** Each weekend, Dylan and his dad go fishing. Dylan checks the odometer reading before each trip and records it in their mileage book. (An odometer is an instrument on the dashboard of a car that tells how far you've driven altogether.) Put these readings in the order that they would appear in the book, from least to greatest. The first one has been done for you.

- 93,102
- 89,776
- 95,004
- 91,204
- 90,089
- 91,438
- 99,173

89,776

**2a** Look at the following numbers. Circle the number that is the closest to 60,034.

60,000      60,100      60,200      60,300

**b** Circle the number closest to 194,321.

190,000      191,000      192,000      193,000      194,000      195,000

**c** Circle the number closest to 233,904.

230,000      231,000      232,000      233,000      234,000      135,000

**d** Circle the number closest to 234,900,032.

232,000,000      233,000,000      234,000,000      235,000,000

(Continued on back.)

## Independent Worksheet 2 Big Numbers (cont.)

**3a** Amanda is sure she got the high score on a video game. But she's not sure what the number is. Please write it down for her.

She scored nine hundred forty-three million, two hundred sixty-one thousand, five hundred eighty-six.

**b** Caleb is positive he beat her score. His score was 925,298,199. Who got the highest score? How do you know?



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set A3 ★ Independent Worksheet 3



## INDEPENDENT WORKSHEET

### Another Look at Big Numbers

**1** The state of Texas has the second highest population in the U.S. with 22,859,968 people. Fill in the answers below, and then use the key to decode the name of the Texas state tree. Look at the key and write the letter that matches each number to the right of the number.

Key: 5=A, 9=N, 2=C, 6=P, 8=E	Number	Letter
<b>a</b> Which digit is in the tens place?		
<b>b</b> Which digit is in the hundred thousands place?		
<b>c</b> Which digit is in the ten millions place?		
<b>d</b> Which digit is in the ten thousands place?		
<b>e</b> Which digit is in the thousands place?		
<b>f</b> The Texas state tree is the		

**2** Fill in the missing numbers.

**a** 90,106      90,107      \_\_\_\_\_      90,109      \_\_\_\_\_

**b** 826,998,996      \_\_\_\_\_      826,998,998

**c** 2,384,209      \_\_\_\_\_      \_\_\_\_\_      2,384,212

**d** 3,581,998      \_\_\_\_\_      \_\_\_\_\_      3,582,001

(Continued on back.)

### Independent Worksheet 3 Another Look at Big Numbers (cont.)

**3** Go on a big number hunt. Find at least one number greater than 100,000. Find at least one number greater than 1,000,000. Hint: Look in science books, around your classroom, on-line, and in the newspaper. Record the numbers below and write at least 2 sentences to describe what each one is about.



# GRADE 4 SUPPLEMENT

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## Set A4 Number & Operations: Estimating to Multiply & Divide

### Includes

Independent Worksheet 1: Using Compatible Numbers	A4.1
Independent Worksheet 2: More Compatible Numbers	A4.3
Independent Worksheet 3: Reasonable Estimates	A4.5

### Skills & Concepts

- ★ use strategies including rounding and compatible numbers to estimate solutions to multiplication and division problems

**Bridges in Mathematics Grade 4 Supplement**

**Set A4** Numbers & Operations: Estimating to Multiply & Divide

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NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set A4 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### Using Compatible Numbers

Some people estimate answers to multiplication and division problems by using compatible numbers. Compatible numbers are numbers that make it easier to estimate the answer to a problem.

**example a** A page has 11 words in one line and 28 lines on the page. *About* how many words on the whole page? If you don't need an exact answer, you can estimate what  $11 \times 28$  is by using compatible numbers.

11 is close to 10

28 is close to 30

$10 \times 30 = 300$ , so the page has about 300 words.

**example b** 10 kids want to share 97 marbles equally. About how many marbles will they each get? If you don't need an exact answer, you can estimate by using compatible numbers.

97 is close to 100.

10 is already a friendly number. You don't have to change both numbers.

$100 \div 10 = 10$ , so they'll each get about 10 marbles.

**1a** Choose a chapter book from your classroom. Turn to a page in the middle of the book. *About* how many words do you think there are on the page? To find out, count the number of words in one line. Next, count the number of lines on the page. Record the information:

Words in one line: \_\_\_\_\_

Lines on the page: \_\_\_\_\_

(Continued on back.)

**Independent Worksheet 1** Using Compatible Numbers (cont.)

**1b** Use compatible numbers to estimate the number of words on the page. Show your work.

**2** The 4th grade is taking a field trip to the zoo. There are 86 students. The bus company plans to use 3 buses. Estimate how many students will ride in each bus. Use compatible numbers to help you. Show your work.

**3** Estimate the answers to the following division problems. Use compatible numbers to help you. Show your work. The first one is done for you.

<p><b>example</b> <math>89 \div 10</math></p> <p><i>89 is close to 90.</i>  <math>90 \div 10 = 9</math>, so the answer is about 9.</p>	<p><b>a</b> <math>25 \div 4</math></p>
<p><b>b</b> <math>39 \div 4</math></p>	<p><b>c</b> <math>48 \div 10</math></p>

**CHALLENGE**

**4** Use compatible numbers to estimate the answer to  $24 \times 21$ . Use a calculator to check your answer. How close was your estimate?

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Set A4 ★ Independent Worksheet 2



### INDEPENDENT WORKSHEET

#### More Compatible Numbers

1 Which 2 numbers in the box could you multiply to come closest to 420? Show your thinking.

<b>39   47   5   11   62   87   26</b>
--

2 Estimate the answers to the following multiplication problems. Use compatible numbers to help you. Show your work.

<p><b>example</b> <math>19 \times 6 =</math></p> <p><i>19 is close to 20 6 is close to 5 <math>20 \times 5 = 100</math> My estimate is 100</i></p>	<p><b>a</b> <math>39</math> <math>\times 12</math></p>	<p><b>b</b> <math>84 \times 9 =</math></p>
--	--	--

3 Estimate the answers to the following division problems. Use compatible numbers to help you. Show your work.

**a** About how much does each can of soda cost if a 6-pack costs \$1.19?

**b** Abbie and her 3 friends want to split a bag of 72 peanuts equally. About how many peanuts will each of the 4 children get?

(Continued on back.)

## Independent Worksheet 2 Using Compatible Numbers (cont.)



### CHALLENGE

**4** Estimate  $726 \div 11$ . Record and explain your estimate. Use a calculator to check your answer. How close was your estimate?



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set A4 ★ Independent Worksheet 3



## INDEPENDENT WORKSHEET

### Reasonable Estimates

**1** Circle the answer that gives a reasonable estimate for each problem. (Hint: try using compatible numbers to help.) To the right of the problem, use words, numbers and/or pictures to explain why you think it is a reasonable estimate. The first one is done for you.

<p><b>example</b>     <math>16</math>                   <math>\times 4</math></p> <p>32            16 is close to 15</p> <p><u>60</u>            <math>15 \times 2 = 30</math>, so <math>15 \times 4 = 60</math>.</p> <p>94            60 is the closest estimate</p> <p>104</p>	<p><b>a</b>     <math>23</math>           <math>\times 5</math></p> <p>75</p> <p>95</p> <p>120</p> <p>175</p>
<p><b>b</b>     <math>26</math>        <math>\times 3</math></p> <p>50</p> <p>75</p> <p>100</p> <p>125</p>	<p><b>c</b>     <math>206 \div 10 =</math></p> <p>10</p> <p>20</p> <p>30</p> <p>120</p>

(Continued on back.)

**Independent Worksheet 3** Using Compatible Numbers (cont.)

**d**  $74 \div 7 =$

10

12

15

20

**e**  $101 \div 9 =$

7

8

9

10

**2** Randy has \$7.00. Basketball trading cards cost \$0.49 each. He estimates that he will be able to buy about 19 cards with his money. Is this a reasonable estimate? Use words, numbers and/or pictures to explain your answer.



# GRADE 4 SUPPLEMENT

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## Set A5 Number & Operations: Multi-digit Multiplication

### Includes

Activity 1: Multi-Digit Multiplication Pre-Assessment	A5.1
Activity 2: Multiplying by 10, 100, & 1000	A5.17
Activity 3: Multiplying Single Digits by Multiples of Ten	A5.23
Activity 4: Single-Digit Multiplication with Pictures & Numbers	A5.29
Activity 5: Introducing the Standard Multiplication Algorithm	A5.35
Activity 6: Think before You Multiply	A5.39
Activity 7: Splat!	A5.45
Activity 8: Sketching Arrays & Partial Products	A5.55
Activity 9: Double-Digit Multiplication with Pictures & Numbers	A5.61
Activity 10: Multiplication Menus	A5.67
Activity 11: Introducing a Two-Part Area Model	A5.73
Activity 12: Extending the Standard Multiplication Algorithm	A5.81
Activity 13: Reviewing & Evaluating Multiplication Strategies	A5.87
Activity 14: Multi-Digit Multiplication Post-Assessment	A5.95
Independent Worksheet 1: More Practice Multiplying by 10, 100, & 1000	A5.105
Independent Worksheet 2: More Tens, Hundreds, & Thousands	A5.107
Independent Worksheet 3: Double-Digit by Single-Digit Multiplication	A5.109
Independent Worksheet 4: Using the Standard Algorithm for 2-Digit by 1-Digit Multiplication	A5.111
Independent Worksheet 5: Choose Your Strategy	A5.113
Independent Worksheet 6: Multiplying Multiples of 10 & More	A5.115
Independent Worksheet 7: Using 4 Partial Products to Multiply 2-Digit Numbers	A5.117
Independent Worksheet 8: More Multiplication Menus	A5.119
Independent Worksheet 9: Pine Cones & School Supplies	A5.121

### Skills & Concepts

- ★ represent multiplication of two-digit by two-digit numbers
- ★ multiply by 10 and 100
- ★ multiply 2- and 3-digit by 1- and 2-digit numbers using efficient methods, including the standard multiplication algorithm
- ★ mentally multiply 2-digit numbers by numbers through 10 and by multiples of 10
- ★ compare the values represented by digits in whole numbers using place value
- ★ multiply one- and two-digit numbers by numbers through 10 and by multiples of 10
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ solve single-step and multi-step word problems involving multi-digit multiplication and verify the solutions
- ★ explain why a specific problem-solving strategy was used to determine a solution

**Bridges in Mathematics Grade 4 Supplement**

**Set A5** Numbers & Operations: Multi-digit Multiplication

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at [www.mathlearningcenter.org](http://www.mathlearningcenter.org).

# Set A5 ★ Activity 1



## ACTIVITY

### Multi-Digit Multiplication Pre-Assessment

#### Overview

This pre-assessment launches a set of activities that return to the multiplication work started in Unit 2. In the 12 activities that follow, students will move from building and sketching 2-digit by 1-digit multiplication combinations to using the standard algorithm to multiply up to 3-digit by 2-digit numbers. Additional practice with the skills introduced in these activities can be found on pages A5.109–A5.126 in the Independent Worksheet section of the Bridges Supplement.

#### Skills & Concepts

- ★ represent multiplication of two-digit by two-digit numbers
- ★ multiply by 10 and 100
- ★ multiply one- and two-digit numbers by numbers through 10 and by multiples of 10
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ solve single-step word problems involving multi-digit multiplication

#### You'll need

- ★ Multi-Digit Multiplication Pre-Assessment (pages A5.7–A5.9, run a class set)
- ★ Multi-Digit Multiplication Pre-Assessment Class Checklist (page A5.10, run 1 or 2 copies)
- ★ Multi-Digit Multiplication Pre- & Post-Assessment Scoring & Comparisons (optional, page A5.11 and A5.12, run a class set)
- ★ Base 10 Grid Paper (page A5.13, run as needed)
- ★ Student Reflection Sheet: Multiplication (pages A5.14–A5.16, optional, run a class set)
- ★ access to base 10 area and linear pieces

#### Instructions for Multi-Digit Multiplication Pre-Assessment

1. Explain to your students that over the next few weeks, the class will return to studying multi-digit multiplication. Today they'll take a pre-assessment that will give you information about their current strategies for multiplying large numbers. Explain that they will take a similar assessment in several weeks, at which time they will have additional ways to handle problems that may seem challenging today.
2. Give students each a copy of the pre-assessment. Ask them to write their name and the date at the top of each page. Read and review the problems together and have students circle the “doing” words as you go. Remind them that once they get started, they'll need to mark each checkpoint with an  $\times$  or a  $\checkmark$  to show that they have completed the task.

Activity 1 Multi-Digit Multiplication Pre-Assessment (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multi-Digit Multiplication Pre-Assessment** page 1 of 3

1 Ben and his mom got 5 cases of bottled water for the soccer game. There were 24 bottles of water in each case. How many bottles of water was that altogether?

a Solve the story problem above. Show your work with labeled sketches, numbers, and/or words.

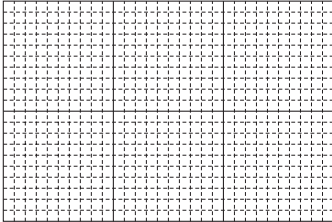
b Ben and his mom got \_\_\_\_\_ bottles of water in all.

2 Choose one of the problems below and circle it.

$10 \times 16$        $18 \times 10$        $13 \times 20$        $20 \times 26$

a Make a labeled sketch on the grid below to show the problem you chose.

b Find the answer to the problem you chose using your sketch. Show all of your work.




Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multi-Digit Multiplication Pre-Assessment** page 2 of 3

3 These base 10 linear pieces show the dimensions of a rectangle.

a Label each dimension and fill in the rectangle.

b Use the information to find the area of the rectangle. Show your work.



4 Fill in the bubble to show the best estimate for each problem. Explain your choice.

a	$\begin{array}{r} 26 \\ \times 6 \\ \hline \end{array}$	<input type="radio"/> 100 <input type="radio"/> 150 <input type="radio"/> 200 <input type="radio"/> 250	b	$\begin{array}{r} 134 \\ \times 5 \\ \hline \end{array}$	<input type="radio"/> 500 <input type="radio"/> 600 <input type="radio"/> 700 <input type="radio"/> 800
	Why?			Why?	

5 Write the answer to each problem.

$\begin{array}{r} 32 \\ \times 10 \\ \hline \end{array}$	$\begin{array}{r} 68 \\ \times 10 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 10 \\ \hline \end{array}$	$\begin{array}{r} 34 \\ \times 100 \\ \hline \end{array}$	$\begin{array}{r} 100 \\ \times 26 \\ \hline \end{array}$	$\begin{array}{r} 100 \\ \times 50 \\ \hline \end{array}$
--	--	--	---	---	---

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multi-Digit Multiplication Pre-Assessment** page 3 of 3

6 Write the answer to each problem.

$\begin{array}{r} 30 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 30 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 50 \\ \hline \end{array}$	$\begin{array}{r} 24 \\ \times 20 \\ \hline \end{array}$	$\begin{array}{r} 22 \\ \times 30 \\ \hline \end{array}$
---	---	--	--	--	--

7 Choose one of the multiplication problems below and circle it. Pick the one that seems best for you—not too hard and not too easy.

$\begin{array}{r} 12 \\ \times 14 \\ \hline \end{array}$	$\begin{array}{r} 15 \\ \times 13 \\ \hline \end{array}$	$\begin{array}{r} 22 \\ \times 23 \\ \hline \end{array}$	$\begin{array}{r} 26 \\ \times 23 \\ \hline \end{array}$	$\begin{array}{r} 38 \\ \times 27 \\ \hline \end{array}$	$\begin{array}{r} 236 \\ \times 39 \\ \hline \end{array}$
--	--	--	--	--	---

a Find the answer to the problem you circled. Be sure to show all of your work.

b Write a story problem to match the multiplication problem you just solved.

### Activity 1 Multi-Digit Multiplication Pre-Assessment (cont.)

3. Before students start to work, be sure they understand that they only need to circle and solve one of the multiplication combinations in both problems 2 and 7. Tell students that you'll place a small stack of base ten grid paper near each table or cluster of desks if they want to use it for any of the problems, and they can also get out their base ten area and linear pieces for use during the assessment.

Remind students that although you can't explain the tasks to them, you will read any of the problems to them again if needed during the assessment period. Although they may not be sure how to solve some of the problems, encourage them to attempt each one. Partial solutions are fine, and if they are unable to answer a particular problem they can write, "I don't know yet."



### LOOKING AT STUDENT WORK

Students will complete a similar assessment in Set A5, Activity 14, at which time a scoring guide will be included for your use. We recommend that you use the results of today's pre-assessment to help guide your instruction as you teach this set of activities. To help, you can use the Multi-Digit Multiplication Class Checklist on page A5.10 if you like. By compiling results for your entire class, you can get a sense of the areas in which the class as a whole needs more work.

Multi-Digit Multiplication Pre-Assessment Class Checklist										
Student name										
1a Shows work for $5 \times 24$										
1b Gives the answer for 1a, 120										
2a Makes a labeled sketch on base 10 grid paper to multiply a 2-digit number by 10 or a multiple of 10										
2b Uses the sketch from 2a to find the correct answer										
3a Completes and correctly labels a free-hand sketch of a $13 \times 17$ array										
3b Uses the sketch from 3a to find the correct answer, 221										
4a Chooses the best estimate for $6 \times 26$ (150), and justifies estimate in a way that makes sense										
4b Chooses the best estimate for $5 \times 134$ (700), and justifies estimate in a way that makes sense										
5 Multiplies 2-digit numbers by 10 and 100 (Solves ____ out of 6 problems correctly.)										
6 Multiplies 1- and 2-digit numbers by multiples of 10 (Solves ____ out of 6 problems correctly.)										
7a Shows work and finds the answer to a 2-digit $\times$ 2-digit multiplication problem										
7b Writes a story problem to match the multiplication problem from 7a										

\* = completely correct, ✓ = partially correct, - = incorrect  
 Most students appear confident with these areas: \_\_\_\_\_ I'll need to focus instruction in this unit on these weaker areas: \_\_\_\_\_

Set A5 Number and Operations: Multi-Digit Multiplication Checklist • Optional (but strongly recommended) for recording the results for all students in your class.

Students' responses to this pre-assessment should give you a good sense of how much they have retained from Unit Two, and where they stand with regard to the skills you'll be teaching over the coming sessions. Problem 1 gives you an opportunity to see how students deal with 2-digit by 1-digit multiplication right now. Some of them will probably make a sketch on base 10 grid paper or a free-hand sketch similar to the one shown on the next page to handle this kind of computation. Some may break 24 into tens and ones and multiply each part, while others use the standard algorithm. Chances are, some of your students will use repeated addition to solve the problem. These students may still be working to develop multiplicative reasoning, and will probably need more support than others to move toward efficient and effective methods for multi-digit multiplication.

Activity 1 Multi-Digit Multiplication Pre-Assessment (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_  
**Multi-Digit Multiplication Pre-Assessment** page 1 of 3

1 Ben and his mom got 5 cases of bottled water for the soccer game. There were 24 bottles of water in each case. How many bottles of water was that altogether?

a Solve the story problem above. Show your work with labeled sketches, numbers, and/or words.

$5 \times 24$

$5 \times 20 = 100$

$5 \times 4 = 20$

$100 + 20 = 120$

b Ben and his mom got 120 bottles of water in all.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_  
**Multi-Digit Multiplication Pre-Assessment** page 1 of 3

1 Ben and his mom got 5 cases of bottled water for the soccer game. There were 24 bottles of water in each case. How many bottles of water was that altogether?

a Solve the story problem above. Show your work with labeled sketches, numbers, and/or words.

b Ben and his mom got 120 bottles of water in all.

Problems 2 and 3 give you an opportunity to see how your students are doing with the area model. Can they make a labeled sketch on base ten grid paper and use it to find the answer to a problem that involves multiplying by 10 or multiples of 10? Can they fill in a frame and use the sketch to find the solution to  $13 \times 17$ ? The area model, introduced in Units One and Two will serve as a scaffold for developing more efficient numeric methods for multi-digit multiplication in the activities to follow.

Problem 4 will help you see whether or not your students can estimate products and justify their estimates. Are they able to consider the results of multiplying tens and ones, or hundreds, tens, and ones, by a single digit to make reasonable estimates? Are they able to explain their thinking?

Problems 5 and 6 will help you see how well your students are able to multiply single- and double-digit numbers by 10, 100, and other multiples of 10. These skills were introduced in Unit Two, and are heavily featured in the upcoming activities, as they are central to developing efficient methods for multi-digit multiplication.

Students' responses to problem 7 will help you understand how they are currently dealing with 2-digit by 2-digit multiplication. While a few may not be able to respond in any way, you'll probably see a number of different methods, some of which are summarized on the chart below.

STUDENT MULTIPLICATION METHODS		
Strategy	Example	Comments
Repeated Addition		Even fourth graders who have more efficient methods of multiplying 2-digit by 1-digit numbers may resort to the reliable yet time consuming method of repeated addition to solve 2-digit by 2-digit computations. This example, slightly more sophisticated than simply adding twelve 14's in a column, combines multiplication and addition.
An Area Model		Chances are, some of your students will handle a computation like $14 \times 12$ by making a sketch on base 10 grid paper or even a freehand sketch similar to the one shown here.



## Activity 1 Multi-Digit Multiplication Pre-Assessment (cont.)

STUDENT MULTIPLICATION METHODS					
Strategy	Example				Comments
Working from Known Facts	$14 \times 2 = 28$ $14 \times 10 = 140$ $140 + 28 = 168$				Some students may break the numbers apart into more manageable chunks. Such student-invented methods demonstrate good number sense and a solid understanding of the place values involved in multi-digit computation.
Mis-Memorized or Mis-Applied Algorithms	$\begin{array}{r} 14 \\ \times 12 \\ \hline 28 \\ + 14 \\ \hline 42 \end{array}$	$\begin{array}{r} 14 \\ \times 12 \\ \hline 28 \\ + 410 \\ \hline 438 \end{array}$	$\begin{array}{r} 14 \\ \times 12 \\ \hline 18 \\ + 14 \\ \hline 32 \end{array}$	$\begin{array}{r} 14 \\ \times 12 \\ \hline 8 \\ + 100 \\ \hline 108 \end{array}$	Any of the errors shown here will be familiar to fourth grade teachers, and tend to crop up among students who have been encouraged to memorize multi-step procedures without adequate conceptual preparation. Such students, many of whom are still reasoning in an additive rather than a multiplicative manner, are often untroubled by the fact that answers like 32 and 42 do not make sense.

If you have students who get the correct answer using the standard algorithm, you might probe their understanding by asking them to explain their steps. Some may comprehend the process very well, while others may be manipulating the numbers carefully and accurately but with little understanding. Such students are likely to explain their work as follows: “When you do  $12 \times 14$ , first you multiply  $2 \times 4$ , that’s 8. Then you multiply  $2 \times 1$ , which is 2, so you have 28. Then you go down to the next row and put a 0 (or skip a space). Then you just go  $1 \times 4$  is 4 and  $1 \times 1$  is 2, so it’s 14 with a zero (or a space) after it. You add the two rows, and it comes to 168.”

You might also ask students who are using the standard algorithm correctly to estimate the results of a problem like  $23 \times 15$ . Students who give an estimate between 300 and 400 and can explain why without resorting to paper and pencil are clearly working with good understanding.

After you have marked the pre-assessments, let your students look them over before you file them away so they have some sense of what they need to work on over the coming weeks. You might also ask them to fill out a Multiplication Student Reflection Sheet. Students may have fairly strong feelings about their own skills, and the experience of solving these kinds of problems will be fresh in their minds. If you decide to use these form, remind students that these are learning targets for the coming weeks, and it’s okay if they can’t do everything on the list right now. Plan to have them fill out the form again at the end of the activity set, and possibly another copy again later in the year after they’ve had additional time to practice the skills.

### Activity 1 Multi-Digit Multiplication Pre-Assessment (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Optional, run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

#### Multi-Digit Multiplication Reflection Sheet page 1 of 3

Here are some of the things you need to know to be able to multiply large numbers quickly and easily. Rate your own understandings and skills right now using the following marks.

- + I know how to do this already.
- ✓ I'm learning to do this, and I feel confident that I'll be able to do it soon.
- ✓- I'm learning to do this, but it still seems pretty confusing.
- 0 I don't get it, and it seems frustrating to try to understand it.

SKILLS AND UNDERSTANDINGS	START OF THE ACTIVITY SET	END OF THE ACTIVITY SET
<b>Multiplication</b>		
I can write a multiplication story problem.		
I know my basic multiplication facts through $12 \times 12$ .		
I can multiply by 10 and 100 in my head. (Examples: $10 \times 52$ or $100 \times 85$ )		
I can multiply one multiple of 10 by another in my head. (Examples: $20 \times 30$ or $50 \times 60$ )		
I can multiply a single-digit number by a multiple of 10 in my head. (Examples: $6 \times 40$ or $70 \times 5$ )		
I can use base 10 pieces to model and solve a double-digit problem like $23 \times 27$ .		
I can make a labeled sketch on base 10 grid paper to solve a problem like $24 \times 38$ .		
I can break a double- by single-digit multiplication problem into 2 parts to solve it more easily. (Example: $5 \times 37 = (5 \times 30) + (5 \times 7)$ )		
I can use the standard algorithm to solve a 2-digit by 1-digit problem like $7 \times 38$ .		
I can break a double-digit multiplication problem into 4 or 2 parts to solve it more easily. (Example: $26 \times 35 = (20 \times 30) + (20 \times 5) + (6 \times 30) + (6 \times 5)$ )		
I can use the standard algorithm to solve a 2-digit by 2-digit problem like $46 \times 58$ .		
I can use the standard algorithm to solve a 3-digit by 2-digit problem like $34 \times 247$ .		
I can make estimates to predict how big the answer will be or to see if my answer seems reasonable.		

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Optional, run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

#### Multiplication & Division Reflection Sheet page 2 of 3

Here's how I feel about solving multiplication problems like  $6 \times 52$  or  $27 \times 23$ , and  $37 \times 148$ :

Start of the Activity Set	End of the Activity Set

What are two goals for multiplication that are important to you? (What could you improve?)

Start of the Activity Set	End of the Activity Set
<b>1</b>	<b>1</b>
<b>2</b>	<b>2</b>

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Optional, run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

#### Multiplication & Division Reflection Sheet page 3 of 3

How will you meet each goal above?

Start of the Activity Set	End of the Activity Set
<b>1</b>	<b>1</b>
<b>2</b>	<b>2</b>

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multi-Digit Multiplication Pre-Assessment

 page 1 of 3

**1** Ben and his mom got 5 cases of bottled water for the soccer game. There were 24 bottles of water in each case. How many bottles of water was that altogether?

**a** Solve the story problem above. Show your work with labeled sketches, numbers, and/or words.

**b** Ben and his mom got \_\_\_\_\_ bottles of water in all.

**2** Choose one of the problems below and circle it.

$10 \times 16$

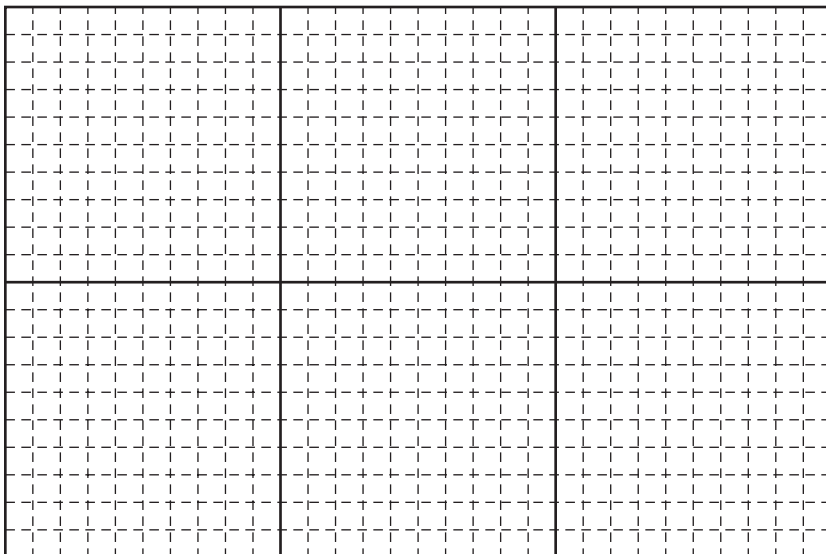
$18 \times 10$

$13 \times 20$

$20 \times 26$

**a** Make a labeled sketch on the grid below to show the problem you chose.

**b** Find the answer to the problem you chose using your sketch. Show all of your work.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Multi-Digit Multiplication Pre-Assessment page 2 of 3

- 3** These base 10 linear pieces show the dimensions of a rectangle.
- a** Label each dimension and fill in the rectangle.
- b** Use the information to find the area of the rectangle. Show your work.



- 4** Fill in the bubble to show the best estimate for each problem. Explain your choice.

<p><b>a</b></p> $\begin{array}{r} 26 \\ \times 6 \\ \hline \end{array}$ <p style="text-align: right;"> <input type="radio"/> 100  <input type="radio"/> 150  <input type="radio"/> 200  <input type="radio"/> 250         </p> <p>Why?</p>	<p><b>b</b></p> $\begin{array}{r} 134 \\ \times 5 \\ \hline \end{array}$ <p style="text-align: right;"> <input type="radio"/> 500  <input type="radio"/> 600  <input type="radio"/> 700  <input type="radio"/> 800         </p> <p>Why?</p>
--	---

- 5** Write the answer to each problem.

$$\begin{array}{r} 32 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 68 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 30 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 34 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 100 \\ \times 26 \\ \hline \end{array}$$

$$\begin{array}{r} 100 \\ \times 50 \\ \hline \end{array}$$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multi-Digit Multiplication Pre-Assessment

 page 3 of 3

**6** Write the answer to each problem.

$$\begin{array}{r} 30 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 50 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 40 \\ \times 30 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 50 \\ \hline \end{array}$$

$$\begin{array}{r} 24 \\ \times 20 \\ \hline \end{array}$$

$$\begin{array}{r} 22 \\ \times 30 \\ \hline \end{array}$$

**7** Choose one of the multiplication problems below and circle it. Pick the one that seems best for you—not too hard and not too easy.

$$\begin{array}{r} 12 \\ \times 14 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \\ \times 13 \\ \hline \end{array}$$

$$\begin{array}{r} 22 \\ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} 26 \\ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} 38 \\ \times 27 \\ \hline \end{array}$$

$$\begin{array}{r} 236 \\ \times 39 \\ \hline \end{array}$$

**a** Find the answer to the problem you circled. Be sure to show all of your work.

**b** Write a story problem to match the multiplication problem you just solved.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Multi-Digit Multiplication Pre-Assessment Scoring & Comparisons

Date of Pre-Assessment \_\_\_\_\_

PRE-ASSESSMENT		
Performance Indicator	Performance *	Comments
<b>1a</b> Shows work for $5 \times 24$		
<b>1b</b> Gives the answer for 1a (120)		
<b>2a</b> Makes a labeled sketch on base 10 grid paper to multiply a 2-digit number by 10 or a multiple of 10		
<b>2b</b> Uses the sketch from 2a to find the correct answer		
<b>3a</b> Completes & labels a free-hand sketch of a $13 \times 17$ array		
<b>3b</b> Uses the sketch from 3a to find the correct answer (221)		
<b>4a</b> Chooses the best estimate for $6 \times 26$ (150), and justifies estimate in a way that makes sense		
<b>4b</b> Chooses the best estimate for $5 \times 134$ (700), and justifies estimate in a way that makes sense		
<b>5</b> Multiplies 2-digit numbers by 10 and 100 (Solves ___ out of 6 problems correctly.)		
<b>6</b> Multiplies 1- and 2-digit numbers by multiples of 10 (Solves ___ out of 6 problems correctly.)		
<b>7a</b> Shows work and finds the answer to a 2-digit $\times$ 2-digit multiplication problem		
<b>7b</b> Writes a story problem to match the multiplication problem from 7a		

\* + completely correctly, ✓ partially correct, – incorrect

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Multi-Digit Multiplication Post-Assessment Scoring & Comparisons

Date of Post-Assessment \_\_\_\_\_

POST-ASSESSMENT			
Problem	Possible Points	Points Earned	Comments
<b>1a</b> Uses any combination of labeled sketches, numbers & words to solve the problem; indicates understanding that 2 steps are necessary	2		
<b>1b</b> Gives the answer for 1b, 768	1		
<b>2a</b> Uses the standard algorithm for 2-digit by 1-digit multiplication	1		
<b>2b</b> Uses a different method for 2-digit by 1-digit multiplication	1		
<b>2c</b> Gives a reasonable explanation about which method was easier	1		
<b>3a</b> Uses the standard algorithm for 2-digit by 2-digit multiplication	1		
<b>3b</b> Uses a different method for 2-digit by 2-digit multiplication	1		
<b>4a</b> Chooses the best estimate for $4 \times 248$ (1,000), and justifies estimate	2		
<b>4b</b> Chooses the best estimate for $25 \times 25$ (600), and justifies estimate	2		
<b>5</b> Multiplies 2-digit numbers by 10, 100, and 1,000	6		
<b>6</b> Multiplies 1- and 2-digit numbers by multiples of 10	6		
<b>7a</b> Uses the standard algorithm for 3-digit by 2-digit multiplication	1		
<b>7b</b> Writes a story problem to match the multiplication problem from 7a	2		
<b>8</b> Writes expression; disagrees with estimate & justifies response; solves correctly	5		

**A** Advanced (working above grade level) 29–32 points (90–100% correct) **P** Proficient (working at grade level) 24–28 points (75–89% correct)

**B** Basic (working toward grade level) 17–23 points (53–74% correct) **N** Novice (working below grade level) 16 points or fewer (50% or less correct)

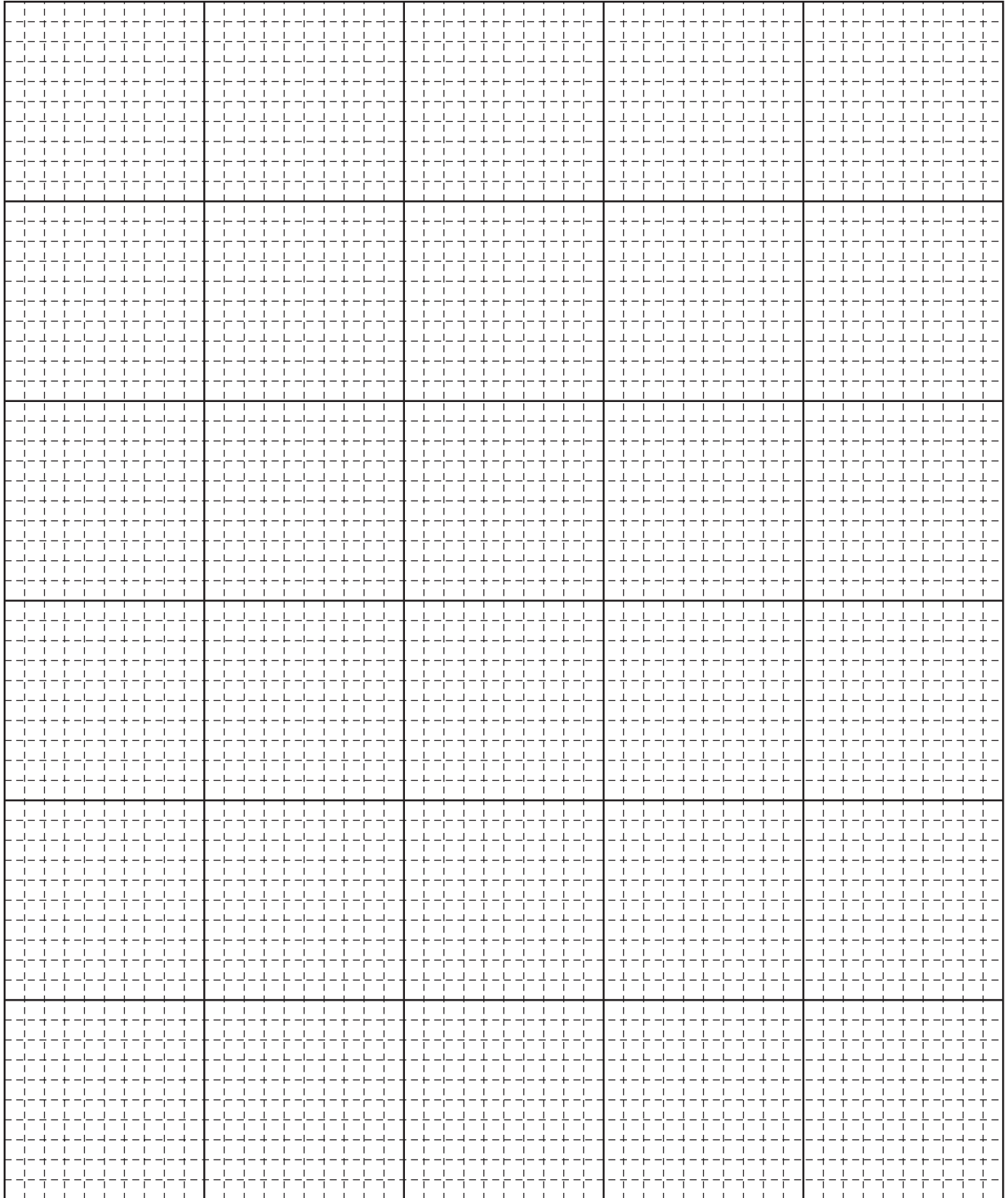
**Total Points** \_\_\_\_\_ **Percentage** \_\_\_\_\_ **Proficiency Level** \_\_\_\_\_



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Base Ten Grid Paper



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multi-Digit Multiplication Reflection Sheet

 page 1 of 3

Here are some of the things you need to know to be able to multiply large numbers quickly and easily. Rate your own understandings and skills right now using the following marks.

- + I know how to do this already.
- ✓ I'm learning to do this, and I feel confident that I'll be able to do it soon.
- ✓- I'm learning to do this, but it still seems pretty confusing.
- 0 I don't get it, and it seems frustrating to try to understand it.

SKILLS AND UNDERSTANDINGS	START OF THE ACTIVITY SET	END OF THE ACTIVITY SET
<b>Multiplication</b>		
I can write a multiplication story problem.		
I know my basic multiplication facts through $12 \times 12$ .		
I can multiply by 10 and 100 in my head. (Examples: $10 \times 52$ or $100 \times 85$ )		
I can multiply one multiple of 10 by another in my head. (Examples: $20 \times 30$ or $50 \times 60$ )		
I can multiply a single-digit number by a multiple of 10 in my head. (Examples: $6 \times 40$ or $70 \times 5$ )		
I can use base 10 pieces to model and solve a double-digit problem like $23 \times 27$ .		
I can make a labeled sketch on base 10 grid paper to solve a problem like $24 \times 38$ .		
I can break a double- by single-digit multiplication problem into 2 parts to solve it more easily. (Example: $5 \times 37 = (5 \times 30) + (5 \times 7)$ )		
I can use the standard algorithm to solve a 2-digit by 1-digit problem like $7 \times 38$ .		
I can break a double-digit multiplication problem into 4 or 2 parts to solve it more easily. (Example: $26 \times 35 = (20 \times 30) + (20 \times 5) + (6 \times 30) + (6 \times 5)$ )		
I can use the standard algorithm to solve a 2-digit by 2-digit problem like $46 \times 58$ .		
I can use the standard algorithm to solve a 3-digit by 2-digit problem like $34 \times 247$ .		
I can make estimates to predict how big the answer will be or to see if my answer seems reasonable.		

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multiplication & Division Reflection Sheet page 2 of 3

Here's how I feel about solving multiplication problems like  $6 \times 52$  or  $27 \times 23$ , and  $37 \times 148$ :

Start of the Activity Set	End of the Activity Set

What are two goals for multiplication that are important to you? (What could you improve?)

Start of the Activity Set	End of the Activity Set
<b>1</b>	<b>1</b>
<b>2</b>	<b>2</b>

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multiplication & Division Reflection Sheet

 page 3 of 3

How will you meet each goal above?

Start of the Activity Set	End of the Activity Set
<b>1</b>	<b>1</b>
<b>2</b>	<b>2</b>

# Set A5 ★ Activity 2



## ACTIVITY

### Multiplying by 10, 100 & 1000

#### Overview

Students build and discuss some combinations that involve multiplying by 10. Then they make some generalizations about what happens when 10 serves as the multiplier, and extend their thinking to multiplying by 100 and 1000.

#### Skills & Concepts

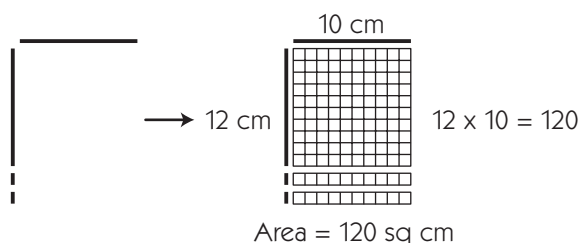
- ★ represent multiplication of a two-digit by a two-digit number with place value models
- ★ multiply by 10, 100, and 1000
- ★ compare the values represented by digits in whole numbers using place value
- ★ solve single- and multi-step word problems involving multi-digit multiplication and verify the solutions

#### You'll need

- ★ Multiplying by 10, 100 & 1000 (pages A5.21 and A5.22, run a class set)
- ★ overhead base ten area and linear pieces
- ★ class set of base ten area and linear pieces
- ★ the full length of the whiteboard and markers

#### Instructions for Multiplying by 10, 100 & 1000

1. Use your overhead linear pieces to frame a 12 by 10 rectangle as shown below. Ask students to pair-share what the dimensions of the figure are and what the area of the figure would be if you filled it in with base ten pieces. After they have had a moment to discuss the questions, fill in the frame with a mat and 2 strips, and work with student input to label the dimensions and area of the rectangle. Then write an equation to show the relationship between the dimensions and the area.



2. Have students pair up. Give each pair a set of base ten area and linear pieces. Ask each pair to work together to frame a 16 by 10 rectangle between them as you do so at the overhead. Have them pair-share what the area of the figure would be if it was filled in with base ten pieces. Ask 2–3 volunteers to share their answers with the class and explain their reasoning.

**Students** *It'll be 160 because it will take a mat and then 6 strips to fill in the frame. We said 160 square centimeters because  $16 \times 10$  is 160.*

**Activity 2** Multiplying by 10, 100 & 1000 (cont.)

3. Have each pair use their base ten pieces to fill in the area as you do so at the overhead. Work with input from the class to label the dimensions and area of the rectangle, and write an equation to match. Ask a volunteer to record the equations on the whiteboard for both rectangles you've examined so far.
4. Repeat Steps 2 and 3 with a 23 by 10, and then a 34 by 10 rectangle.

$12 \times 10 = 120$ $16 \times 10 = 160$ $23 \times 10 = 230$ $34 \times 10 = 340$
---

5. Next, ask students to pair-share what happens when you multiply any number by 10 and invite volunteers to share their thinking with the class.

**Students** *If you multiply by 10, all you have to do is add a 0 at the end.*

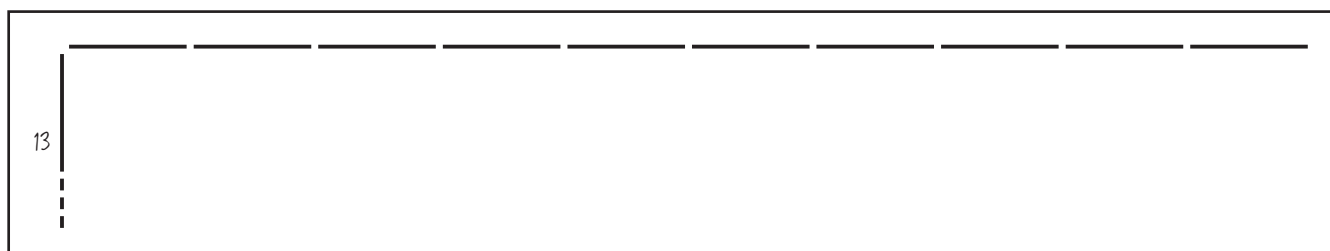
*Like if you have  $23 \times 10$ , you just know the answer is 230 because you add a 0 to the end of 23. It works that way with all of the problems up there.*

*It's the same if you multiply by 100, but then you add 2 zero's to the end.*

Chances are, your students will make reference to adding a zero to the end of any number multiplied by 10 to get the answer. Help them tease out the idea that multiplying tens times tens results in hundreds in all cases. For example, multiplying the 2 tens in 23 by 10 results in 200. Here are some questions you might ask to spur their thinking:

- How does the starting number compare with the answer in each equation? How do 12 and 120 compare? How do 34 and 340 compare?
- What happens to the value of each digit when a number is multiplied by 10?

6. Then draw a 13 by 100 frame on the whiteboard. Work with the class to label the dimensions and ask students to pair-share what the area of the figure would be if you filled it in with base ten pieces



After they have had a minute or two to discuss the question, ask volunteers to share their thinking with the class.

**Students** *We said it's going to be 1000 across the top because you would have to fill that part with 10 mats.*

*It's harder to figure out the strips.*

*There are 3 and then 3 more and then 3 more.*

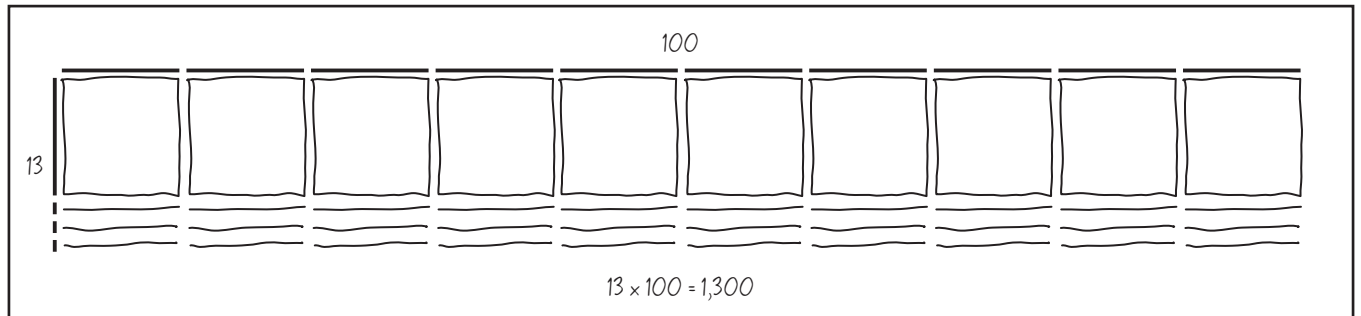
*It will be 10 times 3, so that's 30 strips.*

*Ten strips is 100.*

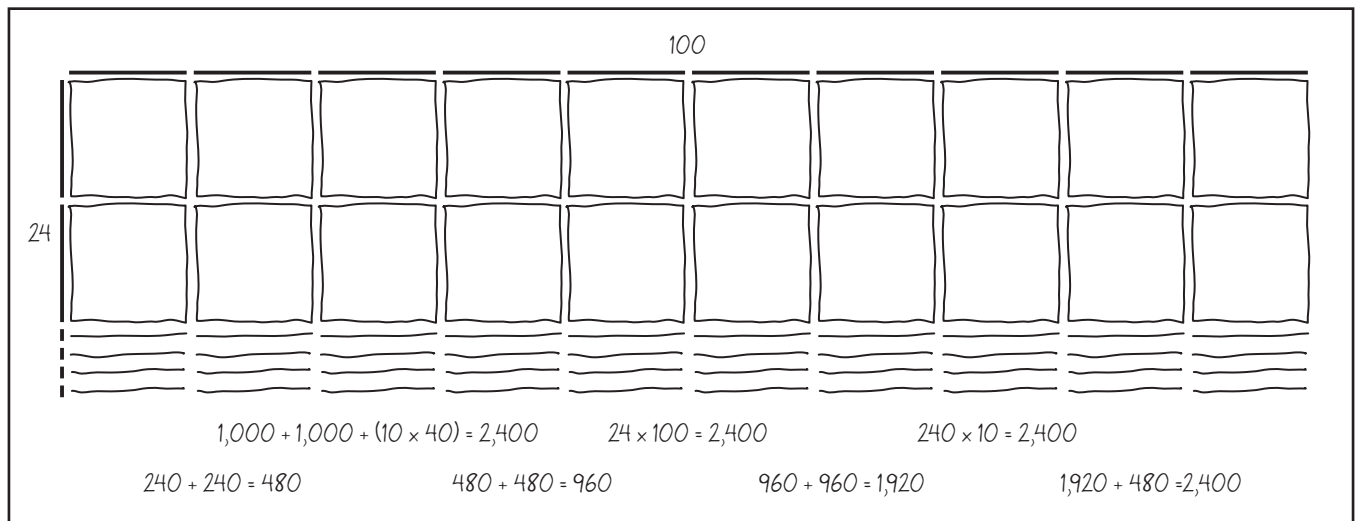
**Activity 2** Multiplying by 10, 100 & 1000 (cont.)

**Students** *It's going to be 1000 and then 300, I think.  
It's going to be like you have ten 130's going across.*

7. Fill in the area with a quick sketch and discuss the result with the class. Work with their input to write a matching multiplication equation. Discuss the fact that thirteen hundred is the same as one thousand three hundred.



8. Erase the whiteboard and repeat Steps 6 and 7 with a 24 by 100 rectangle. This time, encourage students to generate a number of different equations to show the total.



9. Erase the whiteboard. Record  $13 \times 100$ ,  $24 \times 100$ , and several other combinations that involve multiplying by 100. Ask students to supply the answers to each as you go. Have them express the answers in thousands and hundreds as well as just hundreds (i.e., twenty-four hundred or two thousand four hundred).

$13 \times 100 = 1,300$ $24 \times 100 = 2,400$ $39 \times 100 = 3,900$ $56 \times 100 = 5,600$ $70 \times 100 = 7,000$
---

10. Then ask students to explain what happens when you multiply any number times 100. It's likely that some will say you just have to add 2 zeros to the end of the number. Help them understand how the tens times 100 results in thousands.

**Activity 2** Multiplying by 10, 100 & 1000 (cont.)

11. Distribute copies of Multiplying by 10, 100, and 1000. Give students the rest of the math period to work on these sheets independently. Provide assistance as needed, and encourage students to share and compare their answers as they finish.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multiplying by 10, 100 & 1000** page 1 of 2

**1** For each problem, a–c

- label the dimensions.
- fill in the area and label it.
- write a multiplication equation to match.

**example**

**a**

**b**

**c**

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multiplying by 10, 100 & 1000** page 2 of 2

**2** Write the answers.

$\begin{array}{r} 31 \\ \times 10 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ \times 10 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ \times 72 \\ \hline \end{array}$	$\begin{array}{r} 89 \\ \times 10 \\ \hline \end{array}$	$\begin{array}{r} 68 \\ \times 10 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ \times 50 \\ \hline \end{array}$	$\begin{array}{r} 400 \\ \times 10 \\ \hline \end{array}$
--	--	--	--	--	--	---

**3** Fill in the rest of this sentence.  
 When you multiply any number by 10,

**4** Write the answers.

$\begin{array}{r} 29 \\ \times 100 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ \times 100 \\ \hline \end{array}$	$\begin{array}{r} 100 \\ \times 62 \\ \hline \end{array}$	$\begin{array}{r} 46 \\ \times 100 \\ \hline \end{array}$	$\begin{array}{r} 20 \\ \times 100 \\ \hline \end{array}$	$\begin{array}{r} 61 \\ \times 100 \\ \hline \end{array}$	$\begin{array}{r} 300 \\ \times 100 \\ \hline \end{array}$
---	---	---	---	---	---	--

$35 \times 1,000 = \underline{\hspace{2cm}}$        $1,000 \times 19 = \underline{\hspace{2cm}}$        $40 \times 1,000 = \underline{\hspace{2cm}}$

**5** The Ladybugs are planting a garden. They have a 25 cm by 10 cm rectangle for flowers. Each flower needs exactly 1 square centimeter of space. How many flowers can they plant? Show your work.

The Ladybugs can plant \_\_\_\_\_ flowers.

**CHALLENGE**

**6** The Ladybugs have a 30 cm by 10 cm rectangle for pumpkins. Each pumpkin needs exactly 25 square centimeters of space. How many pumpkins can they plant? Show your work on another piece of paper. Include a labeled sketch.

The Ladybugs can plant \_\_\_\_\_ pumpkins.



**INDEPENDENT WORKSHEET**

Use Set A5 Independent Worksheet 1 to provide students with more practice multiplying by 10, 100, and 1000.



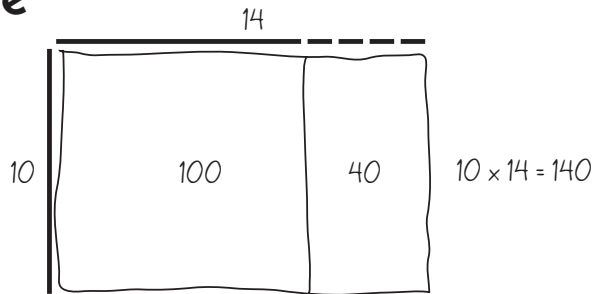
NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multiplying by 10, 100 & 1000 page 1 of 2

- 1** For each problem, a–c
- label the dimensions.
  - fill in the area and label it.
  - write a multiplication equation to match.

**example**



**a**



**b**



**c**



NAME \_\_\_\_\_

DATE \_\_\_\_\_

**Multiplying by 10, 100 & 1000** page 2 of 2**2** Write the answers.

$$\begin{array}{r} 31 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 17 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 72 \\ \hline \end{array}$$

$$\begin{array}{r} 89 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 68 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 50 \\ \hline \end{array}$$

$$\begin{array}{r} 400 \\ \times 10 \\ \hline \end{array}$$

**3** Fill in the rest of this sentence.

When you multiply any number by 10,

**4** Write the answers.

$$\begin{array}{r} 29 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 100 \\ \times 62 \\ \hline \end{array}$$

$$\begin{array}{r} 46 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 61 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 300 \\ \times 100 \\ \hline \end{array}$$

$35 \times 1,000 = \underline{\hspace{2cm}}$

$1,000 \times 19 = \underline{\hspace{2cm}}$

$40 \times 1,000 = \underline{\hspace{2cm}}$

**5** The Ladybugs are planting a garden. They have a 25 cm by 10 cm rectangle for flowers. Each flower needs exactly 1 square centimeter of space. How many flowers can they plant? Show your work.

The Ladybugs can plant \_\_\_\_\_ flowers.

**CHALLENGE****6** The Ladybugs have a 30 cm by 10 cm rectangle for pumpkins. Each pumpkin needs exactly 25 square centimeters of space. How many pumpkins can they plant? Show your work on another piece of paper. Include a labeled sketch.

The Ladybugs can plant \_\_\_\_\_ pumpkins.

# Set A5 ★ Activity 3



## ACTIVITY

### Multiplying Single Digits by Multiples of Ten

#### Overview

Students make sketches to investigate and make generalizations about multiplying single digits by multiples of ten. Then they complete two related worksheets independently.

#### Skills & Concepts

- ★ multiply by 10, 100, and 1000
- ★ compare the values represented by digits in whole numbers using place value

#### You'll need

- ★ Explore Six (page A5.26, run 1 copy on a transparency and a class set on paper)
- ★ Explore More (page A5.27, run a class set)
- ★ Multiplication Practice (page A5.28, run a class set)
- ★ overhead pens in black and red
- ★ red, blue, and regular pencils for students

#### Instructions for Multiplying Single Digits by Multiples of Ten

1. Give students each a copy of Explore Six, and display the transparency at the overhead. Review the instructions and examine the example at the top of the sheet with the class. Do problem a. together. Use your red overhead pen to label the dimensions of the rectangle, and have students use their red pencils to do so on their own sheets. Work with student input to determine the area of the rectangle and write a matching multiplication equation.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Explore Six

**1** Label the dimensions and area of the rectangle on each grid. Write a multiplication equation to match.

**example** 10

**a** 20

**b**

**c**

**2** Use the information above to help solve these equations.

$6 \times 50 = \underline{\hspace{2cm}}$        $6 \times 60 = \underline{\hspace{2cm}}$        $6 \times 70 = \underline{\hspace{2cm}}$   
 $6 \times 80 = \underline{\hspace{2cm}}$        $6 \times 90 = \underline{\hspace{2cm}}$        $6 \times 100 = \underline{\hspace{2cm}}$

**Activity 3** Multiplying Single Digits by Multiples of Ten (cont.)

2. When students understand what to do, have them work on the sheet independently. Give assistance as needed. Encourage them to share and compare their answers with neighbors as they finish.

3. When most students have finished the sheet, reconvene the class. Ask children to pair-share any mathematical observations they can make about the worksheet. Here are some questions you might pose to spark their thinking:

- Did you notice any patterns in your answers?
- Did the sheet seem easy or challenging?
- What was easy (or challenging) for you about these problems?

4. Call on volunteers to share their observations with the class. Chances are, some of your students will note the relationship between the basic facts for 6 and multiplying 6 by multiples of 10. If this does not emerge during the discussion, write the combinations shown below on the board as students watch.

$6 \times 1 = 6$	$6 \times 10 = 60$
$6 \times 2 = 12$	$6 \times 20 = 120$
$6 \times 3 = 18$	$6 \times 30 = 180$
$6 \times 4 = 24$	$6 \times 40 = 240$

Then have them list the rest of the combinations in the series, through  $6 \times 10$  and  $6 \times 100$ , as you record at the board. Here are some additional questions to pose:

- What do you notice about these pairs of combinations?
- Why does this pattern work the way it does?
- What happens to the value of each of the digits in the basic fact products when 6 is multiplied by a multiple of 10? Why?
- Would this pattern work with a different single-digit number? Why or why not?

5. Give students each a copy of Explore More. This sheet asks them to further explore the relationship between basic facts and multiplying by multiples of 10 by choosing a single-digit number between 4 and 9 (other than 6) to investigate. Review the instructions on the sheet with the class. Clarify and model as needed. Ask students to draw the missing dimension for each rectangle in red, and the rectangle on each grid in blue.

6. When students understand what to do, let them go to work. Give assistance as needed, and encourage children to share their discoveries with one another as they work. As they finish, have students start working on the Multiplication Practice sheet. Unfinished work can be sent home to be completed or assigned as seatwork at another time.

### Activity 3 Multiplying Single Digits by Multiples of Ten (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

#### Explore More

1 Chose a number between 4 and 9 (not 6) to multiply by 10 and multiples of 10. Draw the missing dimension and fill in the rectangle on each grid. Label the dimensions and the area of each rectangle. Write a multiplication equation to match.

**a**

**b**

**c**

**d**

2 Use the information above to help complete these equations. Put the number you chose in the blank to the left side of the equation.

\_\_\_ × 50 = \_\_\_\_\_      \_\_\_ × 60 = \_\_\_\_\_      \_\_\_ × 70 = \_\_\_\_\_  
 \_\_\_ × 80 = \_\_\_\_\_      \_\_\_ × 90 = \_\_\_\_\_      \_\_\_ × 100 = \_\_\_\_\_

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

#### Multiplication Practice

1 Solve these problems in your head. Write the answers.

$\begin{array}{r} 10 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 20 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ \times 3 \\ \hline \end{array}$
$\begin{array}{r} 80 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 90 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 100 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 1,000 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 10,000 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 100,000 \\ \times 3 \\ \hline \end{array}$	

2 Explain how you figured out the answers to the problems above.

3 Solve these problems in your head. Write the answers.

$\begin{array}{r} 10 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 20 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ \times 5 \\ \hline \end{array}$
$\begin{array}{r} 80 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 90 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 100 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 1,000 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 80 \\ \times 5 \\ \hline \end{array}$
$\begin{array}{r} 400 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 300 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 500 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 600 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 200 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 700 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 800 \\ \times 5 \\ \hline \end{array}$

**CHALLENGE**

$\begin{array}{r} 900 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 400 \\ \times 12 \\ \hline \end{array}$	$\begin{array}{r} 800 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 600 \\ \times 12 \\ \hline \end{array}$	$\begin{array}{r} 700 \\ \times 11 \\ \hline \end{array}$	$\begin{array}{r} 800 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 800 \\ \times 12 \\ \hline \end{array}$
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### INDEPENDENT WORKSHEET

Use Set A5 Independent Worksheet 2 to provide students with more practice multiplying single digit numbers by multiples of 10.

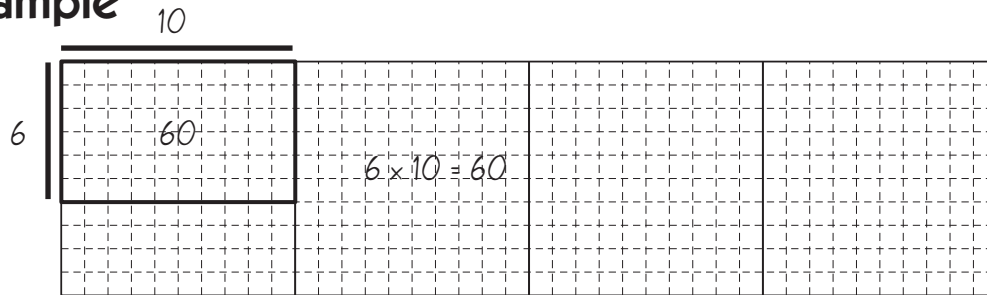
NAME \_\_\_\_\_

DATE \_\_\_\_\_

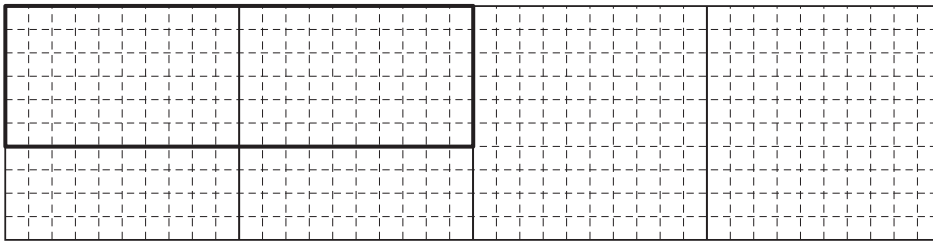
# Explore Six

1 Label the dimensions and area of the rectangle on each grid. Write a multiplication equation to match.

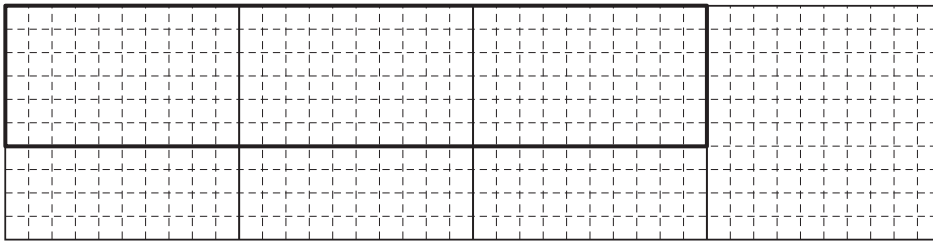
**example**



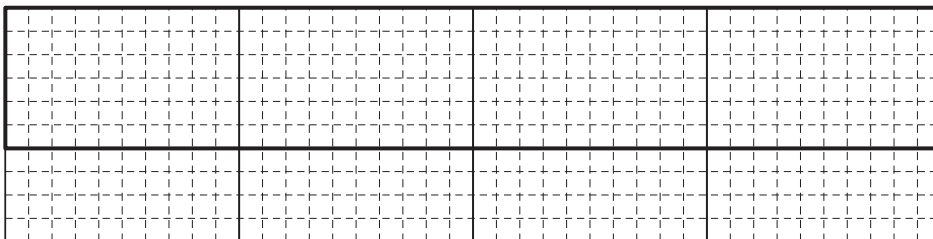
**a**



**b**



**c**



2 Use the information above to help solve these equations.

$6 \times 50 = \underline{\hspace{2cm}}$

$6 \times 60 = \underline{\hspace{2cm}}$

$6 \times 70 = \underline{\hspace{2cm}}$

$6 \times 80 = \underline{\hspace{2cm}}$

$6 \times 90 = \underline{\hspace{2cm}}$

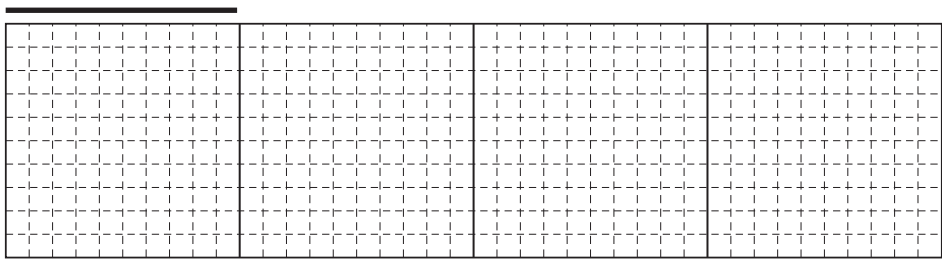
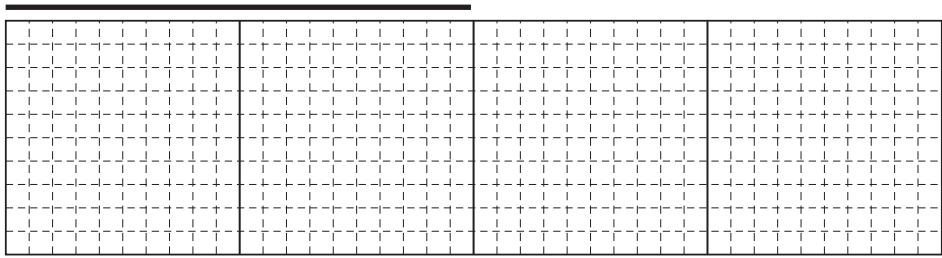
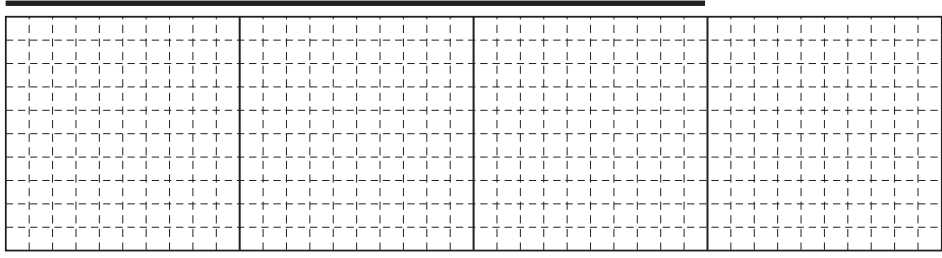
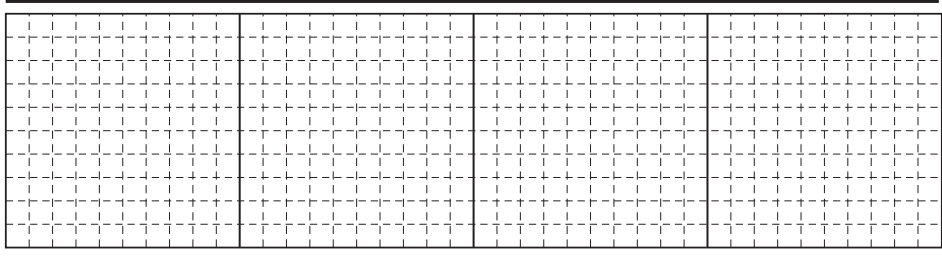
$6 \times 100 = \underline{\hspace{2cm}}$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Explore More

**1** Chose a number between 4 and 9 (not 6) to multiply by 10 and multiples of 10. Draw the missing dimension and fill in the rectangle on each grid. Label the dimensions and the area of each rectangle. Write a multiplication equation to match.

<b>a</b>	
<b>b</b>	
<b>c</b>	
<b>d</b>	

**2** Use the information above to help complete these equations. Put the number you chose in the blank to the left side of the equation.

$___ \times 50 = \underline{\hspace{2cm}}$

$___ \times 60 = \underline{\hspace{2cm}}$

$___ \times 70 = \underline{\hspace{2cm}}$

$___ \times 80 = \underline{\hspace{2cm}}$

$___ \times 90 = \underline{\hspace{2cm}}$

$___ \times 100 = \underline{\hspace{2cm}}$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multiplication Practice

1 Solve these problems in your head. Write the answers.

$$\begin{array}{r} 10 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 30 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 40 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 50 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 70 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 90 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 100 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 1,000 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 10,000 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 100,000 \\ \times 3 \\ \hline \end{array}$$

2 Explain how you figured out the answers to the problems above.

3 Solve these problems in your head. Write the answers.

$$\begin{array}{r} 10 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 30 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 40 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 50 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 70 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 90 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 100 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 1,000 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 70 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 400 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 300 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 500 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 600 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 200 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 700 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 800 \\ \times 5 \\ \hline \end{array}$$



## CHALLENGE

$$\begin{array}{r} 900 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 400 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 800 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 600 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 700 \\ \times 11 \\ \hline \end{array}$$

$$\begin{array}{r} 800 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 800 \\ \times 12 \\ \hline \end{array}$$



# Set A5 ★ Activity 4



## ACTIVITY

### Single-Digit Multiplication with Pictures & Numbers

#### Overview

Students use the area model to picture and solve 1-digit by 2-digit multiplication problems. In this activity, the focus is on transitioning to using numbers only, connecting them to the area model as needed to support students' work.

#### Skills & Concepts

- ★ multiply two-digit by one-digit numbers
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ solve single- and multi-step word problems involving multi-digit multiplication and verify the solutions

#### You'll need

- ★ Multiplication Story Problems (page A5.32, run one copy on a transparency)
- ★ Single-Digit Multiplication (pages A5.33 and A5.34, run a class set)
- ★ overhead pens
- ★ a piece of paper to mask portions of the overhead

#### Instructions for Single-Digit Multiplication with Pictures & Numbers

1. Place the top section of Multiplication Story Problems on display at the overhead. Keep the other two problems covered for now. Read the problem with the class. Work with students' input to record a matching multiplication expression in vertical form. Ask them to pair-share estimates. Then call on volunteers to share their estimates with the class and explain their reasoning.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

#### Multiplication Story Problems

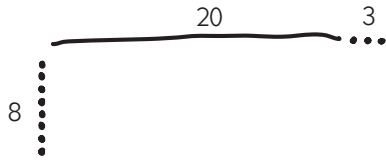
1 The kids in Mr. Gill's class are going to paint a mural in the hallway by the office. The wall is 8 feet high and 23 feet long. How many square feet is the wall they're going to paint?

$$\begin{array}{r} 23 \\ \times 8 \\ \hline \end{array}$$

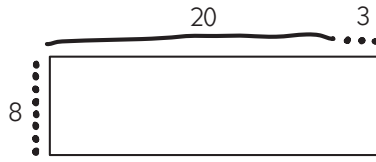
**Students** *It's going to be more than 160 square feet because  $10 \times 8$  is 80, and  $80 + 80$  is 160. I said maybe about 180 because  $8 \times 25$  is 200.  $8 \times 20$  is 160, so this will be more.*

2. Demonstrate how to make a very quick sketch to show  $8 \times 23$  either on the whiteboard or the overhead. First sketch the dimensions, then the total array, and then add a line to show how the array can be divided into two partial products by place value (a step-by-step example is shown on the next page).

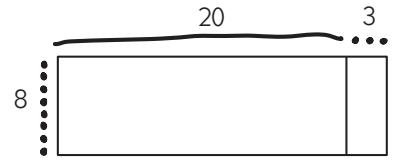
**Activity 4** Single-Digit Multiplication with Pictures & Numbers (cont.)



**Step 1** Sketch and label the dimensions.



**Step 2** Draw a rectangle to show the whole product.



**Step 3** Draw a line to show how the whole product can be divided into 2 partial products.

3. After you've sketched the array, give students each a copy of the Single-Digit Multiplication worksheet. Ask them to record  $8 \times 23$  as the first problem at the top of the sheet and make a quick sketch similar to yours. Then ask everyone to find the total product by filling in and adding together the two partial products. Have them compare their results with a neighbor as they finish, and then reconvene the class.

4. Ask students to share their partial products while you record them in numerical form beside the array. Focus students' attention on the magnitude of the final answer by starting with the numbers in the tens place, as shown below.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

**Multiplication Story Problems**

**1** The kids in Mr. Gill's class are going to paint a mural in the hallway by the office. The wall is 8 feet high and 23 feet long. How many square feet is the wall they're going to paint?

$$\begin{array}{r} 23 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ \times 8 \\ \hline 8 \times 20 = 160 \\ 8 \times 3 = 24 \\ \hline 184 \end{array}$$

5. Repeat Steps 1–4 with the other two problems at the overhead. Ask students to use your method of recording and computing for Problems 2 and 3. (A filled in copy of the overhead is shown below for your reference.) Then give students the second page of Single-Digit Multiplication (or have them turn their sheets over if you ran the pages back-to-back), and work the rest of the problems independently. Give help as needed, or meet with a small group to provide extra support.

**2** The fourth graders are doing a show for their families. They set up 6 rows of chairs. They put 26 chairs in each row. How many chairs did they use altogether?

$$\begin{array}{r} 26 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 26 \\ \times 6 \\ \hline 6 \times 20 = 120 \\ 6 \times 6 = 36 \\ \hline 156 \end{array}$$

**3** There is a big party at the park. There are 7 tables with balloons for the kids. Each table has 34 balloons. How many balloons in all?

$$\begin{array}{r} 34 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 34 \\ \times 7 \\ \hline 7 \times 30 = 210 \\ 7 \times 4 = 28 \\ \hline 238 \end{array}$$

**Activity 4** Single-Digit Multiplication with Pictures & Numbers (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Single-Digit Multiplication** page 1 of 2

1 Use sketches and numbers to solve each of these story problems with your class.

**a**

**b**

**c**

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Single-Digit Multiplication** page 2 of 2

2 Use a sketch and numbers to solve the problems below. Follow the example.

Sketch	Numbers
<b>example</b> 	$\begin{array}{r} 28 \\ \times 4 \\ \hline 4 \times 20 = 80 \\ 4 \times 8 = 32 \\ \hline 112 \end{array}$
<b>a</b>	$\begin{array}{r} 36 \\ \times 5 \\ \hline 5 \times 30 = \\ 5 \times 6 = + \end{array}$
<b>b</b>	$\begin{array}{r} 24 \\ \times 7 \\ \hline 7 \times 20 = \\ 7 \times 4 = + \end{array}$
<b>c</b>	$\begin{array}{r} 45 \\ \times 9 \\ \hline 9 \times 40 = \\ 9 \times 5 = + \end{array}$

3 Use numbers to solve these problems.

<b>a</b>	$\begin{array}{r} 52 \\ \times 6 \\ \hline 6 \times 50 = \\ 6 \times 2 = + \end{array}$	<b>b</b>	$\begin{array}{r} 37 \\ \times 7 \\ \hline 7 \times 30 = \\ 7 \times 7 = + \end{array}$	<b>c</b>	$\begin{array}{r} 65 \\ \times 4 \\ \hline \end{array}$	<b>d</b>	$\begin{array}{r} 325 \\ \times 7 \\ \hline \end{array}$
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**INDEPENDENT WORKSHEET**

Use Set A5 Independent Worksheet 3 to provide students with more practice finding and adding partial products to multiply double-digit by single-digit numbers.

## Multiplication Story Problems

**1** The kids in Mr. Gill's class are going to paint a mural in the hallway by the office. The wall is 8 feet high and 23 feet long. How many square feet is the wall they're going to paint?

**2** The fourth graders are doing a show for their families. They set up 6 rows of chairs. They put 26 chairs in each row. How many chairs did they use altogether?

**3** There is a big party at the park. There are 7 tables with balloons for the kids. Each table has 34 balloons. How many balloons in all?

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Single-Digit Multiplication page 1 of 2

**1** Use sketches and numbers to solve each of these story problems with your class.

**a**

**b**

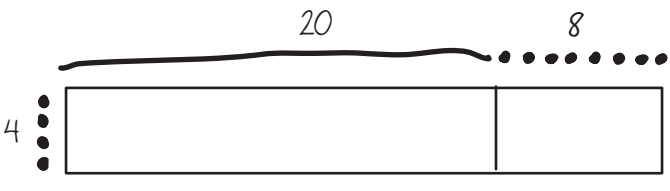
**c**

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Single-Digit Multiplication page 2 of 2

2 Use a sketch and numbers to solve the problems below. Follow the example.

Sketch	Numbers
<p><b>example</b></p> 	$\begin{array}{r} 28 \\ \times 4 \\ \hline 4 \times 20 = 80 \\ 4 \times 8 = 32 \\ \hline 112 \end{array}$
<p><b>a</b></p>	$\begin{array}{r} 36 \\ \times 5 \\ \hline 5 \times 30 = \underline{\quad} \\ 5 \times 6 = + \underline{\quad} \end{array}$
<p><b>b</b></p>	$\begin{array}{r} 24 \\ \times 7 \\ \hline 7 \times 20 = \underline{\quad} \\ 7 \times 4 = + \underline{\quad} \end{array}$
<p><b>c</b></p>	$\begin{array}{r} 45 \\ \times 9 \\ \hline 9 \times 40 = \underline{\quad} \\ 9 \times 5 = + \underline{\quad} \end{array}$

3 Use numbers to solve these problems.

<p><b>a</b></p> $\begin{array}{r} 52 \\ \times 6 \\ \hline 6 \times 50 = \underline{\quad} \\ 6 \times 2 = + \underline{\quad} \end{array}$	<p><b>b</b></p> $\begin{array}{r} 37 \\ \times 7 \\ \hline 7 \times 30 = \underline{\quad} \\ 7 \times 7 = + \underline{\quad} \end{array}$	<p><b>c</b></p> $\begin{array}{r} 65 \\ \times 4 \\ \hline \end{array}$	<p><b>d</b></p> $\begin{array}{r} 325 \\ \times 7 \\ \hline \end{array}$
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# Set A5 ★ Activity 5



## ACTIVITY

### Introducing the Standard Multiplication Algorithm

#### Overview

Students use the standard algorithm to multiply two- and three-digit by one-digit numbers.

#### Skills & Concepts

- ★ multiply 2- and 3-digit by 1-digit numbers using the standard multiplication algorithm
- ★ estimate products to approximate solutions and determine reasonableness of answers

#### You'll need

- ★ Roll Your Own Multiplication Problems (page A5.38, run a class set)
- ★ dice numbered 1–6 (class set)
- ★ dice numbered 4–9 (class set)
- ★ several blank transparencies
- ★ overhead pens
- ★ Student Math Journals or 1 piece of lined or grid paper per student

#### Instructions for Introducing the Standard Multiplication Algorithm

1. Write  $8 \times 28$  on the board or overhead. Ask students to first pair-share estimates and then call on volunteers to share their thinking with the class.

**Students** *It's kind of like 8 times 30. That would be 240 because  $8 \times 3$  is 24. We said 10 times 28 is 280, so it's going to be less than that. Eight times 20 is 160, but then you have to add on the  $8 \times 8$ . It's going to be more than 200 for sure.*

2. Next, ask students to find the product using the computing method they practiced during the previous activity. Encourage them to make sketches to support their thinking if that's helpful to them. Then ask a volunteer to make a labeled sketch that shows the partial products, and another volunteer to record the computations at the board.

$$\begin{array}{r}
 28 \\
 \times 8 \\
 \hline
 8 \times 20 = 160 \\
 8 \times 8 = + 64 \\
 \hline
 224
 \end{array}$$

3. Explain that many people use a method for solving problems like these that features some interesting shortcuts. Before calculators were invented, this method helped people solve large multiplication problems. Then demonstrate the standard algorithm at the overhead or board. Talk your way through each step as you do it. Ask students to watch and listen closely to see if they can make sense of what you're doing based on all the experiences they've had with multiplication.

**Activity 5** Introducing the Standard Multiplication Algorithm (cont.)

**Teacher** This method starts with the ones instead of the tens. So first I multiply  $8 \times 8$ . That's 64. I write the 4 in the ones place and move the 6 tens from 64 over to the tens place. Then I multiply 8 times 20. That's 160. If I add the 60 I carried over to the tens place, it's 220, and 220 plus 4 is 224.

$$\begin{array}{r} 6 \\ 28 \\ \times 8 \\ \hline 224 \end{array}$$

4. When you have finished the demonstration, ask students to explain how this method works. Can they see any connection between the algorithm and the area model? Does the strategy make sense to them?

**Students** My mom showed me how to do it that way last year.

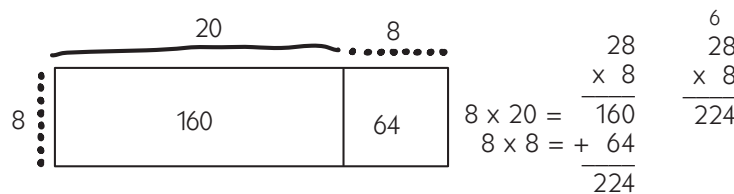
I don't get where the little 6 at the top came from.

It's like carrying when you add.

I like that way of doing it. It seems faster and easier.

Why do they start with the ones instead of the tens? I like the other way better.

Ask your students to connect the algorithm you've modeled to the array. Where do they see 224 in the array?



**Students** I don't see 224 in the array at all.

But that's what you get if you add 160 and 64 together because 160 and 60 makes 220, and then 4 more is 224, right?

It's kind of like you just do everything at the same time instead of doing it in two steps.

5. Now give students a chance to try the standard algorithm for themselves. Write  $6 \times 26$  on the whiteboard and ask students to copy the problem into their journals and jot an estimate to the side. Then work with class input to solve it together, using the standard algorithm. Work the following four problems together in a similar fashion.

- $36 \times 4$
- $48 \times 5$
- $144 \times 6$
- $345 \times 5$

6. Provide students with more practice using the standard algorithm. Depending on the needs and strengths of your class, you may want to have some students solve additional problems with you, while others work independently on the Roll Your Own Multiplication sheet. Students who are very comfortable with the algorithm can be assigned to solve the challenge problem at the bottom of the sheet.



## Activity 5 Introducing the Standard Multiplication Algorithm (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline: Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Roll Your Own Multiplication Problems

1 For problems e–g below:

- Choose a die numbered 1–6 or 4–9.
- Roll it as many times as you need to fill in each of the boxes below. You can write each number you roll in any box on the sheet, but once all the boxes are filled, you can't change them.
- Use the method you just learned in class to solve your problems.
- When you're finished, trade papers with a classmate and have him or her check your answers.

<b>a</b> <div style="text-align: right; margin-right: 20px;">□ □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/>	<b>b</b> <div style="text-align: right; margin-right: 20px;">□ □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/>	<b>c</b> <div style="text-align: right; margin-right: 20px;">□ □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/>	<b>d</b> <div style="text-align: right; margin-right: 20px;">□ □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/>
<b>e</b> <div style="text-align: right; margin-right: 20px;">□ □ □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/>	<b>f</b> <div style="text-align: right; margin-right: 20px;">□ □ □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/>	<b>g</b> <div style="text-align: right; margin-right: 20px;">□ □ □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/>	

**CHALLENGE**

5 Use each of these digits just one time: 0 1 2 3 4 5 6 7 8 9  
Write them in the spaces below to make each problem correct.

<b>a</b> <div style="text-align: right; margin-right: 20px;">6 □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>3</span><span>6</span><span>6</span> </div>	<b>b</b> <div style="text-align: right; margin-right: 20px;">4 □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>3</span><span>□</span><span>1</span> </div>	<b>c</b> <div style="text-align: right; margin-right: 20px;">4 □</div> <div style="text-align: right; margin-right: 20px;">□</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>□</span><span>4</span><span>5</span> </div>	<b>d</b> <div style="text-align: right; margin-right: 20px;">8 □</div> <div style="text-align: right; margin-right: 20px;">2</div> <div style="text-align: right; margin-right: 20px;">×</div> <hr style="width: 50%; margin-left: 0;"/> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>3</span><span>2</span><span>□</span> </div>
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**Note** If some of your students are confused by the standard algorithm, you may want to share the strategy shown below, in which the partial products are added, but computation starts with the ones instead of the tens. This strategy may help ease some students' transition into the standard algorithm.

$$\begin{array}{r}
 47 \quad 47 \\
 \times 4 \quad \times 4 \\
 \hline
 4 \times 7 = 28 \quad 188 \\
 4 \times 40 = + 160 \\
 \hline
 188
 \end{array}$$



### INDEPENDENT WORKSHEET

Use Set A5 Independent Worksheet 4 to provide students with more practice using the standard algorithm for multiplication for 2-digit by 1-digit multiplication.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Roll Your Own Multiplication Problems

1 For problems e–g below:

- Choose a die numbered 1–6 or 4–9.
- Roll it as many times as you need to fill in each of the boxes below. You can write each number you roll in any box on the sheet, but once all the boxes are filled, you can't change them.
- Use the method you just learned in class to solve your problems.
- When you're finished, trade papers with a classmate and have him or her check your answers.

<b>a</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div>	<b>b</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div>	<b>c</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div>	<b>d</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div>
<b>e</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div>	<b>f</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div>	<b>g</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div>	



## CHALLENGE

5 Use each of these digits just one time: 0 1 2 3 4 5 6 7 8 9  
Write them in the spaces below to make each problem correct.

<b>a</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px; text-align: center;"/>6 <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div> <div style="margin-left: 20px; display: flex; justify-content: space-around;"> <input style="width: 30px; height: 30px; text-align: center;"/>3 <input style="width: 30px; height: 30px; text-align: center;"/>6 <input style="width: 30px; height: 30px; text-align: center;"/>6 </div>	<b>b</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px; text-align: center;"/>4 <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div> <div style="margin-left: 20px; display: flex; justify-content: space-around;"> <input style="width: 30px; height: 30px; text-align: center;"/>3 <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px; text-align: center;"/>1 </div>	<b>c</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px; text-align: center;"/>4 <input style="width: 30px; height: 30px;" type="text"/>  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div> <div style="margin-left: 20px; display: flex; justify-content: space-around;"> <input style="width: 30px; height: 30px;" type="text"/> <input style="width: 30px; height: 30px; text-align: center;"/>4 <input style="width: 30px; height: 30px; text-align: center;"/>5 </div>	<b>d</b> <div style="text-align: right; margin-right: 20px;"> <input style="width: 30px; height: 30px; text-align: center;"/>8 <input style="width: 30px; height: 30px; text-align: center;"/>2  <input style="width: 30px; height: 30px;" type="text"/> </div> <div style="margin-left: 20px;">       ×  <hr style="width: 100%;"/> </div> <div style="margin-left: 20px; display: flex; justify-content: space-around;"> <input style="width: 30px; height: 30px; text-align: center;"/>3 <input style="width: 30px; height: 30px; text-align: center;"/>2 <input style="width: 30px; height: 30px;" type="text"/> </div>
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# Set A5 ★ Activity 6



## ACTIVITY

### Think before You Multiply

#### Overview

In this activity, students consider the following questions: Is it always most efficient and effective to use the standard algorithm for multi-digit multiplication? What kinds of combinations are best solved with the algorithm? What kinds of combinations might be better solved using other methods?

#### Skills & Concepts

- ★ multiply 2- and 3-digit by 1-digit numbers using the standard multiplication algorithm
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ identify strategies that can be used to solve a problem, select and use one or more appropriate strategies to solve the problem, and justify the selection
- ★ explain why a specific problem-solving strategy was used to determine a solution

#### You'll need

- ★ Think before You Multiply (page A5.42, run one copy on a transparency)
- ★ Multiplication Methods (pages A5.43 and A5.44, run a class set)
- ★ piece of paper to mask parts of the overhead
- ★ overhead pen
- ★ Student Math Journals or 1 piece of lined or grid paper per student

#### Instructions for Think before You Multiply

1. Tell students in a minute, you're going to show them a multiplication problem at the overhead, and ask them to solve it mentally. Let them know that they can use any method that makes sense to them. Then display the first problem on the overhead, keeping the rest covered for now. Ask students to think privately about the problem and raise their hand when they have the answer.



2. When most of the students have raised their hands, call on several to share their solutions and explain their methods to the class. Record each method at the overhead as students share, and label the methods with input from the class.

*Danny* First I tried doing it the way where you multiply  $2 \times 8$  first, but I couldn't keep the numbers in my head. Then I saw 48 is really close to 50, so I went  $50 + 50$  is 100, and take away 4 is 96.

**Activity 6** Think before You Multiply (cont.)

**Rosa** I thought it was pretty easy to start with the ones. I went  $2 \times 8$  is 16, put down the 6 and carry the 10. Then  $2 \times 40$  is 80 plus 10 more is 90, so it's 96 in all.

**Jamal** I just doubled 48. It's 96 because 40 and 40 is 80, then 8 and 8 is 16, and 80 plus 16 is 96.

**Tran** I did it kind of that way with multiplying. I said  $2 \times 40$  is 80 and  $2 \times 8$  is 16.  $80 + 16$  is 96.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

**Think Before You Multiply**

**1**

$$\begin{array}{r} 48 \\ \times 2 \\ \hline \end{array}$$

3. Repeat Steps 1 and 2 with the next two problems on the overhead ( $23 \times 4$  and  $99 \times 5$ ). Encourage students to debate and discuss the methods they're choosing. Some may feel that the standard algorithm or finding and adding partial products is easiest, while others find a basic facts strategy or the use of landmark numbers such as 25, 50, or 100 is more efficient.

**Students** It's too hard to keep the numbers in your head with the regular way.

On  $99 \times 5$ , you can just go  $100 \times 5$  and take away 5. That's the easiest!

Same with  $4 \times 23$ . That's just like  $4 \times 25$ , and then take 8 away.

I like using tens and ones on that one. Just go  $4 \times 20$  is 80, and  $4 \times 3$  is 12, so you get 92.

I think when you're doing multiplication in your head, the regular way is hard because you have to remember what number you put in the ones place, and what you put over in the tens place.

4. Show the fourth problem,  $125 \times 4$ , and ask students if they can solve it in their heads. Some may say they can't because the numbers are too big. Give them a minute to think about it. Chances are, at least a few will use a basic facts strategy such as double-doubles or landmark numbers. If not, volunteer one of these strategies yourself. Then work with student input to solve the problem using the standard algorithm and then partial products. Which of these methods seems easiest and most efficient? Why?

**4**

$$\begin{array}{r} 125 \\ \times 4 \\ \hline \end{array}$$


---

**5**

$$\begin{array}{r} 469 \\ \times 5 \\ \hline \end{array}$$

5. Show the last problem,  $469 \times 5$ , on the overhead, and ask students if they can work it in their heads. Why or why not? Many students will probably agree that it's too big to tackle mentally. Ask them to pair-share estimates, and then work the problem twice in their journals, once using the standard algorithm and once by finding and adding the partial products. Have them share and compare their work with the people sitting next to them to be sure they have the correct answers. Then talk with the group about both methods. Which seemed easier? Which seemed most efficient? Why?

**Activity 6** Think before You Multiply (cont.)

6. Work with the class to make some generalizations about the different multiplication methods they've used to solve the problems on the overhead. Is the standard algorithm always the quickest and easiest? What about finding and adding partial products? When does it work best to use a basic facts strategy or a landmark number? Record some of their thoughts on a piece of chart paper.

Which Multiplication Methods Work Best?

- If you're multiplying numbers like  $4 \times 38$  in your head, it's easy to do the tens and then the ones and add them.
- You should use landmark numbers when you can. Like if you're doing  $6 \times 199$ , just think about  $6 \times 200$ , and take 6 away.
- If you're multiplying a big number, like  $5 \times 469$ , the regular way is good. But you have to remember to carry the tens and hundreds, and add them in.
- If you find partial products for  $5 \times 469$ , it's  $2000 + 300 + 45$ . There's more to write, but you can see all the numbers.

7. Hand out a copy of Multiplication Methods to each student and give children the rest of the math period to work the problems. If some students still need support in solving multi-digit multiplication problems, you may want to meet with a small group while the rest of the class works independently.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multiplication Methods** page 1 of 2

Here are three different ways to solve  $4 \times 199$ .

Standard Algorithm	Partial Products	Landmark Numbers
$\begin{array}{r} 199 \\ \times 4 \\ \hline 796 \end{array}$	$4 \times 100 = 400$ $4 \times 90 = 360$ $4 \times 9 = 36$ $400 + 360 + 36 = 796$	$199$ is almost like $200$ $4 \times 200 = 800$ $800 - 4 = 796$

**1** Use the standard algorithm to solve each problem below. Then solve it a different way. Label your method. Circle the method that seemed quicker and easier.

	Standard Algorithm	A Different Way
<b>a</b> $\begin{array}{r} 37 \\ \times 4 \\ \hline \end{array}$		
<b>b</b> $\begin{array}{r} 63 \\ \times 7 \\ \hline \end{array}$		
<b>c</b> $\begin{array}{r} 299 \\ \times 6 \\ \hline \end{array}$		
<b>d</b> $\begin{array}{r} 749 \\ \times 7 \\ \hline \end{array}$		

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multiplication Methods** page 2 of 2

**2** Fill in the bubble to show the best estimate for each problem.

<b>a</b> $\begin{array}{r} 43 \\ \times 7 \\ \hline \end{array}$	<b>b</b> $\begin{array}{r} 226 \\ \times 4 \\ \hline \end{array}$
--	---

200  
 250  
 300  
 350

700  
 800  
 900  
 1,000

**c** Circle the method that seems to help most for estimating.

Standard Algorithm
Partial Products

**3** The fourth and fifth graders at King School went to the museum yesterday in 7 buses. There were 65 students on each bus. How many students were there in all? Show your work.

**4** The big building downtown has 27 floors. There are 8 offices on each floor. Each office has 8 computers. How many computers are there in all? Show your work.



**INDEPENDENT WORKSHEET**

Use Set A5 Independent Worksheet 5 to provide students with additional opportunities to select and use different multiplication methods.

# Think Before You Multiply

**1**

$$\begin{array}{r} 48 \\ \times 2 \\ \hline \end{array}$$

**2**

$$\begin{array}{r} 23 \\ \times 4 \\ \hline \end{array}$$

**3**

$$\begin{array}{r} 99 \\ \times 5 \\ \hline \end{array}$$

**4**

$$\begin{array}{r} 125 \\ \times 4 \\ \hline \end{array}$$

**5**

$$\begin{array}{r} 469 \\ \times 5 \\ \hline \end{array}$$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Multiplication Methods page 1 of 2

Here are three different ways to solve  $4 \times 199$ .

Standard Algorithm	Partial Products	Landmark Numbers
$\begin{array}{r} \phantom{0}^{\text{33}} \\ 199 \\ \times 4 \\ \hline 796 \end{array}$	$\begin{aligned} 4 \times 100 &= 400 \\ 4 \times 90 &= 360 \\ 4 \times 9 &= 36 \\ 400 + 360 + 36 &= 796 \end{aligned}$	$\begin{aligned} 199 \text{ is almost like } 200 \\ 4 \times 200 &= 800 \\ 800 - 4 &= 796 \end{aligned}$

**1** Use the standard algorithm to solve each problem below. Then solve it a different way. Label your method. Circle the method that seemed quicker and easier.

	Standard Algorithm	A Different Way
<b>a</b> $\begin{array}{r} 37 \\ \times 4 \\ \hline \end{array}$		
<b>b</b> $\begin{array}{r} 63 \\ \times 7 \\ \hline \end{array}$		
<b>c</b> $\begin{array}{r} 299 \\ \times 6 \\ \hline \end{array}$		
<b>d</b> $\begin{array}{r} 749 \\ \times 7 \\ \hline \end{array}$		

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Multiplication Methods page 2 of 2

**2** Fill in the bubble to show the best estimate for each problem.

<p><b>a</b>    <math display="block">\begin{array}{r} 43 \\ \times 7 \\ \hline \end{array}</math></p>	<p><b>b</b>    <math display="block">\begin{array}{r} 226 \\ \times 4 \\ \hline \end{array}</math></p>
<p><input type="radio"/> 200</p> <p><input type="radio"/> 250</p> <p><input type="radio"/> 300</p> <p><input type="radio"/> 350</p>	<p><input type="radio"/> 700</p> <p><input type="radio"/> 800</p> <p><input type="radio"/> 900</p> <p><input type="radio"/> 1,000</p>
<p><b>c</b> Circle the method that seems to help most for estimating.</p> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <span>Standard Algorithm</span> <span>Partial Products</span> </div>	

**3** The fourth and fifth graders at King School went to the museum yesterday in 7 buses. There were 65 students on each bus. How many students were there in all? Show your work.

**4** The big building downtown has 27 floors. There are 8 offices on each floor. Each office has 8 computers. How many computers are there in all? Show your work.



# Set A5 ★ Activity 7



## ACTIVITY

### Splat!

#### Overview

Students are asked to make some generalizations about multiplying two multiples of 10. Then they play a new game to practice multiplying combinations such as  $20 \times 30$ ,  $40 \times 50$ , and so on, first as a whole class, and then in pairs.

#### Skills & Concepts

- ★ represent multiplication of two-digit by two-digit numbers
- ★ multiply by 10 and multiples of 10
- ★ compare the values represented by digits in whole numbers using place value

#### You'll need

- ★ Splat! Hundreds Grid (page A5.50, run one copy on a transparency and a half-class set on paper)
- ★ Introducing the Game of Splat! (page A5.51, run one copy on a transparency)
- ★ Splat! Spinner (page A5.52, run a half-class set)
- ★ Splat! Record Sheet (page A5.53, run a half-class set)
- ★ overhead pens
- ★ 2 overhead triangle pattern blocks or overhead base 10 units
- ★ half class set of transparent spinner overlays
- ★ game markers (1 per student)
- ★ 5  $\frac{1}{2}$ "  $\times$  8  $\frac{1}{2}$ " colored copy paper, 1 piece for each student plus a few extra

**About the Game** In the game of Splat, players take turns spinning a spinner numbered 10, 20, 30, 40, 50, and 60 twice and multiplying the 2 numbers spun. Each player gets 4 turns per round and adds the results to get a total for the round. If a player spins a 10, she scores 0 for that turn. If she spins two 10s in a single turn, she scores 0 for the entire round. After they have played several rounds, players compute and compare their game totals.

#### Instructions for Splat!

1. Ask students to pair up. Give each pair one copy of the Splat! Hundreds Grid to share, and place the transparency on display at the overhead.

Without giving them any instruction other than to pay attention to the key at the top of the page, ask students to determine the area of the entire grid. Have them pair-share their ideas for a minute, and then ask volunteers to share their thinking at the overhead.

**Students** We said the whole grid is a 6-by-6 square, and the area is 36.

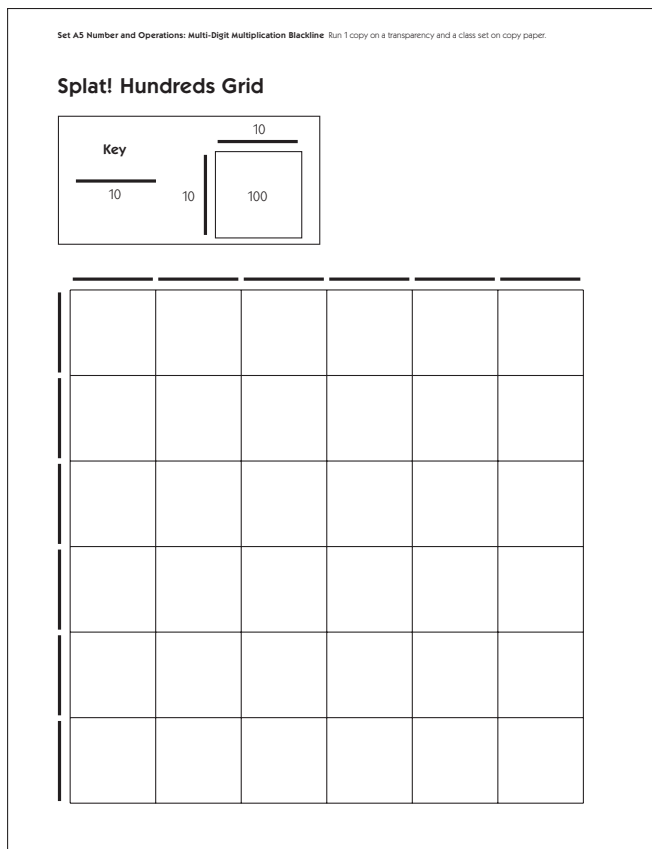
We thought the area was 360 because  $6 \times 6$  is 36, and then you just add a zero.

We looked at the key and said okay, the grid is a 60-by-60 square because each of those lines is like a skinny base 10 strip.

We said the same thing, and then we figured out that the area must be 36 hundred because each of the small squares is worth 100.

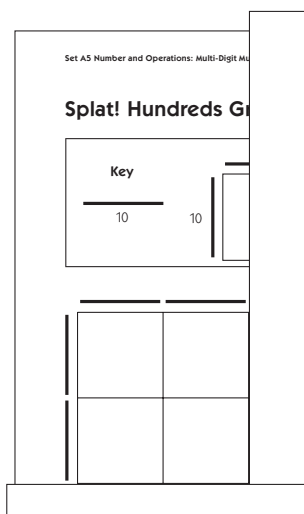
That's the same as 3,600, right?

**Activity 7** Splat! (cont.)



Work with student input to record a multiplication sentence at the whiteboard to match the dimensions and area of the grid ( $60 \times 60 = 3,600$ ).

2. Now use two half-sheets of copy paper to mask the overhead grid until only a 20-by-20 square remains in the top corner, as shown below.



Have student pairs work together, each using their half sheet of paper, to do the same on the Hundreds Grid they're sharing. What is the area of the region that's showing? Ask a student volunteer to record a multiplication sentence to match the dimensions and area of the region ( $20 \times 20 = 400$ ) on the whiteboard.

**Activity 7** Splat! (cont.)

3. Then write  $30 \times 30$  on the board and ask students to move their paper masks until the dimensions you've identified are showing on their grid. What is the area of this region? Record the answer as students share it. Repeat this exercise with  $40 \times 50$ ,  $30 \times 40$ ,  $50 \times 50$ , and  $50 \times 60$ .

Set A5 Number and Operations: Multi-Digit Multiplication Blackline

**Splat! Hundreds Grid**

Key

10 10 100

Multiplying Multiples of 10

$60 \times 60 = 3,600$   
 $20 \times 20 = 400$   
 $30 \times 30 = 900$   
 $40 \times 50 = 2,000$   
 $30 \times 40 = 1,200$   
 $50 \times 50 = 2,500$   
 $50 \times 60 = 3,000$

4. Ask students to explain what happens when two multiples of 10, such as the examples listed on the board, are multiplied. Some students will probably respond with the idea that you simply multiply the digits at the front of each number and then “add on” 2 more zeros at the end. Press the class to think a little more deeply about the question using the visual model provided by the grid to support them in doing so.

**Students**  $3 \times 3$  is 9, right? What's weird is that 30 is only 10 times bigger than 3, but 900 is 100 times bigger than 9.

But each one of the squares in the grid is 100 instead of 1, so the area of a 30-by-30 is 900.

10 times 30 is 300, so 30 times 30 is 3 times more than that.  $3 \times 300$  is 900.

All the answers on the board are 100 times bigger than they would be if the numbers were in 1's instead of 10's. Like  $4 \times 5$  is 20, so  $40 \times 50$  is 2,000.

Just pretend like you're multiplying like  $3 \times 3$  or  $4 \times 5$ , and then make the answer 100 times bigger.

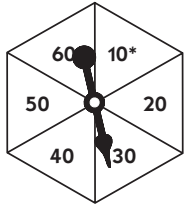
5. Place the game introduction overhead on display and explain that you're going to play a new game with the class. Ask student pairs to keep their Hundreds Grid and half-sheets of copy paper in front of them. Then set the transparent spinner overlay on top of the spinner and spin twice. Use a triangle from your set of overhead pattern blocks to mark the results of both spins at the top of the transparency. (Students will use game markers when they play the game independently, but since those markers won't fit on the transparency, you'll have to use overhead pattern block triangles instead.) Give student pairs a moment to multiply the two numbers you spun, using their Hundreds Grid and half-sheets of paper for support if needed, or computing the answer mentally. Then record the answer in your Round 1, Turn 1 box.

**Activity 7** Splat! (cont.)

6. Continue until you've taken 4 turns. Then work with class input to add the numbers and record your total for the round. If you spin a 10 on one of your turns, you score 0 for that turn. If you spin two 10's on one of your turns, you record an "S" for Splat! in that box. You lose the rest of your turns for the round, and you score 0 for the entire round, no matter how many points you got in previous turns. You have to take all 4 turns unless you get wiped out by a Splat! first.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

### Introducing Splat!



First Spin					
▲	20	30	40	50	60
Second Spin					
10*	20	▲	40	50	60

\*If you spin a 10, you score 0 for that turn.  
If you spin two 10's in a single turn, that's a Splat! and you score 0 for the round.

Teacher						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper 1,200 900 - 2,500 4,600
Round 1	1,200	900	2,500	0	4,600	
Round 2						
Game Total						

I won/lost by \_\_\_\_\_ points.

Class						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper
Round 1						
Round 2						
Game Total						

We won/lost by \_\_\_\_\_ points.

**Teacher** *Whew! That was a close one! I was worried that I'd spin another 10 on that last turn and lose all my points for the round. Okay, I'm up by 4,600 points. Your turn!*

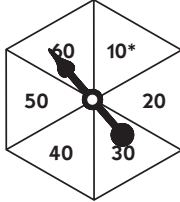
7. Ask student volunteers to spin and record for the class on the lower part of the overhead. As they take 4 turns, encourage all your students to do as much of the computation as they can mentally, continuing to use their Hundreds Grid for visual support as needed.

8. After students have completed their first round, play your second round. Then have volunteers spin and record a second round for the class. When you and the class have both completed 2 rounds, ask students to find the game total for each team and determine the difference between the 2 scores. Finally, show the class how to record the results for each team at the overhead.

### Activity 7 Splat! (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

#### Introducing Splat!



First Spin					
10*	20	30	▲	50	60

Second Spin					
10*	20	30	40	50	▲

\*If you spin a 10, you score 0 for that turn.  
If you spin two 10's in a single turn, that's a Splat! and you score 0 for the round.

Teacher						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper
Round 1	1,200	900	2,500	0	4,600	$\begin{array}{r} 1,200 \\ 900 \\ + 2,500 \\ \hline 4,600 \end{array}$
Round 2	2,000	1,200	S		0	
Game Total					4,600	

I won (lost) by 6,900 points.

Class						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper
Round 1	2,400	800	400	2,000	5,600	$\begin{array}{r} 2,400 \quad 2,500 \\ 800 \quad 1,000 \\ 400 \quad + 2,400 \\ + 2,000 \quad 5,600 \\ \hline 5,600 \end{array}$
Round 2	0	2,500	1,000	2,400	5,900	
Game Total					11,500	

We (won) lost by 6,900 points.

9. When the game is finished, give students time to play it again in partners. Each student pair will need:

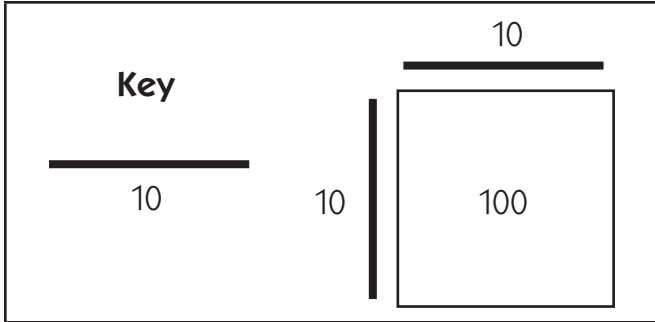
- one copy of the Splat! Spinner
- one Splat! Record Sheet
- 2 game markers
- one spinner overlay

Both partners will record their turns on the same sheet, just as in the demonstration game. Their version of the record sheet has room to play 5 rounds, however, so they may need extra time to complete the game during another math period.

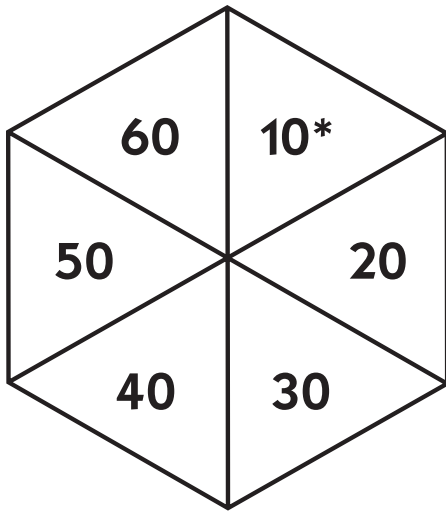
#### Extensions

- Meet with small groups of students who need additional support in multiplying multiples of 10 to play a small-group version of Splat. Model and share your own thinking, and encourage students to help one another as you play.
- Run extra copies of the Splat! Record Sheet and have students revisit the game during Work Places. If you run more copies of the spinner and have students use a pencil and paper clip for a spinner arrow, you can also assign the game as homework.

# Splat! Hundreds Grid




# Introducing Splat!



First Spin					
10*	20	30	40	50	60
Second Spin					
10*	20	30	40	50	60

\*If you spin a 10, you score 0 for that turn.

If you spin two 10's in a single turn, that's a Splat! and you score 0 for the round.

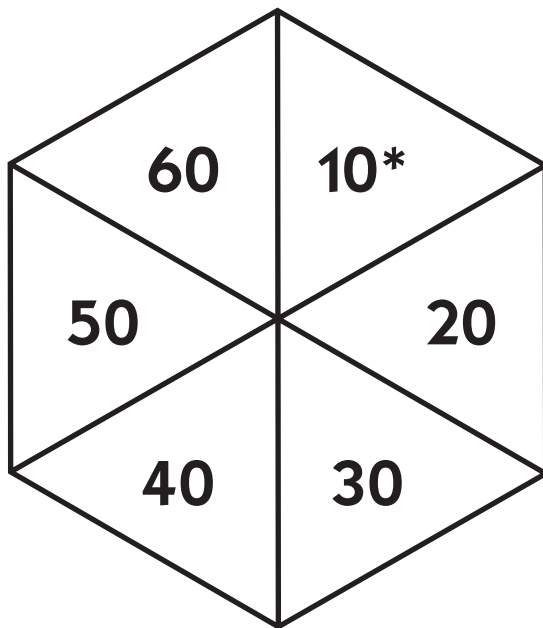
Teacher						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper
Round 1						
Round 2						
Game Total						

I won/lost by \_\_\_\_\_ points.

Class						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper
Round 1						
Round 2						
Game Total						

We won/lost by \_\_\_\_\_ points.

# Splat! Spinner



First Spin					
10*	20	30	40	50	60

Second Spin					
10*	20	30	40	50	60



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Splat! Record Sheet

Player 1						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper
Round 1						
Round 2						
Round 3						
Round 4						
Round 5						
Game Total						

I won/lost by \_\_\_\_\_ points.

Player 2						
	Turn 1	Turn 2	Turn 3	Turn 4	Round Total	Scratch Paper
Round 1						
Round 2						
Round 3						
Round 4						
Round 5						
Game Total						

I won/lost by \_\_\_\_\_ points.



# Set A5 ★ Activity 8



## ACTIVITY

### Sketching Arrays & Partial Products

#### Overview

The teacher introduces a technique for drawing quick sketches of 2-digit by 2-digit multiplication combinations. Students then practice the sketching technique and use it to solve a variety of multiplication problems.

#### Skills & Concepts

- ★ represent multiplication of two-digit by two-digit numbers
- ★ multiply two-digit by two-digit numbers
- ★ estimate products to approximate solutions and determine reasonableness of answers

#### You'll need

- ★ The Ladybugs' Park (page A5.58, run one copy on a transparency)
- ★ Multiplication Sketches (pages A5.59 and A5.60, run a class set)
- ★ overhead pens
- ★ a piece of paper to mask portions of the overhead

#### Instructions for Sketching Arrays & Partial Products

1. Place the top section of The Ladybugs' Park on display at the overhead. Read the problem with the class. Ask students to estimate the area of the sandbox, and call on volunteers to share their thinking with the class.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

### The Ladybugs' Park

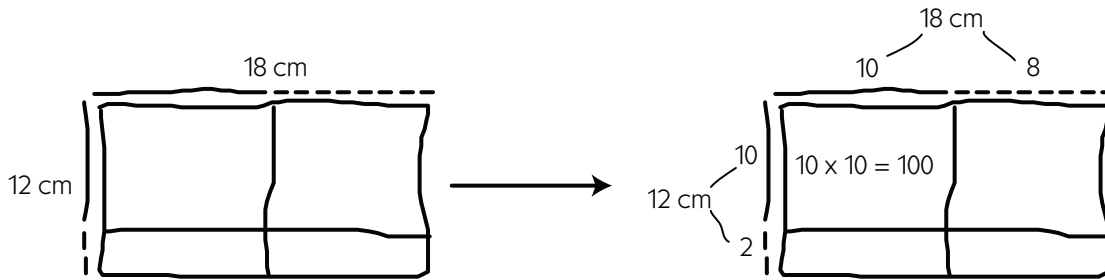
1 The ladybugs over in Leafington are building a park for their children. They are planning to make a sandbox that is 12 centimeters wide and 18 centimeters long. How many square centimeters will their sandbox be?

**Students** *I think about 210 square centimeters because  $10 \times 18$  is 180, and then  $2 \times 18$  is 36. I said 200 because  $12 \times 18$  is kind of like  $10 \times 20$ , and that's 200.*

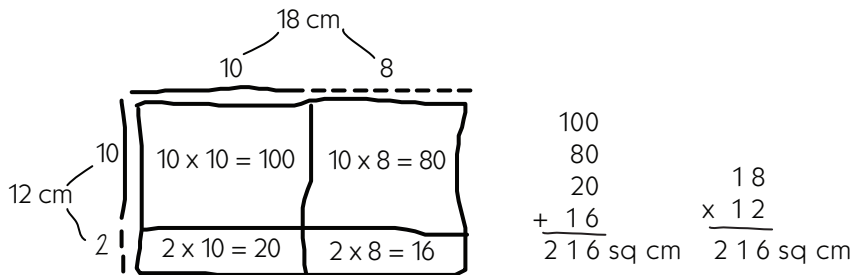
2. As students watch, sketch a frame for  $12 \times 18$  at the overhead. Then fill in the array as shown at the top of the next page. Let students know that you are drawing lines based on the place values in the dimensions (between the 10 and the 8 in 18, and the 10 and the 2 in 12).

3. After you have drawn in the lines, ask the students to help you fill in the area of each part of the array. Prompt their thinking, if necessary, by labeling the tens and ones on the frame.

**Activity 8** Sketching Arrays & Partial Products (cont.)



4. After you've labeled all 4 parts of the array, remind students that each part is called a *partial product*, and that the sum of the partial products is the total product of  $12 \times 18$ . Then ask students to find the sum of the partial products mentally. Record their thinking as an equation beside the array. Also record a multiplication equation to show the dimensions and total area together.



5. Repeat Steps 1–4 with the second problem on the overhead.

**2** There is patch of dirt near the sandbox that measures 24 by 29 centimeters. The ladybugs want to divide it into different sections as shown below. Use a multiplication equation to label each section. Then find the total area of the 24 by 29 cm patch.

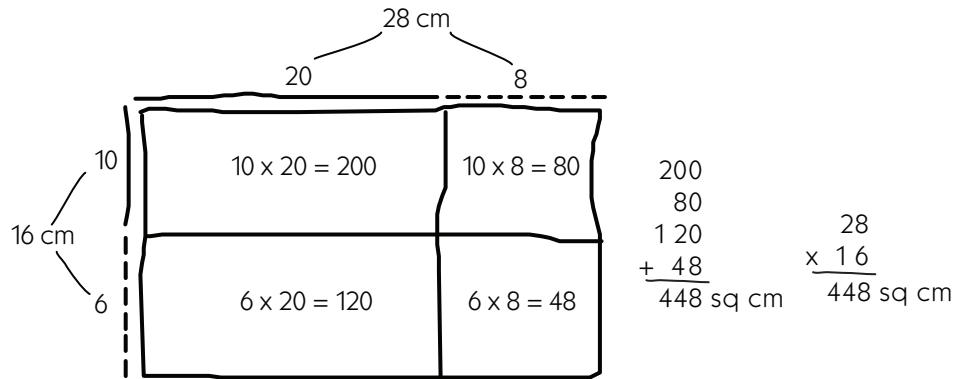
**2** There is patch of dirt near the sandbox that measures 24 by 29 centimeters. The ladybugs want to divide it into different sections as shown below. Use a multiplication equation to label each section. Then find the total area of the 24 by 29 cm patch.

400  
180  
80  
+ 36  
696 sq cm

29  
x 24  
696 sq cm

6. Now give students each a copy of the Multiplication Sketches worksheets. Ask them to complete the first problem on their own or in pairs. Circulate as they work, and then reconvene the class to discuss their thinking when most are finished. Walk through the problems step by step as a whole group, starting with a sketch of the array on the whiteboard that replicates the picture on the first worksheet and finishing with an addition and a multiplication equation to express the total area.

**Activity 8** Sketching Arrays & Partial Products (cont.)



7. When students understand what to do, have them complete the rest of the first sheet and all of the second independently. Provide assistance as needed. Encourage students to share and compare their answers as they finish the assignment.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set. NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Double-digit Multiplication Sketches** page 1 of 2

**1a** Mrs. Hill's pre-school classroom is 16 feet wide and 28 feet long. She is planning to divide it into 4 sections. Here is her plan. Use a multiplication equation to label the area of each section. (in square feet)

**b** What is the total area of the 16-by-28-foot classroom? Show your work.

**2** Write the answers.

$\begin{array}{r} 20 \\ \times 30 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 40 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ \times 30 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 20 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ \times 90 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 30 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 30 \\ \hline \end{array}$
--	--	--	--	--	--	--

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set. NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Double-digit Multiplication Sketches** page 2 of 2

**3** Sketch an array for each of the frames below. Label each part with a multiplication equation to show its area. Then find the total product of the array.

**a**

**b**

**c**

**4** Write the answers.

$\begin{array}{r} 20 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 80 \\ \times 8 \\ \hline \end{array}$
---	---	---	---	---	---	---



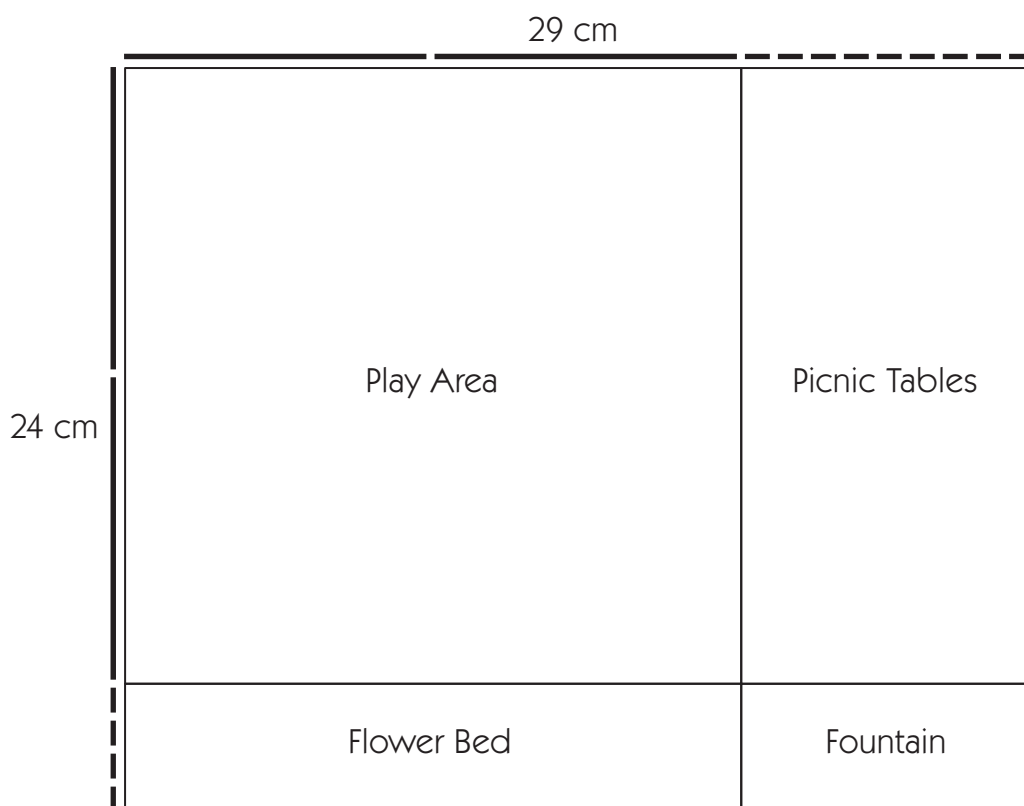
**INDEPENDENT WORKSHEET**

Use Set A5 Independent Worksheet 6 to provide students with more practice multiplying multiples of 10 by multiples of 10.

## The Ladybugs' Park

**1** The ladybugs over in Leafington are building a park for their children. They are planning to make a sandbox that is 12 centimeters wide and 18 centimeters long. How many square centimeters will their sandbox be?

**2** There is patch of dirt near the sandbox that measures 24 by 29 centimeters. The ladybugs want to divide it into different sections as shown below. Use a multiplication equation to label each section. Then find the total area of the 24 by 29 cm patch.

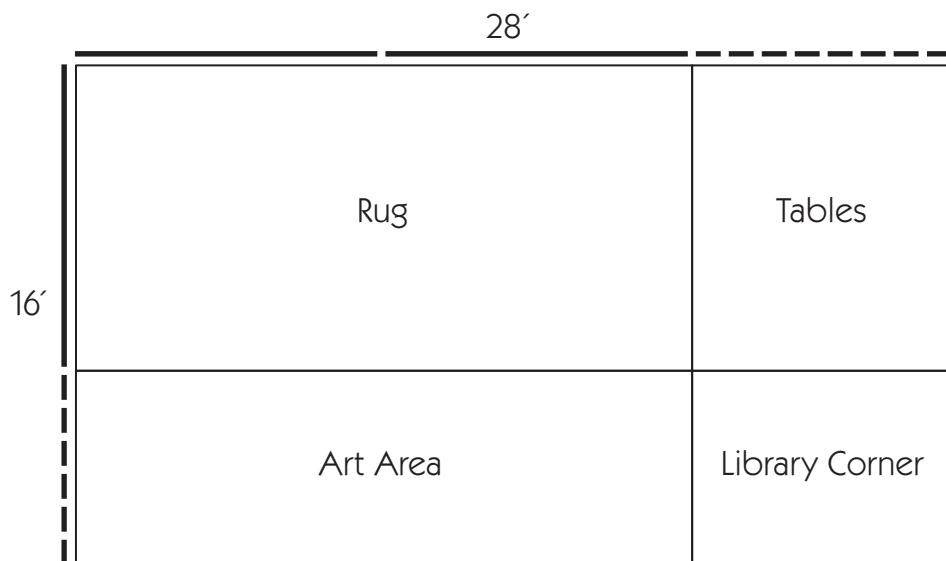


NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Double-digit Multiplication Sketches page 1 of 2

**1a** Mrs. Hill's pre-school classroom is 16 feet wide and 28 feet long. She is planning to divide it into 4 sections. Here is her plan. Use a multiplication equation to label the area of each section. (in square feet)



**b** What is the total area of the 16-by-28-foot classroom? Show your work.

**2** Write the answers.

$$\begin{array}{r} 20 \\ \times 30 \\ \hline \end{array}$$

$$\begin{array}{r} 30 \\ \times 40 \\ \hline \end{array}$$

$$\begin{array}{r} 50 \\ \times 30 \\ \hline \end{array}$$

$$\begin{array}{r} 40 \\ \times 20 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 90 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 30 \\ \hline \end{array}$$

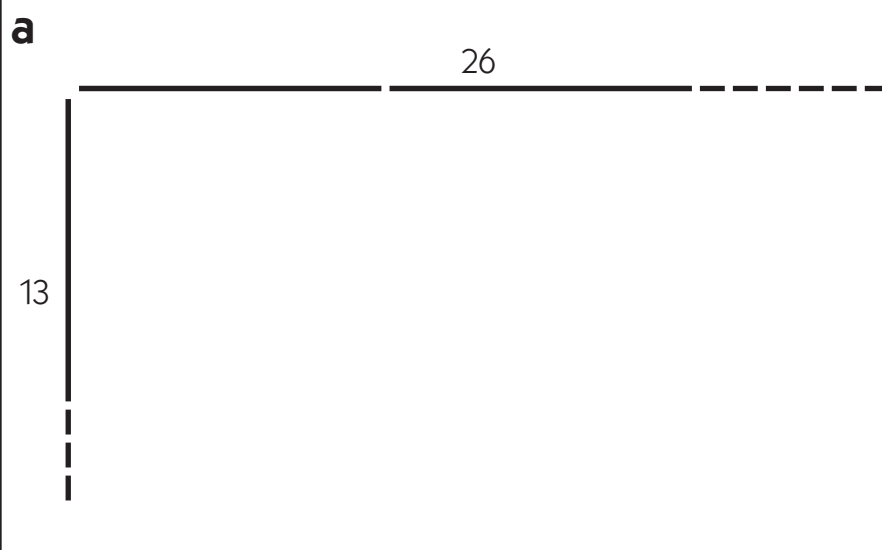
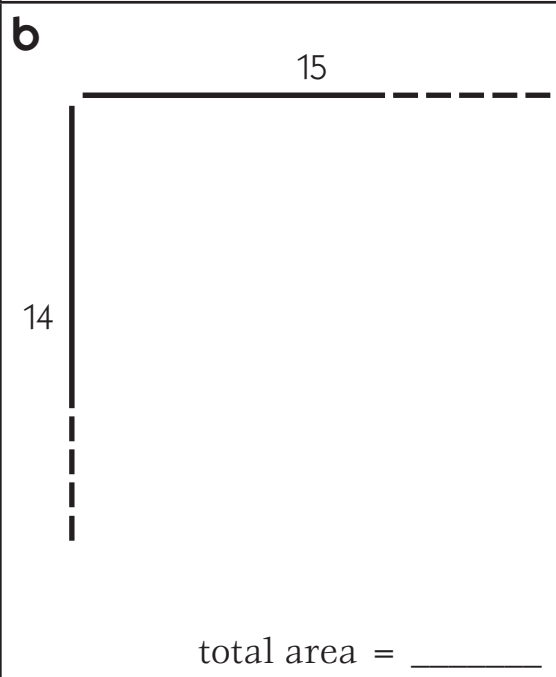
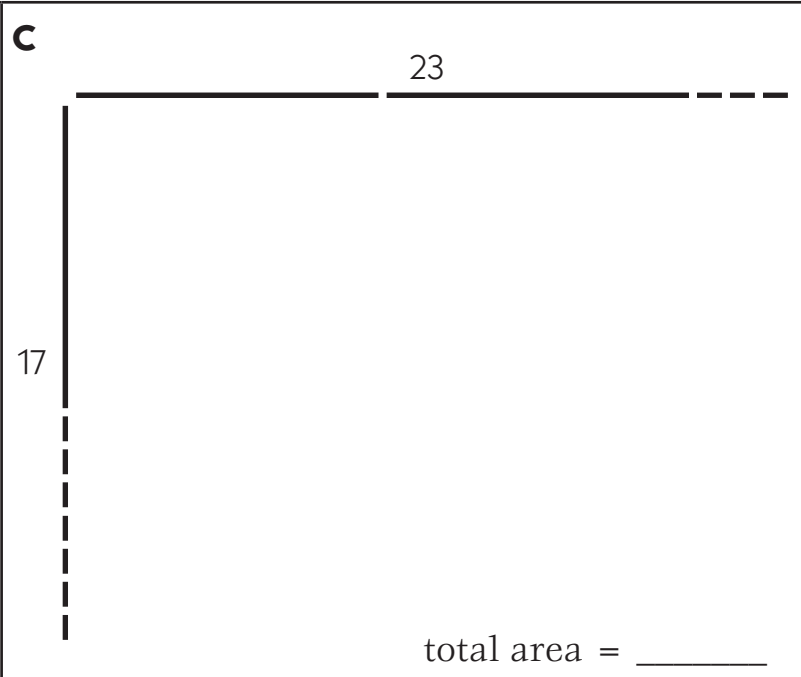
$$\begin{array}{r} 30 \\ \times 30 \\ \hline \end{array}$$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Double-digit Multiplication Sketches page 2 of 2

**3** Sketch an array for each of the frames below. Label each part with a multiplication equation to show its area. Then find the total area of the array.

<p><b>a</b></p>  <p style="text-align: right;">total area = _____</p>	<p><b>b</b></p>  <p style="text-align: right;">total area = _____</p>	<p><b>c</b></p>  <p style="text-align: right;">total area = _____</p>
---	--	--

**4** Write the answers.

$\begin{array}{r} 20 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 80 \\ \times 8 \\ \hline \end{array}$
---	---	---	---	---	---	---



# Set A5 ★ Activity 9



## ACTIVITY

### Double-Digit Multiplication with Pictures & Numbers

#### Overview

Students use the area model to picture and solve 2-digit by 2-digit multiplication problems. In this activity, the focus is on transitioning to using numbers only, connecting them to the area model as needed to support students' work.

#### Skills & Concepts

- ★ represent multiplication of two-digit by two-digit numbers
- ★ multiply two-digit by two-digit numbers
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ solve single- and multi-step word problems involving multi-digit multiplication and verify the solutions

#### You'll need

- ★ Double-Digit Multiplication (pages A5.64 and A5.65, run a class set)
- ★ overhead pens
- ★ Student Math Journals or 1 piece of lined or grid paper per student

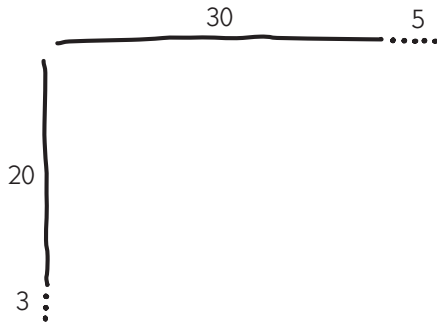
#### Instructions for Double-Digit Multiplication with Pictures & Numbers

1. Write  $23 \times 35$  in vertical format on the whiteboard or the overhead.

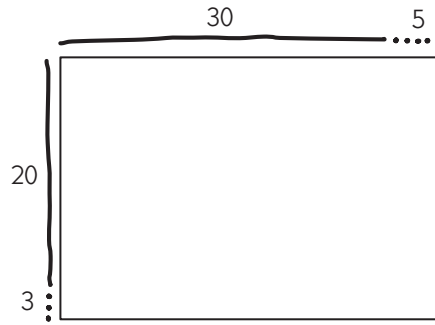
$$\begin{array}{r} 35 \\ \times 23 \\ \hline \end{array}$$

Have students each write a story problem to match the expression in their journals, along with an estimate of the answer. When they've had a few minutes to work, ask them to pair-share their story problems and estimates. Then call on several volunteers to share their story problems with the class, and several others to share and justify their estimates.

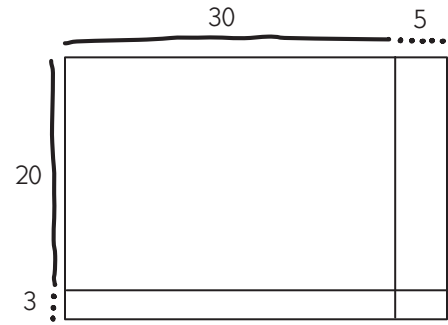
2. Now make a quick sketch to match the expression. First sketch the dimensions, then the total array, and then add two lines to show how the array can be divided into four partial products by place value.

**Activity 9** Double-Digit Multiplication with Pictures & Numbers (cont.)

**Step 1** Sketch and label the dimensions.



**Step 2** Draw a rectangle to show the whole product.



**Step 3** Draw two lines to show how the whole product can be divided into four partial products.

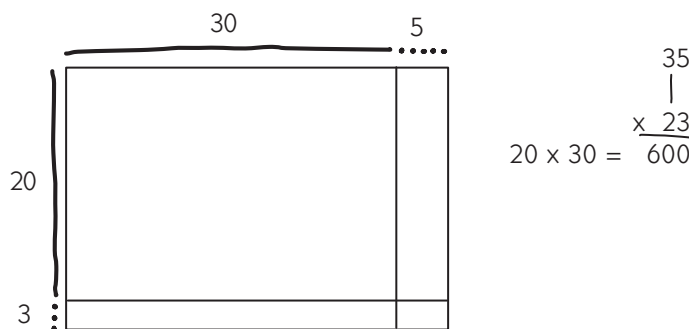
3. After you've sketched the array, give students each a copy of the Double-Digit Multiplication worksheets. Ask them to make a similar quick sketch on the first sheet, which includes  $23 \times 35$  as the example problem. Then ask everyone to find the total product by filling in and adding together the four partial products.

4. After they have had a few minutes to work, ask students to compare their results with a neighbor. Then reconvene the class. Ask students to share their partial products one at a time, while you record them in numerical form beside the array. Each time, use a short line segment to show which two numbers are being multiplied, as shown below. If you work from top left to top right, and then lower left to lower right, you can keep students' attention on the magnitude of the final answer.

**Teacher** Okay, what was the product for this part of the array?

**Briana** It's 20 times 30. That's 600.

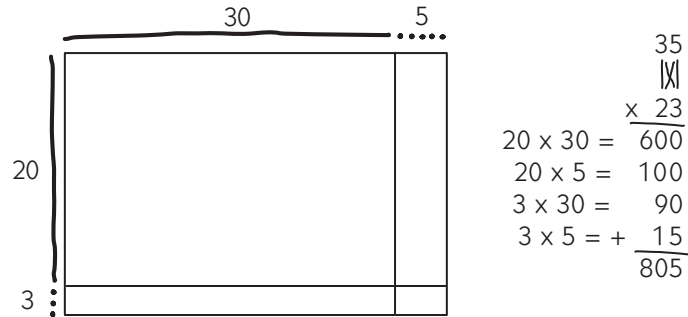
**Teacher** I'll write that over here like this. I am drawing a line from the 2 down below to the 3 up top to show that we have multiplied 20 times 30. What does this tell us right away, before we go any further, about how big our final answer will be?



**James** It's going to be more than 600. There's still more to go.

5. Continue in this manner until students have reported the total product. Each time you add a partial product, draw a line from a digit in the bottom number to a digit in the top number to show which numbers were multiplied. In the end, the recording will look like this:

## Activity 9 Double-Digit Multiplication with Pictures &amp; Numbers (cont.)



6. Leave the example on the overhead or whiteboard and give students the rest of the period to work on the Double-Digit Multiplication sheets, using this method of recording and computing. Let them know that they don't have to draw the lines between the numbers they're multiplying if they don't want to. However, the lines can help them keep track of which numbers they have already multiplied, especially if they choose to drop the sketches, which is also an option. Circulate as they're working, and encourage students who seem confused to continue sketching before they compute. You may also want to meet with a small group to provide extra support if necessary.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Double-Digit Multiplication** page 1 of 2

**1** Find the product of each pair of numbers below. Make a labeled sketch to help, or just use numbers. Show all of your work.

**example**

$\begin{array}{r} 35 \\ \times 23 \\ \hline \end{array}$	
<p><b>a</b></p> $\begin{array}{r} 24 \\ \times 18 \\ \hline \end{array}$	<p><b>b</b></p> $\begin{array}{r} 27 \\ \times 25 \\ \hline \end{array}$
<p><b>c</b></p> $\begin{array}{r} 36 \\ \times 13 \\ \hline \end{array}$	<p><b>d</b></p> $\begin{array}{r} 46 \\ \times 36 \\ \hline \end{array}$

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Double-Digit Multiplication** page 2 of 2

**2** Solve the story problems below. Make a labeled sketch to help, or just use numbers. Show all of your work.

**a** Jon works at T-Shirts R Us. Yesterday, he unpacked 28 boxes of new shirts. Each box had 24 shirts in it. How many shirts did he unpack?

**b** Jon made 23 stacks of long-sleeved t-shirts. He put 17 shirts in each stack. How many shirts did he stack in all?

**CHALLENGE**

**c** Then Jon made 24 stacks of short-sleeved t-shirts. He put 16 shirts in each stack. The store he works for had to pay \$4.99 for each shirt. How much did they have to pay for all the shirts Jon stacked?



## INDEPENDENT WORKSHEET

Use Set A5 Independent Worksheet 7 to provide students with more practice multiplying double-digit numbers by finding and adding 4 partial products.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Double-Digit Multiplication

 page 1 of 2

**1** Find the product of each pair of numbers below. Make a labeled sketch to help, or just use numbers. Show all of your work.

**example**

$$\begin{array}{r} 35 \\ \times 23 \\ \hline \end{array}$$

**a**

$$\begin{array}{r} 24 \\ \times 18 \\ \hline \end{array}$$

**b**

$$\begin{array}{r} 27 \\ \times 25 \\ \hline \end{array}$$

**c**

$$\begin{array}{r} 36 \\ \times 13 \\ \hline \end{array}$$

**d**

$$\begin{array}{r} 46 \\ \times 36 \\ \hline \end{array}$$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Double-Digit Multiplication page 2 of 2

**2** Solve the story problems below. Make a labeled sketch to help, or just use numbers. Show all of your work.

**a** Jon works at T-Shirts R Us. Yesterday, he unpacked 28 boxes of new shirts. Each box had 24 shirts in it. How many shirts did he unpack?

**b** Jon made 23 stacks of long-sleeved t-shirts. He put 17 shirts in each stack. How many shirts did he stack in all?



### CHALLENGE

**c** Then Jon made 24 stacks of short-sleeved t-shirts. He put 16 shirts in each stack. The store he works for had to pay \$4.99 for each shirt. How much did they have to pay for all the shirts Jon stacked?



# Set A5 ★ Activity 10



## ACTIVITY

### Multiplication Menus

#### Overview

A “multiplication menu” is a set of related multiplication facts that revolves around a single multiplicand. Menus are introduced in this activity to help students think flexibly and easily about double-digit multiplication.

#### Skills & Concepts

- ★ multiply by 10 and multiples of 10
- ★ mentally multiply 2-digit numbers by numbers through 10 and by multiples of 10
- ★ apply the distributive property to calculations with whole numbers

#### You'll need

- ★ A Multiplication Menu (page A5.70, run one copy on a transparency)
- ★ Multiplication Menus (pages A5.71 and A5.72, run a class set)
- ★ overhead pen
- ★ a piece of paper to mask portions of the overhead
- ★ calculators available
- ★ Student Math Journals or 1 piece of lined or grid paper per student

#### Instructions for Multiplication Menus

1. Ask students to find the next available page in their journal. Explain that you're going to do some mental math together, and ask them to write the letters a–i down the left side of the page, leaving a line between each letter.
2. Show just the first multiplication problem at the top of the transparency on display. Have students copy the problem,  $1 \times 14$ , and write the answer. Show the next 2 problems one at a time and repeat the process with each. Although the focus is on mental strategies, let students know they can make little “arithmetic notes” off to one side of their journal page to track their thinking. (Some students may recognize, for instance,  $2 \times 14$  is 14 doubled but still need to record  $14 + 14$  to get the answer.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline

**A Multiplication Menu**

**a**  $1 \times 14 = \underline{\hspace{2cm}}$

**b**  $2 \times 14 = \underline{\hspace{2cm}}$

**c**  $10 \times 14 = \underline{\hspace{2cm}}$

Then call on volunteers to share their solutions and strategies for Problems a–c as you fill in the answers at the overhead.

3. Next, show Problem d,  $20 \times 14$ . Have students copy this combination into their journals and record the answer, using information from the first three combinations, mental strategies, and such “arithmetic notes” as they need to track their own thinking. Ask them to pair-share their solutions and strategies and then call on volunteers to share their thinking with the class.

**Activity 10** Multiplication Menus (cont.)

**Students** *I said  $20 \times 14$  is 280 because it's just double 140.*

*If you know that  $10 \times 14$  is 140, you can add 140 and 140 to get 280.*

*At first I thought it was 168, because I added the answer for  $2 \times 14$  and the answer for  $10 \times 14$ , but then I realized it would have to be  $10 \times 14$  plus  $10 \times 14$ .*

*I said it was 280 because  $2 \times 14$  is 28, and  $20 \times 14$  is ten times more than that.*

4. Record the answer, 280, at the overhead. Work through Problems e–h in a similar fashion, stopping after each one to have students share their thinking as you record the answer. In each case, encourage students to use the information that's already available to them to solve the problem.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

**A Multiplication Menu**

**a**  $1 \times 14 = \underline{14}$

**b**  $2 \times 14 = \underline{28}$

**c**  $10 \times 14 = \underline{140}$

**d**  $20 \times 14 = \underline{280}$

Use the information above to find these products using mental strategies.

**e**  $3 \times 14 = \underline{42}$

**f**  $5 \times 14 = \underline{70}$

**Teacher** *Who'd like to share their solution and strategy for solving  $5 \times 14$ ?*

**Students** *I took the answer for  $3 \times 14$  and added on two more 14's. First I got up to 56, and then 70.*

*I did kind of the same thing, but I added the answers for  $2 \times 14$  and  $3 \times 14$  to get  $5 \times 14$ .*

*I said  $5 \times 14$  must be like half of  $10 \times 14$ .  $10 \times 14$  is 140; cut it in half and you get 70.*

*I just went  $5 \times 10$  is 50 and  $5 \times 4$  is 20, so the answer must be 70.*

5. After the class has completed Problems a–h, display the prompt and the last combination at the bottom of the overhead.

Find the product shown below. Explain how you got your answer.

**i**  $23 \times 14 = \underline{\hspace{2cm}}$

Ask students, working individually or in pairs, to use the information provided by the previous combinations to solve the problem, and to write a brief explanation of how they got the answer in their journals. Students who finish well ahead of their classmates may be invited to find a few more related products, such as  $8 \times 14$ ,  $14 \times 14$ ,  $25 \times 14$ , and so on. After they've had a few minutes to work, ask a couple of volunteers to share how they found the answer to  $23 \times 14$  with the class. As they do so, record their strategies on the overhead.



## Activity 10 Multiplication Menus (cont.)

Use the information above to find these products using mental strategies.

**e**  $3 \times 14 = \underline{42}$

**f**  $5 \times 14 = \underline{70}$

**g**  $30 \times 14 = \underline{420}$

**h**  $15 \times 14 = \underline{210}$

Find the product shown below. Explain how you got your answer.

**i**  $23 \times 14 = \underline{322}$

$20 \times 14 = 280$	$10 \times 14 = 140$
$3 \times 14 = 42$	$10 \times 14 = 140$
$23 \times 14 = 322$	$3 \times 14 = \underline{42}$
	$322$

6. Give students each a copy of the Multiplication Menus sheets. Review the instructions with the class and then give them the remainder of the session to work the problems on the two sheets.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multiplication Menus** page 1 of 2

**1a** Find the product on the left side of the page. Then use the information to find the products on the right side of the page.

$1 \times 13 = \underline{\quad}$	$3 \times 13 = \underline{\quad}$
$2 \times 13 = \underline{\quad}$	$5 \times 13 = \underline{\quad}$
$10 \times 13 = \underline{\quad}$	$30 \times 13 = \underline{\quad}$
$20 \times 13 = \underline{\quad}$	$15 \times 13 = \underline{\quad}$

**b** Find the product shown below. Explain how you got your answer.

$23 \times 13 = \underline{\quad}$

**2a** Find the product on the left side of the page. Then use the information to find the products on the right side of the page.

$1 \times 22 = \underline{\quad}$	$3 \times 22 = \underline{\quad}$
$2 \times 22 = \underline{\quad}$	$5 \times 22 = \underline{\quad}$
$10 \times 22 = \underline{\quad}$	$30 \times 22 = \underline{\quad}$
$20 \times 22 = \underline{\quad}$	$15 \times 22 = \underline{\quad}$

**b** Find the product shown below. Explain how you got your answer.

$25 \times 22 = \underline{\quad}$

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Multiplication Menus** page 2 of 2

**3a** Find the product on the left side of the page. Then use the information to find the products on the right side of the page.

$1 \times 34 = \underline{\quad}$	$3 \times 34 = \underline{\quad}$
$2 \times 34 = \underline{\quad}$	$5 \times 34 = \underline{\quad}$
$10 \times 34 = \underline{\quad}$	$30 \times 34 = \underline{\quad}$
$20 \times 34 = \underline{\quad}$	$15 \times 34 = \underline{\quad}$

**b** Find the product shown below. Explain how you got your answer.

$40 \times 34 = \underline{\quad}$

**4a** Make up your own multiplication menu. You can choose any 2, 3, or 4-digit number that doesn't end in a zero to be your multiplier.

$1 \times \underline{\quad} = \underline{\quad}$	$3 \times \underline{\quad} = \underline{\quad}$
$2 \times \underline{\quad} = \underline{\quad}$	$5 \times \underline{\quad} = \underline{\quad}$
$10 \times \underline{\quad} = \underline{\quad}$	$30 \times \underline{\quad} = \underline{\quad}$
$20 \times \underline{\quad} = \underline{\quad}$	$15 \times \underline{\quad} = \underline{\quad}$

**b** Now write one more combination using your multiplier that can be solved using the information on your menu. Find the answer and explain how you got it.

$\underline{\quad} \times \underline{\quad} = \underline{\quad}$



## INDEPENDENT WORKSHEET

Use Set A5 Independent Worksheet 8 to give students more practice with multiplication menus.

## A Multiplication Menu

**a**  $1 \times 14 =$  \_\_\_\_\_

**b**  $2 \times 14 =$  \_\_\_\_\_

**c**  $10 \times 14 =$  \_\_\_\_\_

**d**  $20 \times 14 =$  \_\_\_\_\_

Use the information above to find these products using mental strategies.

**e**  $3 \times 14 =$  \_\_\_\_\_

**f**  $5 \times 14 =$  \_\_\_\_\_

**g**  $30 \times 14 =$  \_\_\_\_\_

**h**  $15 \times 14 =$  \_\_\_\_\_

Find the product shown below. Explain how you got your answer.

**i**  $23 \times 14 =$  \_\_\_\_\_

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Multiplication Menus page 1 of 2

**1a** Find the product on the left side of the page. Then use the information to find the products on the right side of the page.

$1 \times 13 = \underline{\hspace{2cm}}$

$3 \times 13 = \underline{\hspace{2cm}}$

$2 \times 13 = \underline{\hspace{2cm}}$

$5 \times 13 = \underline{\hspace{2cm}}$

$10 \times 13 = \underline{\hspace{2cm}}$

$30 \times 13 = \underline{\hspace{2cm}}$

$20 \times 13 = \underline{\hspace{2cm}}$

$15 \times 13 = \underline{\hspace{2cm}}$

**b** Find the product shown below. Explain how you got your answer.

$23 \times 13 = \underline{\hspace{2cm}}$

**2a** Find the product on the left side of the page. Then use the information to find the products on the right side of the page.

$1 \times 22 = \underline{\hspace{2cm}}$

$3 \times 22 = \underline{\hspace{2cm}}$

$2 \times 22 = \underline{\hspace{2cm}}$

$5 \times 22 = \underline{\hspace{2cm}}$

$10 \times 22 = \underline{\hspace{2cm}}$

$30 \times 22 = \underline{\hspace{2cm}}$

$20 \times 22 = \underline{\hspace{2cm}}$

$15 \times 22 = \underline{\hspace{2cm}}$

**b** Find the product shown below. Explain how you got your answer.

$25 \times 22 = \underline{\hspace{2cm}}$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Multiplication Menus page 2 of 2

**3a** Find the product on the left side of the page. Then use the information to find the products on the right side of the page.

$1 \times 34 = \underline{\hspace{2cm}}$

$3 \times 34 = \underline{\hspace{2cm}}$

$2 \times 34 = \underline{\hspace{2cm}}$

$5 \times 34 = \underline{\hspace{2cm}}$

$10 \times 34 = \underline{\hspace{2cm}}$

$30 \times 34 = \underline{\hspace{2cm}}$

$20 \times 34 = \underline{\hspace{2cm}}$

$15 \times 34 = \underline{\hspace{2cm}}$

**b** Find the product shown below. Explain how you got your answer.

$40 \times 34 = \underline{\hspace{2cm}}$

**4a** Make up your own multiplication menu. You can choose any 2, 3, or 4-digit number that doesn't end in a zero to be your multiplier.

$1 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$3 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$2 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$5 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$10 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$30 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$20 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$15 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

**b** Now write one more combination using your multiplier that can be solved using the information on your menu. Find the answer and explain how you got it.

$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

# Set A5 ★ Activity 11



## ACTIVITY

### Introducing a Two-Part Area Model

#### Overview

Students review some of their current strategies for double-digit multiplication and then explore a variation of the area model in which the rectangular array is divided into 2 instead of 4 parts.

#### Skills & Concepts

- ★ represent multiplication of 2-digit by 2-digit numbers
- ★ mentally multiply 2-digit numbers by numbers through 10 and by multiples of 10
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ explain why a specific problem-solving strategy was used to determine a solution

#### You'll need

- ★ Multiplication Strategies (page A5.77, run one copy on a transparency)
- ★ Two-Part Multiplication (page A5.78, run one copy on a transparency)
- ★ Two-Part Multiplication (pages A5.79 and A5.80, run a class set)
- ★ copy paper, one sheet per student
- ★ overhead pens
- ★ a piece of paper to mask portions of the overhead

#### Instructions for Introducing a Two-Part Area Model

1. Give each student a piece of copy paper and write the following multiplication problem on the whiteboard.

$$\begin{array}{r} 25 \\ \times 23 \\ \hline \end{array}$$

Ask students to jot an estimate of the answer on their paper and explain their thinking to the person sitting next to them.

2. Next ask students to solve the problem, but leave the choice of a strategy up to them. As they finish, have them pair-share their answers and strategies. Then place the top portion of the Multiplication Strategies overhead on display. Ask students to examine the four different responses and locate the one most similar to their own. Then call on a different volunteer to explain each strategy to the class.

## Activity 11 Introducing a Two-Part Area Model (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

### Multiplication Strategies

Mr. Ozuna asked his 4th graders to solve  $23 \times 25$ . Here are the answers from four of his students. How do they compare with yours?

Jon	Josie	Nick	Kamela
	$\begin{array}{r} 25 \\ \times 23 \\ \hline 75 \\ 500 \\ \hline 575 \end{array}$	$\begin{array}{l} 20 \times 25 = 500 \\ 3 \times 25 = 75 \\ \hline 500 + 75 = 575 \end{array}$	$\begin{array}{r} 1 \\ 25 \\ \times 23 \\ \hline 75 \\ + 500 \\ \hline 575 \end{array}$

3. Ask students to compare and contrast these four strategies. How are the strategies alike and how are they different? Does one seem to have any advantage over the others? Why or why not? Which might your students choose if they had to do the problem in their head instead of on paper?

**Students** *Kamela's way is really fast, but it's a little confusing. I don't quite get how to do that one. I do! I think it's the easiest.*  
*I like Josie's way because you can see all the steps.*  
*I still like drawing a picture like Jon did. It just seems easier to see what's going on.*  
*Nick's way is really fast too. I think it would be the easiest one to do in your head.*  
*I can make a sketch in my head and just see what the answer would be.*

4. Now reveal the middle portion of the overhead. Ask students to examine the sketch quietly for a moment and then invite them to share their observations first in pairs and then with the class.

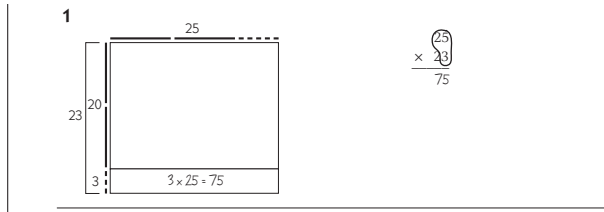
1

$$\begin{array}{r} 25 \\ \times 23 \\ \hline \end{array}$$

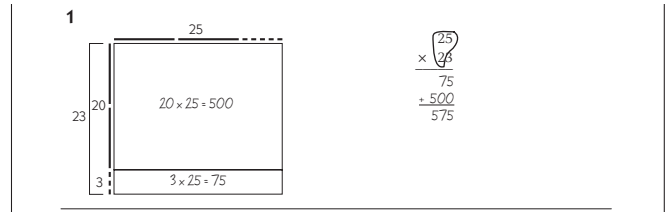
**Students** *It's the area model, but it's different.*  
*It's like Jon's way up there, except there are 2 parts instead of 4.*  
*I think that's a pretty easy way to do it. The top part would be  $20 \times 25$ , and that's 500.*  
*Hey, this is kind of like Nick's way, because it'll be 500 for the top part and 75 for the bottom part.*

5. After students have shared their observations, work with input from the class to label the lower region with a multiplication equation. Then transfer the information to the expression at the right of the sketch, looping the numbers as shown on the top of the next page to emphasize the fact you've multiplied 25 by the number of ones in 23. Repeat the process with the top region, again looping the numbers to emphasize the fact that you've multiplied 25 by the number of tens in 23.

**Activity 11** Introducing a Two-Part Area Model (cont.)

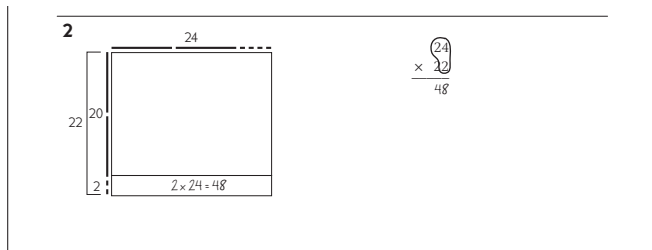


Step 1

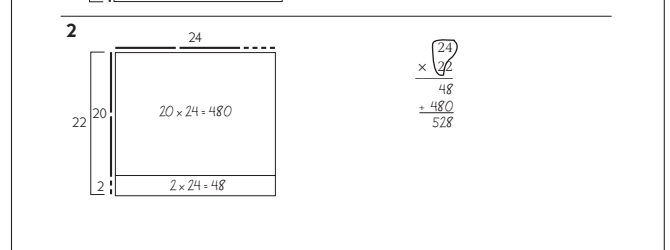


Step 2

6. Now reveal the problem at the bottom of the overhead,  $22 \times 24$ . Work with input from the class to fill in the frame with a rectangle, divide the rectangle into two parts, write a multiplication equation to show the area of each part, and transfer the information to the expression at the right of the sketch.



Step 1



Step 2

7. Give students each a copy of the Two-Part Multiplication sheets.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Two-Part Multiplication** page 1 of 2

**1** For problems a–f:

- label the frame to show the 2 numbers that are being multiplied.
- sketch in the rectangle and divide it into 2 parts.
- label each of the parts with a multiplication equation.
- add the partial products to get the answer.

<b>a</b>	$\begin{array}{r} 21 \\ \times 15 \\ \hline \end{array}$	<b>b</b>	$\begin{array}{r} 14 \\ \times 16 \\ \hline \end{array}$
<b>c</b>	$\begin{array}{r} 22 \\ \times 12 \\ \hline \end{array}$	<b>d</b>	$\begin{array}{r} 17 \\ \times 13 \\ \hline \end{array}$
<b>e</b>	$\begin{array}{r} 23 \\ \times 23 \\ \hline \end{array}$	<b>f</b>	$\begin{array}{r} 24 \\ \times 14 \\ \hline \end{array}$

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Two-Part Multiplication** page 2 of 2

**2** For problems a–f:

- multiply the top number by the ones and then by the tens.
- add the partial products to get the answer.

**example**

	$\begin{array}{r} 24 \\ \times 12 \\ \hline 48 \\ 240 \\ \hline 288 \end{array}$
<b>a</b>	$\begin{array}{r} 23 \\ \times 13 \\ \hline \end{array}$
<b>b</b>	$\begin{array}{r} 25 \\ \times 22 \\ \hline \end{array}$
<b>c</b>	$\begin{array}{r} 25 \\ \times 26 \\ \hline \end{array}$
<b>d</b>	$\begin{array}{r} 33 \\ \times 22 \\ \hline \end{array}$
<b>e</b>	$\begin{array}{r} 36 \\ \times 12 \\ \hline \end{array}$
<b>f</b>	$\begin{array}{r} 42 \\ \times 24 \\ \hline \end{array}$

**Activity 11** Introducing a Two-Part Area Model (cont.)

Use the top part of the corresponding overhead to review the instructions for page 1. Work through Problem 1a and, if necessary, Problem 1b, with the class. Many students find it helpful to break the side dimension on each rectangle into tens and ones, so you may want to model this and encourage them to do so.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency.

### Two-Part Multiplication

**1** For problems a–f:

- label the frame to show the 2 numbers that are being multiplied.
- sketch in the rectangle and divide it into 2 parts.
- label each of the parts with a multiplication equation.
- add the partial products to get the answer.

<p><b>a</b></p> <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <math display="block">\begin{array}{ c } \hline 20 \\ \hline \end{array}</math> <math display="block">\begin{array}{ c } \hline 1 \\ \hline \end{array}</math> </div> <div style="border: 1px solid black; padding: 5px; margin-right: 20px;"> <math display="block">\begin{array}{ c } \hline 10 \\ \hline \end{array}</math> <math display="block">10 \times 21 = 210</math> </div> <div style="margin-right: 20px;"> <math display="block">\begin{array}{r} 21 \\ \times 15 \\ \hline 105 \\ + 210 \\ \hline 315 \end{array}</math> </div> </div>	<p><b>b</b></p> <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <math display="block">\begin{array}{ c } \hline 10 \\ \hline \end{array}</math> <math display="block">\begin{array}{ c } \hline 4 \\ \hline \end{array}</math> </div> <div style="border: 1px solid black; padding: 5px; margin-right: 20px;"> <math display="block">\begin{array}{ c } \hline 10 \\ \hline \end{array}</math> <math display="block">10 \times 14 = 140</math> </div> <div style="margin-right: 20px;"> <math display="block">\begin{array}{r} 14 \\ \times 16 \\ \hline 84 \\ + 140 \\ \hline 224 \end{array}</math> </div> </div>
--	---

**2** For problems a–f:

- multiply the top number by the ones and then by the tens.
- add the partial products to get the answer.

**example**

	24
	$\times 12$
$2 \times 24 =$	48
$10 \times 24 =$	240
	$\hline 288$

<p><b>a</b></p> $\begin{array}{r} 23 \\ \times 13 \\ \hline \end{array}$	<p><b>b</b></p> $\begin{array}{r} 25 \\ \times 22 \\ \hline \end{array}$
--	--

8. Use the lower part of the overhead to review the instructions for the second sheet. Here, students are asked to work with numbers alone, multiplying first by the 1's in the multiplier, then by the 10's, and finally adding the two partial products to get the answer. Work through Problems 2a and 2b together at the overhead, and then give students the remainder of the session to complete the assignment.

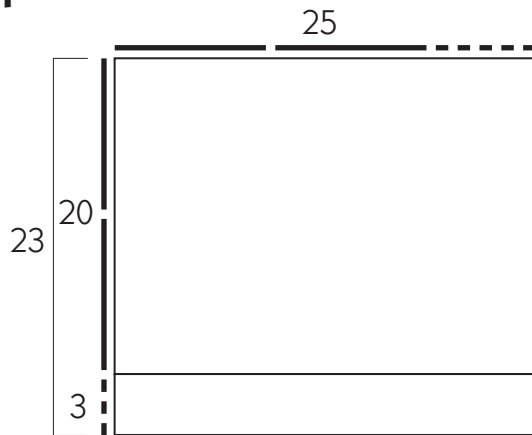


# Multiplication Strategies

Mr. Ozuna asked his 4th graders to solve  $23 \times 25$ . Here are the answers from four of his students. How do they compare with yours?

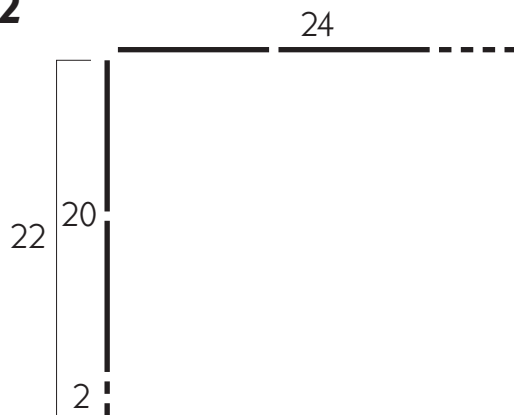
Jon	Josie	Nick	Kamela
	$\begin{array}{r} 25 \\ \times 23 \\ \hline 400 \\ 100 \\ \hline 575 \end{array}$	$\begin{array}{l} 20 \times 25 = 500 \\ 3 \times 25 = 75 \\ \hline 500 + 75 = 575 \end{array}$	$\begin{array}{r} 1 \\ 25 \\ \times 23 \\ \hline 75 \\ + 500 \\ \hline 575 \end{array}$

1



$$\begin{array}{r} 25 \\ \times 23 \\ \hline \end{array}$$

2

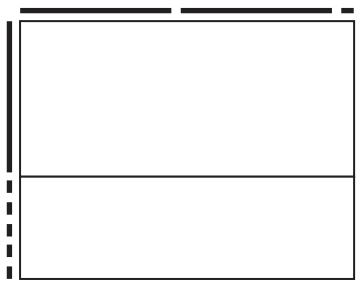
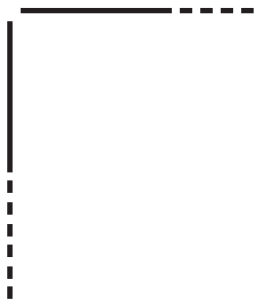


$$\begin{array}{r} 24 \\ \times 22 \\ \hline \end{array}$$

## Two-Part Multiplication

**1** For problems a–f:

- label the frame to show the 2 numbers that are being multiplied.
- sketch in the rectangle and divide it into 2 parts.
- label each of the parts with a multiplication equation.
- add the partial products to get the answer.

<p><b>a</b></p> <div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 20px;"> <math display="block">\begin{array}{r} 21 \\ \times 15 \\ \hline \end{array}</math> </div> </div>	<p><b>b</b></p> <div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 20px;"> <math display="block">\begin{array}{r} 14 \\ \times 16 \\ \hline \end{array}</math> </div> </div>
---	--

**2** For problems a–f:

- multiply the top number by the ones and then by the tens.
- add the partial products to get the answer.

**example**

$$\begin{array}{r} 24 \\ \times 12 \\ \hline 2 \times 24 = 48 \\ 10 \times 24 = 240 \\ \hline 288 \end{array}$$

<p><b>a</b></p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{array}{r} 23 \\ \times 13 \\ \hline \end{array}</math> </div>	<p><b>b</b></p> <div style="text-align: center; margin-top: 20px;"> <math display="block">\begin{array}{r} 25 \\ \times 22 \\ \hline \end{array}</math> </div>
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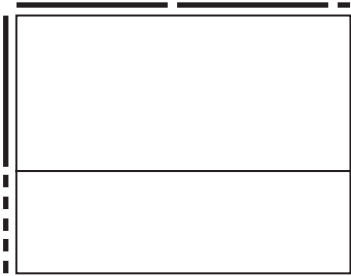
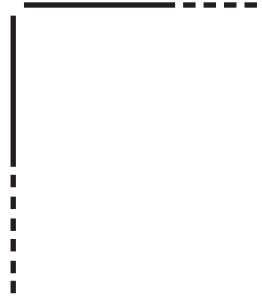


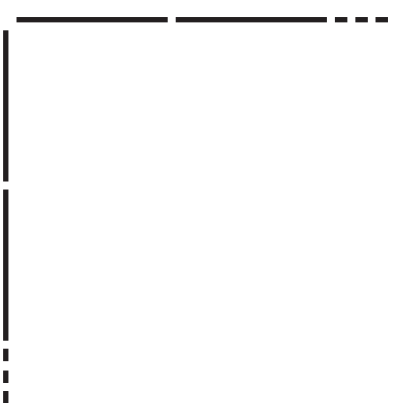

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Two-Part Multiplication page 1 of 2

1 For problems a–f:

- label the frame to show the 2 numbers that are being multiplied.
- sketch in the rectangle and divide it into 2 parts.
- label each of the parts with a multiplication equation.
- add the partial products to get the answer.

<p><b>a</b></p>  $\begin{array}{r} 21 \\ \times 15 \\ \hline \end{array}$	<p><b>b</b></p>  $\begin{array}{r} 14 \\ \times 16 \\ \hline \end{array}$
<p><b>c</b></p>  $\begin{array}{r} 22 \\ \times 12 \\ \hline \end{array}$	<p><b>d</b></p>  $\begin{array}{r} 17 \\ \times 13 \\ \hline \end{array}$
<p><b>e</b></p>  $\begin{array}{r} 23 \\ \times 23 \\ \hline \end{array}$	<p><b>f</b></p>  $\begin{array}{r} 24 \\ \times 14 \\ \hline \end{array}$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

**Two-Part Multiplication** page 2 of 2**2** For problems a–f:

- multiply the top number by the ones and then by the tens.
- add the partial products to get the answer.

**example** 24

$$\begin{array}{r} 24 \\ \times 12 \\ \hline \end{array}$$

$$2 \times 24 = 48$$

$$10 \times 24 = 240$$

$$\hline 288$$

**a**

$$\begin{array}{r} 23 \\ \times 13 \\ \hline \end{array}$$

**b**

$$\begin{array}{r} 25 \\ \times 22 \\ \hline \end{array}$$

**c**

$$\begin{array}{r} 25 \\ \times 26 \\ \hline \end{array}$$

**d**

$$\begin{array}{r} 33 \\ \times 22 \\ \hline \end{array}$$

**e**

$$\begin{array}{r} 36 \\ \times 12 \\ \hline \end{array}$$

**f**

$$\begin{array}{r} 42 \\ \times 24 \\ \hline \end{array}$$

# Set A5 ★ Activity 12



## ACTIVITY

### Extending the Standard Multiplication Algorithm

#### Overview

Students use the standard algorithm to multiply two- and three-digit by two-digit numbers.

#### Skills & Concepts

- ★ multiply 2- and 3-digit by 2-digit numbers using the standard multiplication algorithm
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ identify strategies that can be used to solve a problem, select and use one or more appropriate strategies to solve the problem, and justify the selection
- ★ explain why a specific problem-solving strategy was used to determine a solution

#### You'll need

- ★ Roll Your Own Double-Digit Multiplication Problems (page A5.85, run a class set)
- ★ dice numbered 1–6, class set
- ★ dice numbered 4–9, class set
- ★ several blank transparencies
- ★ overhead pens
- ★ Student Math Journals

#### Instructions for Extending the Standard Multiplication Algorithm

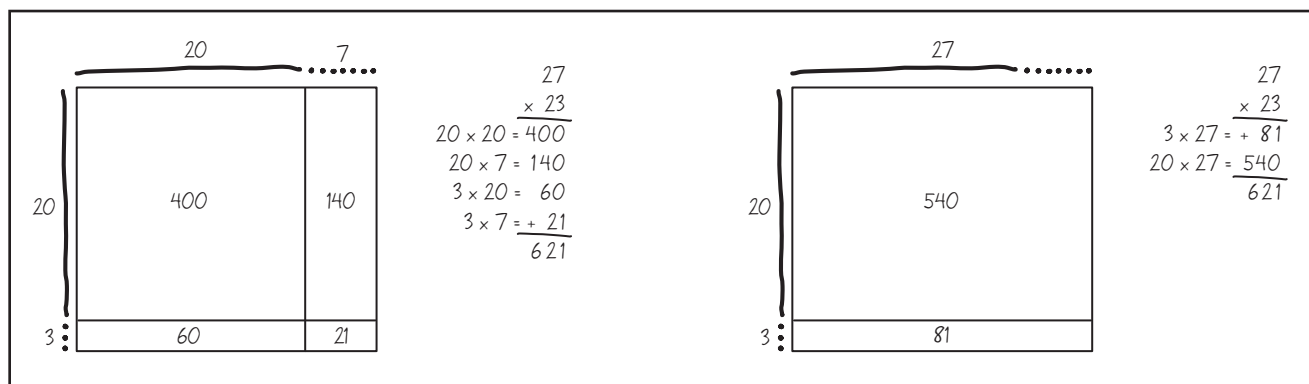
1. Write  $23 \times 27$  on the board or overhead. Ask students to record the problem in their journal, along with an estimate of the answer. Then call on volunteers to share and explain their estimates.

*Students* It will be more than 400 because 20 times 20 is 400.

27 is pretty close to 30, and  $20 \times 30$  is 600, so maybe it will be around 600.

2. Next, ask students to find the product using either the four-part area model, or the two-part area model they explored during the previous activity. Let students know that if they can solve the problem without a sketch by finding the partial products mentally and adding them, that's fine.

3. Have students pair-share their solutions and strategies as they finish. Then work with input from the class to record both the four-part and the two-part strategies on the whiteboard.



**Activity 12** Extending the Standard Multiplication Algorithm (cont.)

4. Ask the class to compare and contrast the two strategies. What are the advantages and disadvantages of each?

**Students** *It's easier to see what you're doing with the four-part model.*

*The multiplication is easier to do in your head with four parts. You just have to think of stuff like  $20 \times 20$  and  $20 \times 7$ . With the 2-part model, you have to do  $20 \times 27$ .*

*That's easy, though!  $27 + 27$  is 54, so the answer is 540.*

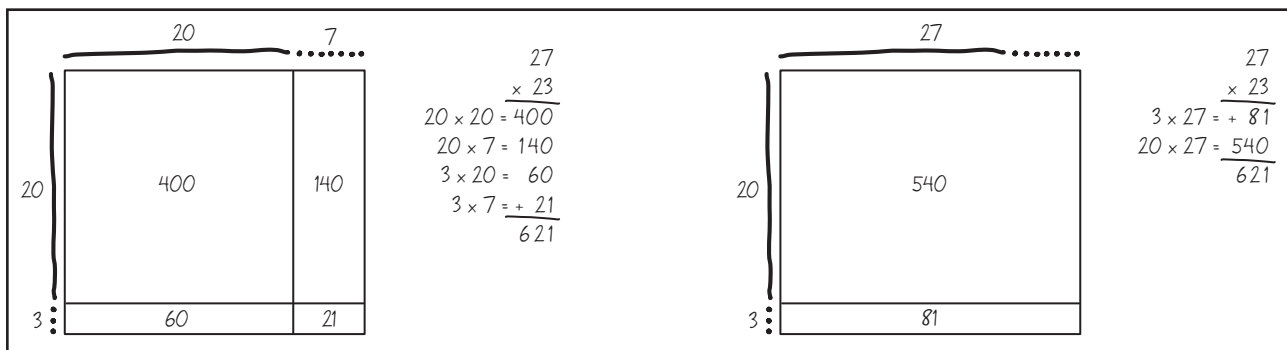
*I like the 2-part way because you only have to multiply two things instead of four.*

*I did  $3 \times 27$  in my head because it's like  $3 \times 25$ , and then just add 6 more for the extra.*

5. Then explain that you want to share the standard algorithm for double-digit multiplication. It is called the standard algorithm because it is widely used, and provides a method that is very useful in many situations. Demonstrate the algorithm at the overhead or board. We recommend that you do it in two parts, as shown below, to make the two steps of multiplying first by the 1's and then by the 10's in 23 a little more clear. Explain each step as you do it. Ask students to watch and listen closely to see if they can make sense of what you're doing based on all the experiences they've had with multiplication.

$$\begin{array}{r} 27 \\ \times 23 \\ \hline 81 \\ + 540 \\ \hline 621 \end{array}$$

6. When you have finished the demonstration, ask students to explain how this method works. Can they see any connection between the algorithm and the area model? Does the strategy make sense to them? If they don't mention it, ask students to connect the algorithm you've modeled to the arrays on the board. Where do they see the partial products 81 and 540 in the array?



**Students** *They're right there in the 2-part array. They're just switched around, so first it's 540 and then it's 81.*

*I don't see them on the other array, though.*

*If you add the numbers going across it works. It's  $400 + 140$  on top. That's 540. Then it's  $60 + 21$  on the bottom. That's 81.*

*With the standard algorithm, it's kind of like multiplying and adding at the same time.*

7. Now write  $36 \times 77$  on the board:

**Activity 12** Extending the Standard Multiplication Algorithm (cont.)

Ask students whether they would choose to use the 4-part model, the 2-part model, or the standard algorithm to solve this problem. Why? Which strategy would be most efficient and effective? Some may opt for the 4-part model, while others argue in favor of the standard algorithm. Chances are, many will feel that the 2-part model is too difficult given the numbers in this combination, which aren't nearly as friendly as  $23 \times 27$ .

8. Ask students to copy the problem into their journal, along with an estimate. Have a few volunteers share their estimates. Then work with class input to solve the problem together, using the standard algorithm. If some students believe that the 4-part model would be equally efficient and effective, work it that way as well. Then compare and contrast the two methods.

Standard Algorithm	4-Part Model
$\begin{array}{r} 4 \\ 36 \\ \times 77 \\ \hline 252 \end{array}$	$\begin{array}{r} 36 \\ \overline{)77} \\ \times 77 \\ 70 \times 30 = 2100 \\ 70 \times 6 = 420 \\ 7 \times 30 = 210 \\ 7 \times 6 = + 42 \\ \hline 2772 \end{array}$
$\begin{array}{r} 4 \\ 36 \\ \times 77 \\ \hline 252 \\ + 2520 \\ \hline 2772 \end{array}$	

**Students** *There's so much more writing with the 4-part way!*

*There's not so much if you just write each of the answers, and don't write the multiplication sentences too.*

*But you still have to add 4 numbers. It just seems like more work.*

*I think it's easier to understand.*

9. Acknowledge the usefulness of both methods, and then explain that most people find the standard algorithm to be the most efficient and effective as the numbers get larger. Solve the problems below with the class, using the standard algorithm. In each case, have students copy the problem into their journal, record an estimate, and then work through the steps with you. If you have students who are already quite proficient with the algorithm, you might call on them to lead the class in solving some of these combinations.

58	69	72	138	243
$\times 24$	$\times 35$	$\times 34$	$\times 33$	$\times 46$

10. Give students more practice using the standard algorithm. Depending on the needs and strengths of your class, you may want to have some students solve additional problems with you, while others work independently on the Roll Your Own Double-Digit Multiplication sheet. Students who are very comfortable with the algorithm can be assigned to solve the challenge problems at the bottom of the sheet.

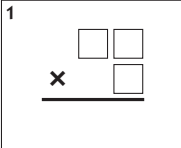
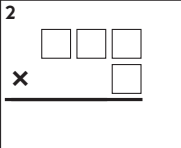
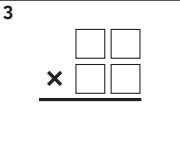
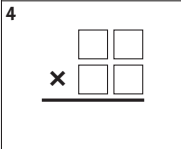
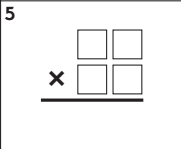
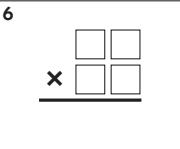
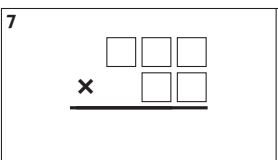
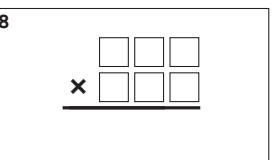
## Activity 12 Extending the Standard Multiplication Algorithm (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Roll Your Own Double-Digit Multiplication Problems

- Choose a die numbered 1–6 or 4–9.
- Roll it as many times as you need to fill in each of the boxes below. You can write each number you roll in any box on the sheet, but once all the boxes are filled, you can't change them.
- Use the method you just learned in class to solve your problems.
- When you're finished, trade papers with a classmate and have him or her check your answers.

1 	2 	3 
4 	5 	6 
<b>CHALLENGE</b>		
7 	8 	

**Note** If some of your students are confused by the standard algorithm, you may want to share the strategy shown at the left below, in which the partial products are added, but computation starts with the ones instead of the tens. This strategy may help ease some students' transition into the standard algorithm a little.

$\begin{array}{r} 47 \\ \times 35 \\ \hline 200 \\ 210 \\ + 1200 \\ \hline 1645 \end{array}$	$\begin{array}{r} 2\times \\ 47 \\ \times 35 \\ \hline 235 \\ + 1410 \\ \hline 1645 \end{array}$
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## INDEPENDENT WORKSHEET

Use Set A5 Independent Worksheet 9 to provide students with more practice with the standard algorithm for double-digit multiplication.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Roll Your Own Double-Digit Multiplication Problems

Directions:

- Choose a die numbered 1–6 or 4–9.
- Roll it as many times as you need to fill in each of the boxes below. You can write each number you roll in any box on the sheet, but once all the boxes are filled, you can't change them.
- Use the method you just learned in class to solve your problems.
- When you're finished, trade papers with a classmate and have him or her check your answers.

<p>1</p> $\begin{array}{r} \square \square \\ \times \quad \square \\ \hline \end{array}$	<p>2</p> $\begin{array}{r} \square \square \square \\ \times \quad \square \\ \hline \end{array}$	<p>3</p> $\begin{array}{r} \square \square \\ \times \square \square \\ \hline \end{array}$
<p>4</p> $\begin{array}{r} \square \square \\ \times \square \square \\ \hline \end{array}$	<p>5</p> $\begin{array}{r} \square \square \\ \times \square \square \\ \hline \end{array}$	<p>6</p> $\begin{array}{r} \square \square \\ \times \square \square \\ \hline \end{array}$



## CHALLENGE

<p>7</p> $\begin{array}{r} \square \square \square \\ \times \quad \square \square \\ \hline \end{array}$	<p>8</p> $\begin{array}{r} \square \square \square \\ \times \square \square \square \\ \hline \end{array}$
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# Set A5 ★ Activity 13



## ACTIVITY

### Reviewing & Evaluating Multiplication Methods

#### Overview

Students review some of the multi-digit multiplication methods they have explored and think critically about which strategies are most effective when. Then they work independently on a set of problems and discuss their solutions, as well as the strategies they selected.

#### Skills & Concepts

- ★ multiply 2- and 3-digit by 2-digit numbers using the standard multiplication algorithm
- ★ solve single- and multi-step word problems involving multi-digit multiplication and verify the solutions
- ★ identify strategies that can be used to solve a problem, select and use one or more appropriate strategies to solve the problem, and justify the selection
- ★ explain why a specific problem-solving strategy was used to determine a solution

#### You'll need

- ★ Reviewing Multiplication Methods (page A5.91, run one copy on a transparency and a class set on paper)
- ★ Evaluating Multiplication Methods (pages A5.92 and A5.93, run a class set)
- ★ overhead pens

#### Instructions for Reviewing & Evaluating Multiplication Methods

1. Give students each a copy of Reviewing Multiplication Methods, and display a copy of the sheet at the overhead.
2. On this sheet, students will find five of the multiplication methods they've explored over the past few weeks. Give them a minute to examine the sheet quietly and star the methods they find easiest and most effective right now. Ask them to share and explain their choices in pairs, and then invite volunteers to share with the class.

**Students** *I put a star by Method A because it's easy, like with  $4 \times 124$ , you can just do doubles and then double it again.*

*I still like the 4-part way because it's easy for me to do the multiplication in my head and then add up the numbers.*

*I really like that 2-part way—it's faster than the other one.*

*I think the regular way on E is the best because it works with big numbers.*

*But with numbers like 299, you don't even need to do hardly any work. Just think it's like  $3 \times 300$ , and then subtract 3.*

## Activity 13 Reviewing &amp; Evaluating Multiplication Methods (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency and a class set on paper.

### Reviewing Multiplication Methods

Read and review these multiplication methods with your class. Then complete the example in each strategy box, A–E.

<p><b>Method A</b> Use basic fact strategies.</p> <p><b>example</b> <math>4 \times 124</math> Double it and then double it again.</p>	
<p><b>Method B</b> Multiply to get 4 partial products and add them up.</p> <p><b>example</b> <math>27 \times 34</math></p> $\begin{array}{r} 34 \\ \times 27 \\ \hline \end{array}$	
<p><b>Method C</b> Multiply by the 10's and then by the 1's. Add the partial products.</p> <p><b>example</b> <math>16 \times 25</math></p> $\begin{array}{r} 25 \\ \times 16 \\ \hline \end{array}$	
<p><b>Method D</b> Use landmark numbers.</p> <p><b>example</b> <math>3 \times 299</math></p> $\begin{array}{r} 299 \\ \times 3 \\ \hline \end{array}$	<p><b>Method E</b> Use the standard algorithm.</p> <p><b>example</b> <math>46 \times 73</math></p> $\begin{array}{r} 73 \\ \times 46 \\ \hline \end{array}$

3. Then work with class input to complete the examples at the overhead as students do so on their copies of the sheet.

**Teacher** Let's complete the example for Method A together. It says  $4 \times 124$  and tells us to double it and then double it again. What do we need to write on the sheet to show this?

**Justin** You could just write  $124 + 124$ , or  $124 \times 2$  and do it in your head. Then just double that to get the answer.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency and a class set on paper.

### Reviewing Multiplication Methods

Read and review these multiplication methods with your class. Then complete the example in each strategy box, A–E.

<p><b>Method A</b> Use basic fact strategies.</p> <p><b>example</b> <math>4 \times 124</math> Double it and then double it again.</p> $\begin{array}{l} 124 \times 2 = 248 \\ 248 \times 2 = 496 \\ \hline 496 \end{array}$
---

**Teacher** What if the problem had been  $3 \times 124$  or  $5 \times 124$  instead of  $4 \times 124$ ? Would our basic fact strategies still work? Talk with the person sitting next to you—what do you think?

**Students** If it was  $3 \times 124$ , you could just double it and add another 124.

For  $5 \times 124$ , you could just multiply by 10 and cut the answer in half, just like if you were doing  $5 \times 9$  or  $5 \times 12$ .

**Activity 13** Reviewing & Evaluating Multiplication Methods (cont.)

**Teacher** So if you're multiplying a number—even a big number—by a single digit, you might remember back to some of the basic fact strategies you already know. Let's look at Method B, the 4-part model. What do we have to do to use this method?

**Students** We have to look at the 4 little lines and do those multiplication problems. Like on the first one, it's  $20 \times 30$ . That's 600. And the next one is  $20 \times 4$ , and that's 80.

**Teacher** Let's write each step down on our papers. I'll do that up here, and you work on your sheets.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run 1 copy on a transparency and a class set on paper.

### Reviewing Multiplication Methods

Read and review these multiplication methods with your class. Then complete the example in each strategy box, A–E.

**Method A** Use basic fact strategies.

**example**  $4 \times 124$  Double it and then double it again.

$$\begin{array}{r} 124 \times 2 = 248 \\ 248 \times 2 = 496 \\ \hline 496 \end{array}$$

**Method B** Multiply to get 4 partial products and add them up.

**example**  $27 \times 34$

$$\begin{array}{r} 34 \\ \times 27 \\ \hline 238 \\ 680 \\ \hline 918 \end{array}$$

4. Complete the rest of the examples on the sheet together in a similar fashion, reviewing and discussing each strategy as you enter the needed information at the overhead and students do so on their worksheets.

**Method C** Multiply by the 10's and then by the 1's. Add the partial products.

**example**  $16 \times 25$

$$\begin{array}{r} 25 \\ \times 16 \\ \hline 10 \times 25 = 250 \\ 6 \times 25 = 150 \\ \hline 400 \end{array}$$

**Method D** Use landmark numbers.

**example**  $3 \times 299$

$$\begin{array}{r} 299 \\ \times 3 \\ \hline 3 \times 300 = 900 \\ 900 - 3 = 897 \end{array}$$

**Method E** Use the standard algorithm.

**example**  $46 \times 73$

$$\begin{array}{r} 73 \\ \times 46 \\ \hline 438 \\ + 2920 \\ \hline 3358 \end{array}$$

5. Leave the overhead on display, and give students each a copy of the Evaluating Multiplication Methods sheets. Review the instructions at the top of the first page, and explain to students that for each problem, they'll need to choose the multiplication method that seems best to them, and then use that method to solve the problem. Decisions will vary from one student to the next, and that's okay. If a few students raise the point that there are multiplication methods other than the ones shown on the overhead, acknowledge the fact, but ask them to make their selections from Methods A–E for this assignment.

## Activity 13 Reviewing &amp; Evaluating Multiplication Methods (cont.)

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Evaluating Multiplication Methods** page 1 of 2

For each problem on this page and the next,

- write the letter of the method you think will work best.
- use the method to solve the problem. Show all your work.

**1** People need to drink about 8 cups of water each day. Zoo elephants need to drink about 158 quarts of water each day. How many cups of water are there in 158 quarts of water? (Remember that there are 4 cups in a quart.)  
I think Method \_\_\_\_ will work best for this problem.


**2** So far, the elephant keeper has brought in 40 gallons of water for the elephants. How many cups of water are there in 40 gallons? (Remember that there are 16 cups in a gallon.)  
I think Method \_\_\_\_ will work best for this problem.

Set A5 Number and Operations: Multi-Digit Multiplication Blackline Run a class set.  
NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Evaluating Multiplication Methods** page 2 of 2

**3** Zoo elephants eat about 175 pounds of food a day. Most of their food is hay, but they also eat fruits and vegetables. How many pounds of food would it take to feed 26 elephants for one day?  
I think Method \_\_\_\_ will work best for this problem.

**4** Each elephant at our zoo gets about 45 pounds of vegetables a day. How many pounds of vegetables does it take to feed one elephant for 49 days (7 weeks)?  
I think Method \_\_\_\_ will work best for this problem.

 **CHALLENGE**

**5** An elephant can spend up to 18 hours a day eating. How many hours would that total in one year? About how many months' worth of time is that?

6. Once students understand what to do, give them time to complete the sheets. When most have finished the assignment, ask them to meet in pairs to share and compare their answers, as well as the methods they chose. If their answers don't match, ask them to re-examine the problem and see if they can resolve the difference.

7. Reconvene the class toward the end of the period. Work with student input to record each multiplication problem at the whiteboard along with the answer.

$$\begin{array}{r} 158 \\ \times 8 \\ \hline 1,264 \end{array} \quad \begin{array}{r} 40 \\ \times 16 \\ \hline 640 \end{array} \quad \begin{array}{r} 175 \\ \times 26 \\ \hline 4,550 \end{array} \quad \begin{array}{r} 45 \\ \times 49 \\ \hline 2,205 \end{array}$$

Then ask volunteers to share the methods they chose to help solve each problem and explain their choices to the class. During the discussion, elicit these ideas:

- There are a variety of ways to solve multi-digit multiplication problems; it's not necessary to use the same method every time. What's important is to choose the method that is most efficient and effective.
- The method you choose to solve a particular problem depends on the numbers themselves. Here are some examples:
  - Use a basic fact strategy if the multiplier is a single digit.
  - Use a 2-part method when it's relatively easy to compute each partial product mentally (i.e.,  $16 \times 40$ ).
  - Use a 4-part method or the standard algorithm when the numbers are not as "friendly" (i.e.,  $49 \times 45$ ).
  - Use the standard algorithm when you're multiplying 3 digits by 2 digits.

## Reviewing Multiplication Methods

Read and review these multiplication methods with your class. Then complete the example in each strategy box, A–E.

**Method A** Use basic fact strategies.

**example**  $4 \times 124$  Double it and then double it again.

**Method B** Multiply to get 4 partial products and add them up.

**example**  $27 \times 34$

$$\begin{array}{r} 34 \\ \times 27 \\ \hline \end{array}$$

**Method C** Multiply by the 10's and then by the 1's. Add the partial products.

**example**  $16 \times 25$

$$\begin{array}{r} 25 \\ \times 16 \\ \hline \end{array}$$

**Method D** Use landmark numbers.

**example**  $3 \times 299$

$$\begin{array}{r} 299 \\ \times 3 \\ \hline \end{array}$$

**Method E** Use the standard algorithm.

**example**  $46 \times 73$

$$\begin{array}{r} 73 \\ \times 46 \\ \hline \end{array}$$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Evaluating Multiplication Methods page 1 of 2

For each problem on this page and the next,

- write the letter of the method you think will work best.
- use the method to solve the problem. Show all your work.

**1** People need to drink about 8 cups of water each day. Zoo elephants need to drink about 158 quarts of water each day. How many cups of water are there in 158 quarts of water? (Remember that there are 4 cups in a quart.)

I think Method \_\_\_\_\_ will work best for this problem.

**2** So far, the elephant keeper has brought in 40 gallons of water for the elephants. How many cups of water are there in 40 gallons? (Remember that there are 16 cups in a gallon.)

I think Method \_\_\_\_\_ will work best for this problem.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Evaluating Multiplication Methods page 2 of 2

**3** Zoo elephants eat about 175 pounds of food a day. Most of their food is hay, but they also eat fruits and vegetables. How many pounds of food would it take to feed 26 elephants for one day?

I think Method \_\_\_\_ will work best for this problem.

**4** Each elephant at our zoo gets about 45 pounds of vegetables a day. How many pounds of vegetables does it take to feed one elephant for 49 days (7 weeks)?

I think Method \_\_\_\_ will work best for this problem.



### CHALLENGE

**5** An elephant can spend up to 18 hours a day eating. How many hours would that total in one year? About how many months' worth of time is that?



# Set A5 ★ Activity 14



## ACTIVITY

### Multi-Digit Multiplication Post-Assessment

#### Overview

The pre-assessment given in Activity 1 is re-administered in somewhat different form during this activity. Students' work on the post-assessment will provide information about what they have learned, as well as the areas in which they need continued support.

#### Skills & Concepts

- ★ multiply by 10, 100, and 1000
- ★ multiply one- and two-digit numbers by numbers through 10 and by multiples of 10
- ★ multiply up to 3-digit by 1- and 2-digit numbers accurately using the standard algorithm
- ★ estimate products to approximate solutions and determine reasonableness of answers
- ★ solve single- and multi-step word problems involving multi-digit multiplication

#### You'll need

- ★ Multi-Digit Multiplication Post-Assessment (pages A5.100–A5.103, run a class set)
- ★ Multi-Digit Multiplication Post-Assessment Class Checklist (page A5.104, run 1 or 2 copies)
- ★ Multi-Digit Multiplication Pre- & Post-Assessment Scoring & Comparisons (optional, pages A5.11 and A5.12, run a class set)
- ★ Student Reflection Sheet: Multiplication (see note)
- ★ Base 10 Grid Paper (page A5.13, run as needed)

.....

**Note** If you had students fill out the Student Reflection Sheet (pages A5.14–A5.16) after the Multi-Digit Multiplication Pre-Assessment, plan to have them fill it out again when you return their scored post-assessments.

.....

#### Instructions for Multi-Digit Multiplication Post-Assessment

1. Give each student a copy of the 4-page post-assessment and then read and review the tasks with the class. Have students write their names on their papers and circle each “doing” word as you read through the items together. Remind students that they'll need to check off each checkpoint as they complete the items.
2. Before they start to work, be sure students understand that they only need to circle and solve one combination in problems 2, 3, and 7. Take a minute, if necessary, to review the standard multiplication algorithm, because students are specifically asked to use that method to solve problems 2, 3, and 7. In problems 2 and 3, they're also asked to use a second method. You might take a minute to review some of the methods they've explored over the past few weeks: sketches on base 10 grid paper, freehand 4-part and 2-part area models, finding and adding 4 or 2 partial products, and so on. Tell students that you'll place a stack of base ten grid paper near each table or cluster of desks if they want to use it for any of the problems other than problem 7.
3. Remind students that you are available to re-read any of the directions or problems for them while they work. Advise them to complete the items they find easiest and most familiar first, even if that means skipping around a bit, and then return to the questions they find more challenging and writing “I don't know yet” if necessary.

**Activity 14** Multi-Digit Multiplication Post-Assessment (cont.)

4. If you plan to score this assessment as suggested in “Looking at Student Work” below, let students know that you will be scoring their papers. In many of the problems, they will be given a point for the answer and a point for showing their work. In problems 2 and 3, they will get a point for using the standard algorithm to solve the combination they’ve selected, and another point for solving it using a different method. In problems 4 and 8, they need to estimate answers and explain their estimates; points will be given for the estimate and the explanation. While it may seem that this will create more test anxiety, we find that it is very helpful to students when we share our expectations before they start.

5. Give students the rest of the period to complete the assessment. Make sure your students understand what they are expected to do when they complete the assessment and where you want them to place their finished papers.

**LOOKING AT STUDENT WORK**

Below you’ll find an item-by-item answer key and scoring suggestions for this post-assessment. We generally use the percentage of points earned to determine whether a student is working at an advanced, proficient, basic, or novice level with regard to the material on the assessment. You may need to adjust the scoring system for this assessment to ensure that it reflects the expectations for fourth-graders in your district.

POINTS SCORED	PERCENTAGE OF TOTAL	LEVEL
29 – 32 points	90 – 100 %	Advanced (Working above grade level)
24 – 28 points	75 – 89%	Proficient (Working at grade level)
17 – 23 points	53 – 74%	Basic (Working toward grade level)
16 points or fewer	50% or lower	Novice (Working below grade level)

In addition to scoring these post-assessments, you may find it helpful to compare them to students’ pre-assessments. Although some students may not score particularly well on the post-assessment, you may find that they have actually made quite a bit of progress based on what they were able to do at the beginning of this collection of activities.

Activity 14 Multi-Digit Multiplication Post-Assessment (cont.)

PROBLEM 1	SCORING: 3 POINTS POSSIBLE
<p>1 There are 24 crayons in a box. There are 8 boxes of crayons in a jumbo pack. Mrs. Perez bought 4 jumbo packs of crayons for her class. How many crayons did she get in all?</p> <p>a ____ Solve the story problem above. Show your work with labeled sketches, numbers, and/or words.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: right;"> <math display="block">\begin{array}{r} 24 \\ \times 8 \\ \hline 160 \\ + 32 \\ \hline 192 \end{array}</math> </div> <div style="text-align: right;"> <math display="block">\begin{array}{r} 192 \\ \times 4 \\ \hline 400 \\ 360 \\ \hline 768 \end{array}</math> </div> </div> <p>b ____ Mrs. Perez got <u>768</u> crayons in all.</p>	<ul style="list-style-type: none"> <li>1 point for a strategy that indicates the student understands this is a 2-step problem requiring two different calculations or sets of calculations</li> <li>1 point for work that uses any combination of labeled sketches, numbers, and words to demonstrate how the solution was found</li> <li>1 point for the correct answer, 768</li> </ul>
<p><b>Comments</b></p> <p>It is possible for a student to score 2 points on this problem, even if she doesn't get the correct answer. One of the goals of multi-digit multiplication activities was to help students develop skills at solving multi-step problems. Even if the student makes errors in her calculations, using a strategy that reflects good understanding of the problem can be awarded 2 points.</p>	

PROBLEM 2	SCORING: 3 POINTS POSSIBLE
<p>2 Choose one of the problems below and circle it.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-bottom: 10px;"> <div style="text-align: center;"><math>\begin{array}{r} 24 \\ \times 6 \end{array}</math></div> <div style="text-align: center;"><math>\begin{array}{r} 32 \\ \times 8 \end{array}</math></div> <div style="text-align: center;"><math>\begin{array}{r} 42 \\ \times 7 \end{array}</math></div> <div style="text-align: center;"><math>\begin{array}{r} 99 \\ \times 5 \end{array}</math></div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%; padding: 5px;"> <p>a ____ Use the standard algorithm to solve the problem you circled. Show all your work in the box below.</p> <p><b>Responses will vary. Sample for <math>32 \times 8</math>:</b></p> <math display="block">\begin{array}{r} 1 \\ \times 32 \\ \times 8 \\ \hline 256 \end{array}</math> </div> <div style="width: 45%; padding: 5px;"> <p>b ____ Use a different method to solve the problem you circled. Show all your work in the box below.</p> <p><math>32 \times 2 = 64</math>  <math>64 \times 2 = 128</math>  <math>128 \times 2 = 256</math></p> </div> </div> <p>c ____ Which method was easier and faster for you? Why?</p> <p><b>Responses will vary. Sample: The standard algorithm is faster, but doubling seems easier.</b></p>	<ul style="list-style-type: none"> <li>1 point for using the standard algorithm to get the correct answer</li> <li>1 point for using any other method to get the correct answer (see Comments)</li> <li>1 point for any reasonable response to the question about which method was easier and faster</li> </ul> <p><b>Answers to the 4 problems</b></p> <ul style="list-style-type: none"> <li><math>6 \times 24 = 144</math></li> <li><math>8 \times 32 = 256</math></li> <li><math>7 \times 42 = 294</math></li> <li><math>5 \times 99 = 495</math></li> </ul>
<p><b>Comments</b></p> <p>Possible strategies include a labeled sketch on base 10 grid paper, a freehand sketch of the area model divided into 4 or 2 parts, finding and adding 4 or 2 partial products, a basic facts strategy such as double-double-doubles, or repeated addition. Student who are still using repeated addition and are not yet using the standard algorithm for 1-by 2-digit multiplication accurately will need extra support to develop proficiency with this skill. (See Grade 4 Support Activity 22, Spin &amp; Multiply. You'll find this activity at the back of the Grade 4 Number Corner Blacklines.)</p>	

PROBLEM 3	SCORING: 2 POINTS POSSIBLE
<p>3 Choose one of the problems below and circle it.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-bottom: 10px;"> <div style="text-align: center;"><math>\begin{array}{r} 25 \\ \times 18 \end{array}</math></div> <div style="text-align: center;"><math>\begin{array}{r} 33 \\ \times 23 \end{array}</math></div> <div style="text-align: center;"><math>\begin{array}{r} 43 \\ \times 23 \end{array}</math></div> <div style="text-align: center;"><math>\begin{array}{r} 51 \\ \times 32 \end{array}</math></div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%; padding: 5px;"> <p>a ____ Use the standard algorithm to solve the problem you circled. Show all your work in the box below.</p> <p><b>Responses will vary. Sample for <math>51 \times 32</math>:</b></p> <math display="block">\begin{array}{r} 51 \\ \times 32 \\ \hline 102 \\ + 1530 \\ \hline 1,632 \end{array}</math> </div> <div style="width: 45%; padding: 5px;"> <p>b ____ Use a different method to solve the problem you circled. Show all your work in the box below.</p> <math display="block">\begin{array}{r} 51 \\ \times 32 \\ \hline 1500 \\ 30 \\ 100 \\ \hline 1,632 \end{array}</math> </div> </div>	<ul style="list-style-type: none"> <li>1 point for using the standard algorithm to get the correct answer</li> <li>1 point for using any other method to get the correct answer (see Comments)</li> </ul> <p><b>Answers to the 4 problems</b></p> <ul style="list-style-type: none"> <li><math>18 \times 25 = 450</math></li> <li><math>23 \times 33 = 759</math></li> <li><math>23 \times 43 = 989</math></li> <li><math>32 \times 51 = 1,632</math></li> </ul>
<p><b>Comments</b></p> <p>Possible methods include a labeled sketch on base 10 grid paper, a freehand sketch of the area model divided into 4 or 2 parts, finding and adding 4 or 2 partial products, or repeated addition. Student who are still using repeated addition and are not yet using the standard algorithm for 2-by 2-digit multiplication accurately will need extra support to develop proficiency with this skill. (See Grade 5 Support Activities 31, Spin &amp; Multiply Big Time, and 36, Multiplication Tic-Tac-Toe. You'll find these activities at the back of the Grade 5 Number Corner Blacklines.)</p>	

## Activity 14 Multi-Digit Multiplication Post-Assessment (cont.)

PROBLEM 4	SCORING: 4 POINTS POSSIBLE		
<p>4 ____ Fill in the bubble to show the best estimate for each problem. Explain your choice.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;"> <p><b>a</b></p> <math display="block">\begin{array}{r} 248 \\ \times 4 \\ \hline \end{array}</math> <p style="font-size: small;">Why?</p> <p><b>Responses will vary. Sample: <math>4 \times 200</math> is 800. Then 48 is almost like 50, and <math>4 \times 50</math> is 200. 800 + 200 is 1,000 so that's what I picked.</b></p> </td> <td style="width: 50%; border: none;"> <p><b>b</b></p> <math display="block">\begin{array}{r} 25 \\ \times 25 \\ \hline \end{array}</math> <p style="font-size: small;">Why?</p> <p><b>Responses will vary. Sample: <math>20 \times 25</math> is 500. Then <math>5 \times 25</math> is 125. <math>500 + 125</math> is 625 so 600 is the closest.</b></p> </td> </tr> </table>	<p><b>a</b></p> $\begin{array}{r} 248 \\ \times 4 \\ \hline \end{array}$ <p style="font-size: small;">Why?</p> <p><b>Responses will vary. Sample: <math>4 \times 200</math> is 800. Then 48 is almost like 50, and <math>4 \times 50</math> is 200. 800 + 200 is 1,000 so that's what I picked.</b></p>	<p><b>b</b></p> $\begin{array}{r} 25 \\ \times 25 \\ \hline \end{array}$ <p style="font-size: small;">Why?</p> <p><b>Responses will vary. Sample: <math>20 \times 25</math> is 500. Then <math>5 \times 25</math> is 125. <math>500 + 125</math> is 625 so 600 is the closest.</b></p>	<ul style="list-style-type: none"> <li>1 point for selecting the closest estimate to each problem (1,000 and 600)</li> <li>1 point for each reasonable explanation of the selected estimate (see Comments)</li> </ul>
<p><b>a</b></p> $\begin{array}{r} 248 \\ \times 4 \\ \hline \end{array}$ <p style="font-size: small;">Why?</p> <p><b>Responses will vary. Sample: <math>4 \times 200</math> is 800. Then 48 is almost like 50, and <math>4 \times 50</math> is 200. 800 + 200 is 1,000 so that's what I picked.</b></p>	<p><b>b</b></p> $\begin{array}{r} 25 \\ \times 25 \\ \hline \end{array}$ <p style="font-size: small;">Why?</p> <p><b>Responses will vary. Sample: <math>20 \times 25</math> is 500. Then <math>5 \times 25</math> is 125. <math>500 + 125</math> is 625 so 600 is the closest.</b></p>		
<p><b>Comments</b></p> <p>If a student hasn't chosen the closest estimate, but has given an explanation that demonstrates good number sense, consider awarding 1 point for the item.</p>			

PROBLEM 5	SCORING: 6 POINTS POSSIBLE						
<p>5 ____ Write the answer to each problem.</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;"><math>\begin{array}{r} 45 \\ \times 10 \\ \hline 450 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 10 \\ \times 50 \\ \hline 500 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 29 \\ \times 100 \\ \hline 2,900 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 100 \\ \times 60 \\ \hline 6,000 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 1,000 \\ \times 18 \\ \hline 18,000 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 60 \\ \times 1,000 \\ \hline 60,000 \end{array}</math></td> </tr> </table>	$\begin{array}{r} 45 \\ \times 10 \\ \hline 450 \end{array}$	$\begin{array}{r} 10 \\ \times 50 \\ \hline 500 \end{array}$	$\begin{array}{r} 29 \\ \times 100 \\ \hline 2,900 \end{array}$	$\begin{array}{r} 100 \\ \times 60 \\ \hline 6,000 \end{array}$	$\begin{array}{r} 1,000 \\ \times 18 \\ \hline 18,000 \end{array}$	$\begin{array}{r} 60 \\ \times 1,000 \\ \hline 60,000 \end{array}$	<ul style="list-style-type: none"> <li>1 point for each correct answer</li> </ul>
$\begin{array}{r} 45 \\ \times 10 \\ \hline 450 \end{array}$	$\begin{array}{r} 10 \\ \times 50 \\ \hline 500 \end{array}$	$\begin{array}{r} 29 \\ \times 100 \\ \hline 2,900 \end{array}$	$\begin{array}{r} 100 \\ \times 60 \\ \hline 6,000 \end{array}$	$\begin{array}{r} 1,000 \\ \times 18 \\ \hline 18,000 \end{array}$	$\begin{array}{r} 60 \\ \times 1,000 \\ \hline 60,000 \end{array}$		
<p><b>Comments</b></p> <p>Because they should be able to do these problems mentally, students are not required to show their work. Don't penalize them, however, if they've used the standard algorithm or some other method to get the answers.</p>							

PROBLEM 6	SCORING: 6 POINTS POSSIBLE						
<p>6 ____ Write the answer to each problem.</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;"><math>\begin{array}{r} 40 \\ \times 2 \\ \hline 80 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 60 \\ \times 4 \\ \hline 240 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 50 \\ \times 30 \\ \hline 1,500 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 80 \\ \times 50 \\ \hline 4,000 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 21 \\ \times 30 \\ \hline 630 \end{array}</math></td> <td style="text-align: center;"><math>\begin{array}{r} 32 \\ \times 30 \\ \hline 960 \end{array}</math></td> </tr> </table>	$\begin{array}{r} 40 \\ \times 2 \\ \hline 80 \end{array}$	$\begin{array}{r} 60 \\ \times 4 \\ \hline 240 \end{array}$	$\begin{array}{r} 50 \\ \times 30 \\ \hline 1,500 \end{array}$	$\begin{array}{r} 80 \\ \times 50 \\ \hline 4,000 \end{array}$	$\begin{array}{r} 21 \\ \times 30 \\ \hline 630 \end{array}$	$\begin{array}{r} 32 \\ \times 30 \\ \hline 960 \end{array}$	<ul style="list-style-type: none"> <li>1 point for each correct answer</li> </ul>
$\begin{array}{r} 40 \\ \times 2 \\ \hline 80 \end{array}$	$\begin{array}{r} 60 \\ \times 4 \\ \hline 240 \end{array}$	$\begin{array}{r} 50 \\ \times 30 \\ \hline 1,500 \end{array}$	$\begin{array}{r} 80 \\ \times 50 \\ \hline 4,000 \end{array}$	$\begin{array}{r} 21 \\ \times 30 \\ \hline 630 \end{array}$	$\begin{array}{r} 32 \\ \times 30 \\ \hline 960 \end{array}$		
<p><b>Comments</b></p> <p>Because they should be able to do these problems mentally, students are not required to show their work. Don't penalize them, however, if they've used the standard algorithm or some other method to get the answers. Of greater concern are those students who are trying to manipulate the numbers without adequate understanding. Such students may give an answer of 150 for <math>30 \times 50</math> or 400 for <math>50 \times 80</math> because they have latched onto the idea of multiplying the digits in the tens place as if they were ones (i.e., <math>5 \times 8 = 40</math>), but aren't sure how many zeros to add. You might ask these students to continue using Base Ten Grid Paper or even base ten pieces to solve such problems so that they can develop a greater understanding of the place value concepts at work.</p>							

## Activity 14 Multi-Digit Multiplication Post-Assessment (cont.)

## PROBLEM 7

## SCORING: 3 POINTS POSSIBLE

7 Choose one of the multiplication problems below and circle it. Pick the one that seems best for you - not too hard and not too easy.

$$\begin{array}{r} 112 \\ \times 24 \\ \hline \end{array} \quad \begin{array}{r} 125 \\ \times 17 \\ \hline \end{array} \quad \begin{array}{r} 332 \\ \times 26 \\ \hline \end{array} \quad \begin{array}{r} 254 \\ \times 25 \\ \hline \end{array} \quad \begin{array}{r} 382 \\ \times 37 \\ \hline \end{array} \quad \begin{array}{r} 569 \\ \times 48 \\ \hline \end{array}$$

a \_\_\_\_ Use the standard algorithm to find the answer to the problem you circled. Be sure to show all of your work.

Responses will vary.

Sample for  $332 \times 26$ :

$$\begin{array}{r} 11 \\ 332 \\ \times 26 \\ \hline 1992 \\ + 6640 \\ \hline 8,632 \end{array}$$

b \_\_\_\_ Write a story problem to match the multiplication problem you just solved.

Responses will vary. Sample: The school cafeteria got 26 packs of napkins. There are 332 napkins in each pack. How many napkins in all?

- 1 point for using the standard algorithm to get the correct answer
- 2 points for a multiplication story problem that matches the selected combinations (A story problems that involves repeated addition rather than multiplication may be awarded 1 point.)

## Answers to the 6 problems:

- $24 \times 112 = 2,688$
- $17 \times 125 = 2,125$
- $26 \times 332 = 8,632$
- $25 \times 254 = 6,350$
- $37 \times 382 = 14,134$
- $48 \times 569 = 27,312$

## Comments

Students' story problems will give you some indication of how well they understand the operation of multiplication. Even if they're able to go through the mechanics of the standard algorithm, students who write story problems that involve addition rather than multiplication may still be using additive rather than multiplicative reasoning when they think about multiplication.

## PROBLEM 8

## SCORING: 5 POINTS POSSIBLE

8 We can hear someone out mowing the lawn in front of our school. The lawn is 24 feet wide and 49 feet long. How many square feet of grass do they have to mow

a \_\_\_\_ Write an expression to match this problem.

$$\begin{array}{r} 49 \\ \times 24 \\ \hline \end{array}$$

b Andy says the answer is going to be about 800. Do you agree with Andy? Why or why not?

Responses will vary. Sample: No because 49 is really close to 50.  $20 \times 50$  would be 1,000 so I think Andy's estimate is too low.

c \_\_\_\_ Use any method except repeated addition to solve the problem. Show all of your work.

$$\begin{array}{r} 20 \times 49 = 980 \\ 4 \times 49 = 196 \\ \hline 1,176 \end{array}$$

They have 1,176 square feet of grass to mow.

- 1 point for the correct expression:  $24 \times 49$  or  $49 \times 24$
- 1 point for the correct response to part b: No or I disagree
- 1 point for a reasonable explanation of why Andy's estimate is too low (see Comments)
- 1 point for a method other than repeated addition
- 1 point for the correct answer, 1,176

## Comments

If a student agrees with Andy that 800 is a reasonable estimate, and gives an explanation that reflects good number sense, you might consider awarding a point for the explanation. Possible methods for solving the problem include a labeled sketch on base 10 grid paper, a freehand sketch of the area model divided into 4 or 2 parts, finding and adding 4 or 2 partial products, or the standard algorithm. Repeated addition is not acceptable.

**Note** In order to help students develop fluency with the skills taught during this activity set, you'll want to provide more practice over the coming months. Independent Worksheets 1–9 that follow this activity are provided for this purpose. Additional multi-digit multiplication exercises and problems can be found on The Math Learning Center website: [www.mathlearningcenter.org](http://www.mathlearningcenter.org).

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# Multi-Digit Multiplication Post-Assessment

 page 1 of 4

**1** There are 24 crayons in a box. There are 8 boxes of crayons in a jumbo pack. Mrs. Perez bought 4 jumbo packs of crayons for her class. How many crayons did she get in all?

**a** \_\_\_\_ Solve the story problem above. Show your work with labeled sketches, numbers, and/or words.

**b** \_\_\_\_ Mrs. Perez got \_\_\_\_\_ crayons in all.

**2** Choose one of the problems below and circle it.

$\begin{array}{r} 24 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 32 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 42 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 99 \\ \times 5 \\ \hline \end{array}$
---	---	---	---

**a** \_\_\_\_ Use the standard algorithm to solve the problem you circled. Show all your work in the box below.

**b** \_\_\_\_ Use a different method to solve the problem you circled. Show all your work in the box below.

**c** \_\_\_\_ Which method was easier and faster for you? Why?



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# Multi-Digit Multiplication Post-Assessment

 page 2 of 4

**3** Choose one of the problems below and circle it.

$$\begin{array}{r} 25 \\ \times 18 \\ \hline \end{array}$$

$$\begin{array}{r} 33 \\ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} 43 \\ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} 51 \\ \times 32 \\ \hline \end{array}$$

**a** \_\_\_\_ Use the standard algorithm to solve the problem you circled. Show all your work in the box below.

**b** \_\_\_\_ Use a different method to solve the problem you circled. Show all your work in the box below.

**4** \_\_\_\_ Fill in the bubble to show the best estimate for each problem. Explain your choice.

**a**

$$\begin{array}{r} 248 \\ \times 4 \\ \hline \end{array}$$

- 800  
 900  
 1,000  
 1,200

Why?

**b**

$$\begin{array}{r} 25 \\ \times 25 \\ \hline \end{array}$$

- 400  
 500  
 600  
 700

Why?

**5** \_\_\_\_ Write the answer to each problem.

$$\begin{array}{r} 45 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 50 \\ \hline \end{array}$$

$$\begin{array}{r} 29 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 100 \\ \times 60 \\ \hline \end{array}$$

$$\begin{array}{r} 1,000 \\ \times 18 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 1,000 \\ \hline \end{array}$$

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**Multi-Digit Multiplication Post-Assessment** page 3 of 4**6** \_\_\_\_\_ Write the answer to each problem.

$$\begin{array}{r} 40 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 50 \\ \times 30 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ \times 50 \\ \hline \end{array}$$

$$\begin{array}{r} 21 \\ \times 30 \\ \hline \end{array}$$

$$\begin{array}{r} 32 \\ \times 30 \\ \hline \end{array}$$

**7** Choose one of the multiplication problems below and circle it. Pick the one that seems best for you - not too hard and not too easy.

$$\begin{array}{r} 112 \\ \times 24 \\ \hline \end{array}$$

$$\begin{array}{r} 125 \\ \times 17 \\ \hline \end{array}$$

$$\begin{array}{r} 332 \\ \times 26 \\ \hline \end{array}$$

$$\begin{array}{r} 254 \\ \times 25 \\ \hline \end{array}$$

$$\begin{array}{r} 382 \\ \times 37 \\ \hline \end{array}$$

$$\begin{array}{r} 569 \\ \times 48 \\ \hline \end{array}$$

**a** \_\_\_\_\_ Use the standard algorithm to find the answer to the problem you circled. Be sure to show all of your work.**b** \_\_\_\_\_ Write a story problem to match the multiplication problem you just solved.

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## Multi-Digit Multiplication Post-Assessment page 4 of 4

**8** We can hear someone out mowing the lawn in front of our school. The lawn is 24 feet wide and 49 feet long. How many square feet of grass do they have to mow?

**a** \_\_\_\_ Write an expression to match this problem.

**b** Andy says the answer is going to be about 800. Do you agree with Andy? Why or why not?

**c** \_\_\_\_ Use any method except repeated addition to solve the problem. Show all of your work.



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# Set A5 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### More Practice Multiplying by 10, 100 & 1000

1 Write the answers.

$$\begin{array}{r} 43 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 29 \\ \hline \end{array}$$

$$\begin{array}{r} 67 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 40 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 11 \\ \hline \end{array}$$

$$\begin{array}{r} 600 \\ \times 10 \\ \hline \end{array}$$

2 Write the answers.

$$\begin{array}{r} 22 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 16 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 100 \\ \times 73 \\ \hline \end{array}$$

$$\begin{array}{r} 30 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 44 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 71 \\ \times 100 \\ \hline \end{array}$$

$$\begin{array}{r} 500 \\ \times 100 \\ \hline \end{array}$$

3 Fill in the rest of this sentence.

When you multiply any number by 100,

4 Write the answers

$79 \times 1,000 = \underline{\hspace{2cm}}$

$1,000 \times 20 = \underline{\hspace{2cm}}$

$500 \times 1,000 = \underline{\hspace{2cm}}$

5 The painters are painting one of the walls in the gym. The wall is 10 feet high and 45 feet long. They have already painted 133 square feet. How many square feet do they have left to paint?

a Write the question in your own words.

b Underline the information in the problem that will help you answer the question.

(Continued on back.)

**Independent Worksheet 1** More Practice Multiplying by 10, 100 & 100 (cont.)

**5c** Circle the operations you will need to solve this problem:

addition (+)          subtraction (-)          multiplication ( $\times$ )          division ( $\div$ )

**d** Solve problem 5 in the space below. Show all your work.

**e** Write your answer here. Include the units. \_\_\_\_\_



**CHALLENGE**

**6** The painters are going to paint the hallway wall. The wall is 10 feet high and 80 feet long. It takes one gallon of paint to cover 200 square feet. A gallon of paint costs \$26.25. How much will it cost to paint the wall?

**a** Write the question in your own words.

**b** Underline the information in the problem that will help you answer the question.

**c** Circle the operations you will need to solve this problem:

addition (+)          subtraction (-)          multiplication ( $\times$ )          division ( $\div$ )

**d** Solve this problem in the space below. Show all your work.

**e** Write your answer here. Include the units. \_\_\_\_\_

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# Set A5 ★ Independent Worksheet 2



## INDEPENDENT WORKSHEET

### More Tens, Hundreds & Thousands

1 Solve these problems in your head. Write the answers.

$$\begin{array}{r} 100 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 200 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 300 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 400 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 500 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 600 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 700 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 800 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 900 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 2,000 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 3,000 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 4,000 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 5,000 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 6,000 \\ \times 9 \\ \hline \end{array}$$

2 Solve these problems in your head. Write the answers.

$$\begin{array}{r} 90 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 70 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 60 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 50 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 40 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 30 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 900 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 800 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 700 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 600 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 500 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 400 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 300 \\ \times 3 \\ \hline \end{array}$$

3 Write the answers to these problems.

$200 \times 10 = \underline{\quad}$

$400 \times 100 = \underline{\quad}$

$30 \times 1,000 = \underline{\quad}$

$200 \times 20 = \underline{\quad}$

$400 \times 200 = \underline{\quad}$

$30 \times 2,000 = \underline{\quad}$

$200 \times 30 = \underline{\quad}$

$400 \times 300 = \underline{\quad}$

$30 \times 3,000 = \underline{\quad}$

(Continued on back.)

**Independent Worksheet 2** More Tens, Hundreds & Thousands (cont.)

**4** Circle one of the expressions below. Write a story problem to match. Solve your own problem.

$400 \times 40$

$1,000 \times 18$

$300 \times 30$

$2,000 \times 24$



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# Set A5 ★ Independent Worksheet 3



## INDEPENDENT WORKSHEET

### Double-Digit by Single-Digit Multiplication

1 Use a sketch and numbers to solve the problems below. Follow the example.

Sketch	Numbers
<p><b>example</b></p>	$\begin{array}{r} 24 \\ \times 7 \\ \hline 7 \times 20 = 140 \\ 7 \times 4 = + 28 \\ \hline 168 \end{array}$
<p><b>a</b></p>	$\begin{array}{r} 27 \\ \times 5 \\ \hline 5 \times 20 = \underline{\hspace{2cm}} \\ 5 \times 7 = + \underline{\hspace{2cm}} \end{array}$
<p><b>b</b></p>	$\begin{array}{r} 23 \\ \times 9 \\ \hline 9 \times 20 = \underline{\hspace{2cm}} \\ 9 \times 3 = + \underline{\hspace{2cm}} \end{array}$
<p><b>c</b></p>	$\begin{array}{r} 35 \\ \times 8 \\ \hline 8 \times 30 = \underline{\hspace{2cm}} \\ 8 \times 5 = + \underline{\hspace{2cm}} \end{array}$

2 Use numbers to solve these problems.

<p><b>a</b></p> $\begin{array}{r} 43 \\ \times 6 \\ \hline 6 \times 40 = \underline{\hspace{2cm}} \\ 6 \times 3 = + \underline{\hspace{2cm}} \end{array}$	<p><b>b</b></p> $\begin{array}{r} 68 \\ \times 6 \\ \hline 6 \times 60 = \underline{\hspace{2cm}} \\ 6 \times 8 = + \underline{\hspace{2cm}} \end{array}$	<p><b>c</b></p> $\begin{array}{r} 65 \\ \times 4 \\ \hline \end{array}$	<p><b>d</b></p> $\begin{array}{r} 83 \\ \times 4 \\ \hline \end{array}$
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(Continued on back.)

**Independent Worksheet 3** Double-Digit by Single-Digit Multiplication (cont.)

**3** There is an area on our playground for kids to ride their bikes. It is 9 feet wide and 26 feet long. How many square feet is the bike area?

**a** Write the question in your own words.

**b** Underline the information in the problem that will help you answer the question.

**c** Solve this problem in the space below. Show all your work.

**d** Write your answer here. Include the units. \_\_\_\_\_



**CHALLENGE**

**4** A professional basketball court is 94' long and 50' wide. A highschool basketball court is 84' long and 50' wide. How many more square feet is a professional basketball court than a highschool basketball court?

**a** Write the question in your own words.

**b** Underline the information in the problem that will help you answer the question.

**c** Circle the operations you will need to solve this problem:

addition (+)

subtraction (-)

multiplication ( $\times$ )

division ( $\div$ )

**d** Solve this problem in the space below. Show all your work.

**e** Write your answer here. Include the units. \_\_\_\_\_

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# Set A5 ★ Independent Worksheet 4



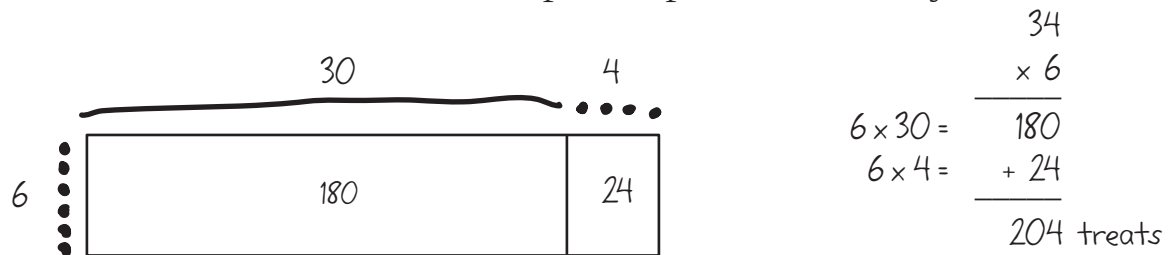
## INDEPENDENT WORKSHEET

### Using the Standard Algorithm for 2-Digit by 1-Digit Multiplication

Maddie and her mom got 6 boxes of treats for their dogs. There are 34 treats in each box. How many treats did they get for their dogs?

To solve this problem, multiply  $6 \times 34$ . Here are two different methods:

- You can make a sketch and list the partial products. Then you can add them.



- You can also multiply by using the standard algorithm. If you use this method, you don't have to list the partial products.

$$\begin{array}{r}
 2 \\
 34 \\
 \times 6 \\
 \hline
 204
 \end{array}$$

Multiply the ones.  $6 \times 4 = 24$  ones.  
 Since 24 is 2 tens plus 4 ones, write the 4 in the ones place and write the 2 tens above the 3 in the tens place.

Multiply the tens.  $6 \times 3 = 18$  tens.  
 Add the 2 tens you carried over to the 18 tens.  
 Write 20 tens in the tens and hundreds place.

1 Use the standard algorithm to solve the problems below.

$$\begin{array}{r}
 23 \\
 \times 4 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 35 \\
 \times 7 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 29 \\
 \times 3 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 44 \\
 \times 4 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 67 \\
 \times 2 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 19 \\
 \times 8 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 132 \\
 \times 4 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 234 \\
 \times 3 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 416 \\
 \times 6 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 240 \\
 \times 4 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 321 \\
 \times 7 \\
 \hline
 \end{array}
 \quad
 \begin{array}{r}
 439 \\
 \times 5 \\
 \hline
 \end{array}$$



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# Set A5 ★ Independent Worksheet 5



## INDEPENDENT WORKSHEET

### Choose Your Strategy

Here are three different ways to solve  $4 \times 29$ .

Standard Algorithm	Partial Products	Landmark Numbers
$\begin{array}{r} 3 \\ 29 \\ \times 4 \\ \hline 116 \end{array}$	$\begin{array}{l} 4 \times 20 = 80 \\ 4 \times 9 = 36 \\ 80 + 36 = 116 \end{array}$	$\begin{array}{l} 29 \text{ is almost like } 30. \\ 4 \times 30 = 120 \\ 120 - 4 = 116 \end{array}$

**1** Use the standard algorithm to solve each problem below. Then solve it a different way. Label your method. Circle the method that seemed quicker and easier.

	Standard Algorithm	A Different Way
<b>a</b> $\begin{array}{r} 39 \\ \times 6 \\ \hline \end{array}$		
<b>b</b> $\begin{array}{r} 51 \\ \times 7 \\ \hline \end{array}$		
<b>c</b> $\begin{array}{r} 65 \\ \times 7 \\ \hline \end{array}$		
<b>d</b> $\begin{array}{r} 199 \\ \times 8 \\ \hline \end{array}$		

(Continued on back.)

**Independent Worksheet 5** Choose Your Strategy (cont.)

**2** Fill in the bubble to show the best estimate for each problem. Explain your choice.

<p><b>a</b></p> $\begin{array}{r} 51 \\ \times 8 \\ \hline \end{array}$	<p><b>b</b></p> $\begin{array}{r} 326 \\ \times 3 \\ \hline \end{array}$	
<input type="radio"/> 350 <input type="radio"/> 400 <input type="radio"/> 450 <input type="radio"/> 500	<input type="radio"/> 700 <input type="radio"/> 800 <input type="radio"/> 900 <input type="radio"/> 1,000	
<p><b>c</b> Circle the method that seems to help most for estimating.</p>		
Standard Algorithm	Partial Products	Landmark Numbers

**3** Sam, Sarah, Deena, and TJ each have 37 marbles. How many marbles do they have in all? Show your work.

**4** The kids at the high school are having a car wash. They charge \$6.00 to wash a car. If they wash 28 cars a day for 4 days, how much money will they make? Show your work.

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# Set A5 ★ Independent Worksheet 6



## INDEPENDENT WORKSHEET

### Multiplying Multiples of 10 & More

1 Write the answers.

$\begin{array}{r} 20 \\ \times 20 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 30 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 40 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ \times 50 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 60 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ \times 70 \\ \hline \end{array}$	$\begin{array}{r} 80 \\ \times 80 \\ \hline \end{array}$
--	--	--	--	--	--	--

$\begin{array}{r} 20 \\ \times 40 \\ \hline \end{array}$	$\begin{array}{r} 30 \\ \times 50 \\ \hline \end{array}$	$\begin{array}{r} 60 \\ \times 50 \\ \hline \end{array}$	$\begin{array}{r} 20 \\ \times 60 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ \times 90 \\ \hline \end{array}$	$\begin{array}{r} 70 \\ \times 80 \\ \hline \end{array}$	$\begin{array}{r} 90 \\ \times 80 \\ \hline \end{array}$
--	--	--	--	--	--	--

2 Multiply each number in the top row by the number at the left. The first one is done for you as an example.

×	2	4	8	3	6	12	5	10	7	9
20	40									

×	2	4	8	3	6	12	5	10	7	9
4										

×	2	4	8	3	6	12	5	10	7	9
24										

3 Katy says you can use the answers in the first 2 rows of Problem 2 to help figure out the answers in the third row. Do you agree with her? Why or why not?





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# Set A5 ★ Independent Worksheet 7



## INDEPENDENT WORKSHEET

### Using 4 Partial Products to Multiply 2-Digit Numbers

1 Multiply to get four partial products and add them up.

<p><b>example</b></p> $\begin{array}{r} 29 \\ \times 25 \\ \hline 20 \times 20 = 400 \\ 20 \times 9 = 180 \\ 5 \times 20 = 100 \\ 5 \times 9 = + 45 \\ \hline 725 \end{array}$	<p><b>a</b></p> $\begin{array}{r} 37 \\ \times 24 \\ \hline \end{array}$	<p><b>b</b></p> $\begin{array}{r} 26 \\ \times 32 \\ \hline \end{array}$
<p><b>c</b></p> $\begin{array}{r} 45 \\ \times 36 \\ \hline \end{array}$	<p><b>d</b></p> $\begin{array}{r} 24 \\ \times 18 \\ \hline \end{array}$	<p><b>e</b></p> $\begin{array}{r} 76 \\ \times 15 \\ \hline \end{array}$
<p><b>f</b></p> $\begin{array}{r} 33 \\ \times 28 \\ \hline \end{array}$	<p><b>g</b></p> $\begin{array}{r} 53 \\ \times 39 \\ \hline \end{array}$	<p><b>h</b></p> $\begin{array}{r} 34 \\ \times 73 \\ \hline \end{array}$



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## Set A5 ★ Independent Worksheet 8



### INDEPENDENT WORKSHEET

#### More Multiplication Menus

**1a** Fill in the blanks on the left side of the page. Then use the information to fill in the blanks on the right side of the page.

$1 \times 23 = \underline{\hspace{2cm}}$

$3 \times 23 = \underline{\hspace{2cm}}$

$2 \times 23 = \underline{\hspace{2cm}}$

$5 \times 23 = \underline{\hspace{2cm}}$

$10 \times 23 = \underline{\hspace{2cm}}$

$30 \times 23 = \underline{\hspace{2cm}}$

$20 \times 23 = \underline{\hspace{2cm}}$

$15 \times 23 = \underline{\hspace{2cm}}$

**b** Find the product shown below. Explain how you got your answer.

$25 \times 23 = \underline{\hspace{2cm}}$

**2a** Fill in the blanks on the left side of the page. Then use the information to fill in the blanks on the right side of the page.

$1 \times 35 = \underline{\hspace{2cm}}$

$3 \times 35 = \underline{\hspace{2cm}}$

$2 \times 35 = \underline{\hspace{2cm}}$

$5 \times 35 = \underline{\hspace{2cm}}$

$10 \times 35 = \underline{\hspace{2cm}}$

$30 \times 35 = \underline{\hspace{2cm}}$

$20 \times 35 = \underline{\hspace{2cm}}$

$15 \times 35 = \underline{\hspace{2cm}}$

**b** Find the product shown below. Explain how you got your answer.

$36 \times 35 = \underline{\hspace{2cm}}$

(Continued on back.)

**Independent Worksheet 8** More Multiplication Menus (cont.)

**3a** Fill in the blanks on the left side of the page. Then use the information to fill in the blanks on the right side of the page.

$1 \times 45 = \underline{\hspace{2cm}}$

$3 \times 45 = \underline{\hspace{2cm}}$

$2 \times 45 = \underline{\hspace{2cm}}$

$5 \times 45 = \underline{\hspace{2cm}}$

$10 \times 45 = \underline{\hspace{2cm}}$

$30 \times 45 = \underline{\hspace{2cm}}$

$20 \times 45 = \underline{\hspace{2cm}}$

$15 \times 45 = \underline{\hspace{2cm}}$

**b** Find the product shown below. Explain how you got your answer.

$19 \times 45 = \underline{\hspace{2cm}}$

**4a** Make up your own multiplication menu. You can choose any 2, 3, or 4-digit number that doesn't end in a zero to be your multiplier.

$1 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$3 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$2 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$5 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$10 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$30 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$20 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

$15 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

**b** Now make up one more combination using your multiplier that can be solved using the information on your menu. Find the answer and explain how you got the answer.

$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

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# Set A5 ★ Independent Worksheet 9



## INDEPENDENT WORKSHEET

### Pine Cones & School Supplies

The scouts made bags of pine cones to sell at the crafts fair. They made 24 bags. Each bag had 36 pine cones in it. How many pine cones did they use in all?

To solve this problem, multiply  $24 \times 36$ .

One way to do this is to multiply to find 4 partial products and then add them up.	Another way is to use the standard algorithm.
$\begin{array}{r} 36 \\ \times 24 \\ \hline 20 \times 30 = 600 \\ 20 \times 6 = 120 \\ 4 \times 30 = 120 \\ 4 \times 6 = + 24 \\ \hline 864 \text{ pine cones} \end{array}$	$\begin{array}{r} 1\cancel{2} \\ 36 \\ \times 24 \\ \hline 144 \\ + 720 \\ \hline 864 \text{ pine cones} \end{array}$

Some people call the standard algorithm a short-cut because you don't have to write as much.

**1** Use the standard algorithm to solve the problems below. Show your work.

### Example

$$\begin{array}{r} 1\cancel{2} \\ 28 \\ \times 23 \\ \hline 84 \\ + 560 \\ \hline 644 \end{array}$$

$$\begin{array}{r} 32 \\ \times 27 \\ \hline \end{array}$$

$$\begin{array}{r} 45 \\ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} 53 \\ \times 26 \\ \hline \end{array}$$

$$\begin{array}{r} 18 \\ \times 19 \\ \hline \end{array}$$

$$\begin{array}{r} 37 \\ \times 26 \\ \hline \end{array}$$

$$\begin{array}{r} 41 \\ \times 22 \\ \hline \end{array}$$

$$\begin{array}{r} 47 \\ \times 39 \\ \hline \end{array}$$

$$\begin{array}{r} 66 \\ \times 25 \\ \hline \end{array}$$

$$\begin{array}{r} 83 \\ \times 24 \\ \hline \end{array}$$

(Continued on back.)

## Independent Worksheet 9 Pine Cones & School Supplies (cont.)

**2** Use the standard algorithm to solve the multiplication problems below. Show your work.

**a** Mr. Wu got 35 boxes of crayons for his fourth graders. Every box had 24 crayons in it. How many crayons in all?

**b** Ms. Penny got 18 packs of felt markers for her fifth graders. Each pack had 36 markers in it. How many markers in all?



### CHALLENGE

**c** The office got 15 cartons of envelopes. Each carton had 12 boxes of envelopes in it. Each box had 54 envelopes in it. How many envelopes did they get in all?



# GRADE 4 SUPPLEMENT

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## Set A6 Numbers & Operations: Fractions & Mixed Numbers

### Includes

Activity 1: Fractions & Mixed Numbers

A6.1

Activity 2: Simplify & Compare

A6.7

### Skills & Concepts

- ★ convert a mixed number to a fraction and vice versa, and visually represent the number
- ★ write a fraction equivalent to a given fraction
- ★ simplify fractions using common factors
- ★ compare fractions and mixed numbers using the symbols  $<$ ,  $>$ , or  $=$

**Bridges in Mathematics Grade 4 Supplement**

**Set A6** Numbers & Operations: Fractions & Mixed Numbers

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at [www.mathlearningcenter.org](http://www.mathlearningcenter.org).



# Set A6 ★ Activity 1



## ACTIVITY

### Fractions & Mixed Numbers

#### Overview

Students work with guidance from the teacher to make a set of construction paper fraction strips. Then they use their fraction kits to learn about converting fractions to mixed numbers, and vice versa.

#### Skills & Concepts

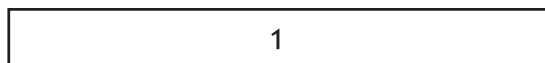
- ★ convert a mixed number to a fraction and vice versa, and visually represent the number
- ★ write a fraction equivalent to a given fraction

#### You'll need

- ★ Fractions & Mixed Numbers (pages A6.5 and A6.6, run a class set)
- ★ 1.5" x 12" construction paper strips, class set plus a few extra in each of the following colors: white, light brown, purple, green, and orange
- ★ class set of 6" x 9" manila or legal size envelopes
- ★ class set of scissors

#### Instructions for Fractions & Mixed Numbers

1. Explain that today everyone in class will make a set of construction paper fraction strips, and use them to learn some new things about fractions. Ask students to get out their scissors and pencils, and then give them each a set of 5 construction paper strips, one each in the following colors: white, light brown, purple, green, and orange, and reserve a set for yourself. Holding up the white strip, label it with a 1 as students do the same on their white strips.



2. Ask students to fold their light brown strip in half and cut it along the fold line as you do so with your light brown strip. What is the value of these 2 pieces relative to the white strip? After a bit of discussion, have students label each of the light brown pieces with the fraction  $\frac{1}{2}$ .



3. Now ask students to fold the purple strip in half and then in half again. Before they open it out, ask them to pair-share the number of segments they'll see and the value of each, relative to the white strip. Then ask them to unfold the strip, check their predictions, cut it along the fold lines, and label each part, as you do the same with your purple strip.



4. As they work, encourage students to compare and contrast the different colored pieces. In doing so, you may be able to get some sense of students' current understandings (and misconceptions) about fractions.

**Activity 1** Fractions & Mixed Numbers (cont.)

**Teacher** How do the purple pieces you've cut compare to the others you've cut and labeled so far?

**Students** The purple ones, the fourths, are half the size of the halves.

Yeah, a fourth is like half of a half.

Right! It's like a half folded in half again.

If you put 2 of the fourths together, they're the same as a half.

5. Next, ask students to fold their green strip in half, in half again, and in half a third time. Before they open it out, have them pair-share their ideas about how many segments they'll see and how the size of each will compare to the white strip, the designated "whole". You may discover in doing this that while some students believe they'll see 8 segments when they unfold the strip, some may be equally convinced that they'll see 6. In either case, ask students to explain their thinking.

6. When students unfold their green strips, they'll discover that, in fact, they're able to see 8 segments. If there's been debate beforehand, continue the discussion as students cut and label each of the green pieces.

**Students** I think what's doubling is the number of pieces. Every time you fold the strip, you get double the number of pieces you got the last time, like 2 is double 1, 4 is double 2, and 8 is double 4. So it is a doubling pattern, just different from how some of us thought.

7. Now ask students to fold their orange strip in half 4 times. Again, have them make predictions about the number of segments they'll see when they unfold the strip and the size of each of the segments relative to the others they've cut. After some discussion, have them cut the orange strip along the folds and label each of the pieces.

8. As they finish cutting and labeling their pieces, have students each arrange the fraction pieces from largest to smallest in front of them, as shown below.

1															
$\frac{1}{2}$								$\frac{1}{2}$							
$\frac{1}{4}$				$\frac{1}{4}$				$\frac{1}{4}$				$\frac{1}{4}$			
$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$	
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$

9. Give the children a minute or two to pair share any mathematical observations they can make about these pieces and then invite volunteers to share their thinking with the class.

Then write the fractions shown below on the board or the overhead, one at a time. As you record each fraction, read it with the class and ask students to use their pieces to build it. Encourage them to share observations with one another and the class as they work.

$\frac{3}{16}$

$\frac{5}{8}$

$\frac{3}{4}$

$\frac{5}{16}$

$\frac{7}{16}$

**Activity 1** Fractions & Mixed Numbers (cont.)

**Students**  $\frac{3}{16}$  is the same as an eighth and a sixteenth.

Yes, but there's no one piece that matches  $\frac{3}{16}$  exactly.

It's the same with  $\frac{5}{8}$ . You can make the same amount with one half and one eighth, but there's not just one piece that matches.

$\frac{5}{16}$  is just one more sixteenth than  $\frac{1}{4}$ , and  $\frac{7}{16}$  is just one sixteenth less than  $\frac{1}{2}$ .

10. Write the fraction  $\frac{3}{2}$  on the board. Ask student pairs to share their pieces to make this fraction. Then invite their comments. What observations can they make about this fraction? Is there a way they can build the same quantity with fewer pieces?

**Students** It's bigger than 1.

It's just 3 halves – it's easy to make.

You can also just put a whole strip and a half to make the same amount.  $\frac{3}{2}$  is the same as  $1\frac{1}{2}$ .

$\frac{3}{2}$  is a weird fraction because the number on top is more than the number on the bottom.

11. Write the following equation on the board:

$$\frac{3}{2} = 1\frac{1}{2}$$

Explain that when a fraction has a numerator greater than the denominator, it is sometimes called an *improper fraction*. There's really nothing “improper” at all about fractions like these, but people often change such a fraction to a *mixed number*, or a number that includes both a whole number and a proper fraction that is less than 1.

12. Write the fractions shown below on the board or overhead one at a time. Ask student pairs to build each one as written and then build it a second time in the form of a mixed number. Note with them that it takes fewer pieces to build each fraction as a mixed number. Encourage them to share observations with one another and the class as they work.

$$\frac{6}{4} \qquad \frac{10}{8} \qquad \frac{20}{16} \qquad \frac{12}{8} \qquad \frac{8}{4}$$

**Students** You can make  $\frac{6}{4}$  with a whole strip and  $\frac{2}{4}$ , but it's also the same as  $1\frac{1}{2}$ .

It's way faster to make a mixed number for  $\frac{10}{8}$ . It's just a whole strip and 2 more eighths.

We said it was the same as  $1\frac{1}{4}$ , because  $\frac{2}{8}$  is the same as a fourth.

I don't think  $\frac{8}{4}$  is a mixed number because it's just 2. There's no fraction left.

13. Next, write the mixed numbers shown below. Ask student pairs to build each and then build it a second time in the form of a fraction. Can they begin to predict how many fractional pieces of the same size it will take to make a mixed number without laying them all out?

$$1\frac{3}{4} \qquad 1\frac{6}{8} \qquad 1\frac{8}{16} \qquad 2\frac{2}{4} \qquad 2\frac{5}{8}$$

**Tressa** We don't have enough fourths to make  $2\frac{2}{4}$ . Why not?

**Ian** Because it's 4 fourths for each whole and then 2 more. We need 10 fourths, but we only have 8 fourths.

**Hillary** It's going to be the same with  $2\frac{5}{8}$ . That would take 8 eighths for each whole strip, and then 5 more.  $8 + 8 + 5 = 21$  eighths. We don't have that many.

**Activity 1** Fractions & Mixed Numbers (cont.)

14. Finally, give students each a copy of Fractions and Mixed Numbers. Review the instructions on the sheet with the class. When they understand what to do, let them go to work. Circulate to provide assistance as needed. Encourage students to use their fraction strips and help one another.

Set A6 Numbers & Operations: Fractions & Mixed Numbers Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Fractions & Mixed Numbers** Page 1 of 2

**1** Change each of the fractions below into a mixed number. Use a labeled sketch and words to explain your answers. Use your fraction pieces to help if you want.

<b>example</b> $\frac{7}{4} = 1\frac{3}{4}$	<table border="1"> <tr> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> </tr> <tr> <td colspan="4">1</td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td></td> </tr> </table>	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	1				$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$										
1				$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$											
<b>a</b> $\frac{9}{8} = \square$																	
<b>b</b> $\frac{19}{16} = \square$																	
<b>c</b> $\frac{10}{4} = \square$																	


Set A6 Numbers & Operations: Fractions & Mixed Numbers Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Fractions & Mixed Numbers** Page 2 of 2


**2** For each of the problems on this page:

- Solve the problem and show your thinking with numbers, words, and/or labeled sketches. Use your fraction pieces to help if you want.
- If the answer turns out to be an improper fraction (like  $\frac{3}{2}$  or  $\frac{7}{4}$ ) rename it as a mixed number (like  $1\frac{1}{2}$  or  $1\frac{3}{4}$ ).

**a** Carlos and his mom went out on a bike ride. They rode  $\frac{5}{8}$  of a mile to the park, and then  $\frac{3}{8}$  of a mile back home. How far did they ride in all?



**b** It takes  $\frac{1}{4}$  of a cup of orange juice to make 1 smoothie. Erin wants to make 2 smoothies. How much orange juice will she need?



**3** Change each of the mixed numbers below into a fraction. Use your fraction pieces to help.

<b>ex.</b> $1\frac{3}{4} = \frac{7}{4}$	<b>a</b> $1\frac{3}{8} = \square$	<b>b</b> $1\frac{5}{16} = \square$
<b>c</b> $2\frac{1}{2} = \square$	<b>d</b> $2\frac{2}{4} = \square$	<b>e</b> $1\frac{7}{8} = \square$

15. Give each student a manila or legal sized envelope in which to store his or her fraction kit. Let them know that it's fine to fold the white strip so it will fit into the envelope. Then have students label their envelopes with their names and store them safely so they can use these fraction kits for the next activity in this set.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Fractions & Mixed Numbers Page 1 of 2

**1** Change each of the fractions below into a mixed number. Use a labeled sketch and words to explain your answers. Use your fraction pieces to help if you want.

<p><b>example</b></p> $\frac{7}{4} = \boxed{1\frac{3}{4}}$	<table border="1"> <tbody> <tr> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> </tr> <tr> <td colspan="4" style="text-align: center;">1</td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> <td><math>\frac{1}{4}</math></td> </tr> </tbody> </table>	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	1				$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$									
1				$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$									
<p><b>a</b></p> $\frac{9}{8} = \boxed{\phantom{00}}$															
<p><b>b</b></p> $\frac{19}{16} = \boxed{\phantom{00}}$															
<p><b>c</b></p> $\frac{10}{4} = \boxed{\phantom{00}}$															

NAME \_\_\_\_\_

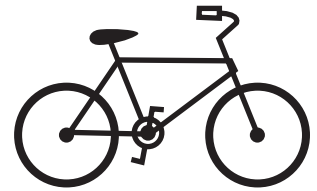
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## Fractions & Mixed Numbers Page 2 of 2

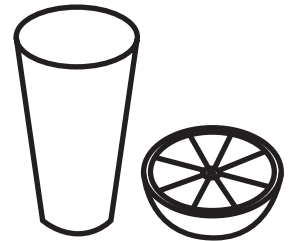
**2** For each of the problems on this page:

- Solve the problem and show your thinking with numbers, words, and/or labeled sketches. Use your fraction pieces to help if you want.
- If the answer turns out to be an improper fraction (like  $\frac{3}{2}$  or  $\frac{7}{4}$ ) rename it as a mixed number (like  $1\frac{1}{2}$  or  $1\frac{3}{4}$ ).

**a** Carlos and his mom went out on a bike ride. They rode  $\frac{5}{8}$  of a mile to the park, and then  $\frac{5}{8}$  of a mile back home. How far did they ride in all?



**b** It takes  $\frac{3}{4}$  of a cup of orange juice to make 1 smoothie. Erin wants to make 2 smoothies. How much orange juice will she need?



**3** Change each of the mixed numbers below into a fraction. Use your fraction pieces to help.

<b>ex.</b> $1\frac{3}{4} = \boxed{\frac{7}{4}}$	<b>a</b> $1\frac{3}{8} = \boxed{\phantom{\frac{7}{4}}}$	<b>b</b> $1\frac{5}{16} = \boxed{\phantom{\frac{7}{4}}}$
<b>c</b> $2\frac{1}{2} = \boxed{\phantom{\frac{7}{4}}}$	<b>d</b> $2\frac{2}{4} = \boxed{\phantom{\frac{7}{4}}}$	<b>e</b> $1\frac{7}{8} = \boxed{\phantom{\frac{7}{4}}}$

# Set A6 ★ Activity 2



## ACTIVITY

### Simplify & Compare

#### Overview

Students use their fraction kits from the previous activity to learn to simplify fractions. Then the teacher introduces a new game to provide more practice with simplifying and comparing fractions. Simplify & Compare can be used as a partner game once it has been introduced to the class, or played several times as a whole group.

#### Skills & Concepts

- ★ simplify fractions using common factors
- ★ convert a mixed number to a fraction and vice versa, and visually represent the number
- ★ compare fractions and mixed numbers using the symbols  $<$ ,  $>$ , or  $=$
- ★ write a fraction equivalent to a given fraction

#### You'll need

- ★ Simplify & Compare Game Board (page A6.11, run 1 copy on a transparency)
- ★ Simplify & Compare Record Sheet (page A6.12, run a class set)
- ★ students' fraction kits from Set A6, Activity 1
- ★ overhead double spinner
- ★ a more/less cube
- ★ overhead pens
- ★ 1.5" x 12" pink construction paper strips, one per student plus a few extra
- ★ rulers, class set
- ★ scissors, class set

#### Instructions for Simplify & Compare

1. Explain that students are going to use their fraction kits to learn some more about fractions and play a new game today. Have them take all the fraction strips out of their envelopes and stack them in neat piles by size on their desks.
2. Write the fraction  $\frac{6}{8}$  at the overhead. Read it with the students and ask them to build the fraction with their pieces. Then challenge them to lay out an equivalent fraction with fewer pieces that are all the same size. Most will set out three fourths in response. If some students set out one half and one fourth, remind them that all the pieces in the equivalent fraction have to be the same size.

$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{4}$		$\frac{1}{4}$		$\frac{1}{4}$	

3. Ask students to share any observations they can make about the two sets of pieces. Record the equation  $\frac{6}{8} = \frac{3}{4}$  on the overhead, and have students return the pieces they have just used to their stacks. Then write  $\frac{8}{16}$ , and have students show this fraction with their pieces. When most have finished, ask them to build all the equivalent fractions they can find, using only same-sized pieces for each one. Give them a minute to work and talk with one another, and then invite volunteers to share their results.

**Activity 2** Simplify & Compare (cont.)

$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$	
$\frac{1}{4}$				$\frac{1}{4}$			
$\frac{1}{2}$							

**Students** I got  $\frac{8}{16}$ ,  $\frac{4}{8}$ ,  $\frac{2}{4}$ , and  $\frac{1}{2}$ .

They're all the same as  $\frac{1}{2}$ .

When you use bigger pieces, you don't need as many.

4. Write a series of numbers and arrows on the board to represent the sequence. Ask students to pair-share any observations they can make about the sequence of fractions, and then have volunteers share their ideas with the class. Can they find and describe any patterns? How do the numbers relate to one another? Which requires the fewest pieces to build?

$$\frac{8}{16} \rightarrow \frac{4}{8} \rightarrow \frac{2}{4} \rightarrow \frac{1}{2}$$

**Students** The numbers on the top, the numerators, go 8, 4, 2, and 1. It's like they keep getting cut in half.

It's the same with the numbers on the bottom.  $16 \div 2$  is 8.  $8 \div 2$  is 4.  $4 \div 2$  is 2.

A half was the fastest way to build the fraction.

I knew  $\frac{8}{16}$  was a half to begin with because 8 is half of 16.

Every number on the top is half of the number on the bottom.

5. Press students to consider the last fraction in the sequence,  $\frac{1}{2}$ . Is there any way to build  $\frac{8}{16}$  with even fewer pieces than the one half piece? Why not? Give them a minute to discuss the question, and then explain that  $\frac{1}{2}$  is the simplest way to show  $\frac{8}{16}$ . Tell the class that *a fraction is in its simplest form when its numerator and denominator have no common factors other than 1*.

6. Remind students that *a factor is a whole number that divides exactly into another number*. One way people find factors of a number is to think of the pairs of numbers that can be multiplied to make that number. Work with input from the students to list the factors of 8 and 16.

Factors of 8 are 1, 2, 4, and 8. You can divide 8 by each of these numbers.

$$1 \times 8 = 8 \quad 2 \times 4 = 8$$

Factors of 16 are 1, 2, 4, 8, and 16. You can divide 16 by each of these numbers.

$$1 \times 16 = 16 \quad 2 \times 8 = 16 \quad 4 \times 4 = 16$$

7. Work with input from the class to identify and circle the factors 8 and 16 have in common: 1, 2, 4, and 8. Then draw students' attention back to  $\frac{1}{2}$ . Since 1 and 2 have no common factor other than 1, there's no way to further simplify the fraction.

8. Explain that you can find the simplest form of a fraction by building it with the fewest number of pieces. But you can also simplify a fraction by identifying the *greatest common factor*, or the biggest number by which you can divide both the numerator and the denominator. Write  $\frac{12}{16}$  on the board. Can this fraction be simplified? Ask students to pair-share ideas about the largest number by which both 12 and



**Activity 2** Simplify & Compare (cont.)

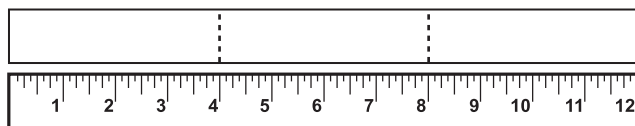
16 can be divided. When they have identified 4 as the greatest common factor of 12 and 16, record the operation shown below at the overhead, and ask students to confirm it with their pieces. Is it true that  $\frac{12}{16}$  cannot be built with any fewer pieces than 3 fourths?

$$\frac{12 \div 4}{16 \div 4} = \frac{3}{4} \qquad \frac{12}{16} = \frac{3}{4}$$

$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$
$\frac{3}{4}$			$\frac{3}{4}$			$\frac{3}{4}$					

9. Repeat step 8 with  $\frac{10}{16}$ ,  $\frac{3}{16}$ , and  $\frac{6}{4}$ . Students will note that  $\frac{3}{16}$  cannot be simplified because 3 and 16 have no factors in common other than 1. They will also discover that  $\frac{6}{4}$  simplifies to  $\frac{3}{2}$  and then converts to a mixed number,  $1\frac{1}{2}$ .

10. Now explain that you're going to play a new game with students that will give them more opportunities to simplify fractions. Ask them to carefully re-stack all their fraction strips by size, and tell them that they're going to need to cut one more strip to have all the pieces they need for the game. Ask them to get out their rulers, pencils, and scissors. Then give them each a 1.5" by 12" strip of pink construction paper. Have them use the inch side of their ruler to mark and cut the strip at 4" intervals. If the entire strip represents 1, what fraction does each of the pink pieces represent? Why?



11. Place the Simplify & Compare game board on display at the overhead. Give students a few moments to examine it quietly, and then read the game rules with the class. Explain that they are going to play as Team 2, and you will play as Team 1. You will play a trial round so everyone can learn the rules, and then play the whole game with them.

12. Place the double spinner overlay on top of the spinners, spin both, and record the results under "Team 1". Work with students to simplify your fraction by identifying the greatest number by which both the numerator and the denominator can be divided. Encourage them to check the results with their pieces as well.

13. Invite a volunteer up to the overhead to spin for the class. Record the students' fraction under "Team 2" and work with their input to simplify it. Then ask students to compare their fraction with yours. If they are not sure which fraction is greater, have them build both with their fraction pieces. Use a  $<$ ,  $>$ , or  $=$  sign to show the results. Then have a second volunteer roll the more/less cube to determine the winner. Circle the winning fraction on the overhead.

**Teacher** *I really lucked out on this first trial. I thought you were going to win because  $\frac{3}{4}$  is greater than  $\frac{1}{2}$ , but Kendra rolled "less" instead of "more".*


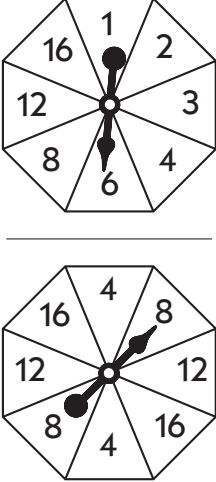
## Activity 2 Simplify &amp; Compare (cont.)

Set A6 Numbers & Operations: Fractions & Mixed Numbers Blackline Run 1 copy on a transparency.

### Simplify & Compare Game Board

Take turns:

- Spin the top spinner to get your numerator. Spin the bottom spinner to get your denominator.
- Record your fraction. Simplify it if you can. Change it to a mixed number if it is greater than 1.
- Use a  $<$ ,  $=$ , or  $>$  sign to compare the two fractions.
- Play 6 rounds. Then roll a More/Less cube to see which team wins each round. Circle the winning fraction and mark a point for the correct team on the score board each time.

Team 1

8
16

Team 2

6
8

Simplify and Compare

$\frac{1}{2}$
---------------

$<$

$\frac{3}{4}$
---------------

Scoreboard	
Team 1	1
Team 2	

14. Once the trial round is completed, erase the overhead. Give students each a copy of the Simplify & Compare record sheet and play 6 rounds with the class. You will need to erase the overhead between each round, but students will have a record of the complete game on their sheets. At the end of the game, have students take turns rolling the more/less cube for each pair of fractions. Have them circle the winning fraction for each round, fill in the scoreboard on their papers, and determine the winning team. If any of the pairs of fractions are equal, both teams score a point for the round.

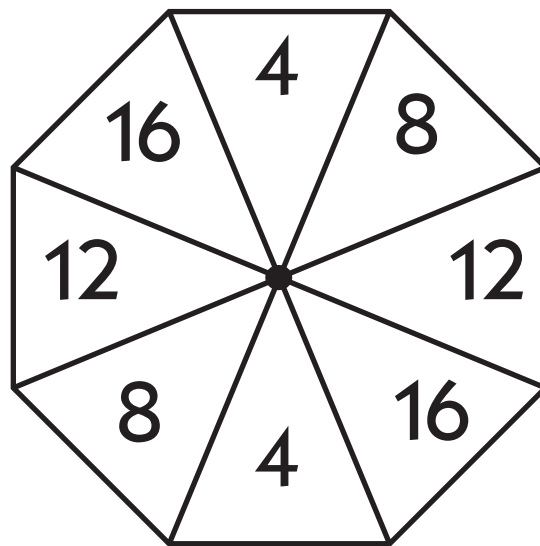
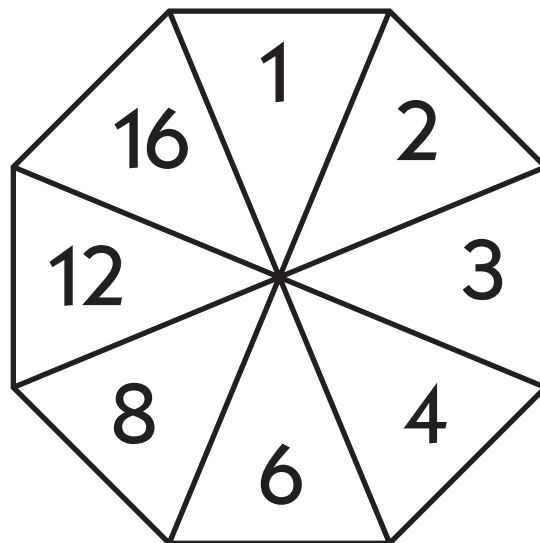
### Extensions

- Play Simplify & Compare several times with the class. The game provides an engaging context in which to practice simplifying and comparing fractions, and you don't have to play all 6 rounds at once.
- Run extra copies of the record sheet and game board, and have the students play the game in pairs. Encourage them to use their fraction kits to confirm their answers if necessary.
- Additional exercises and problems for students to simplify fractions and move back and forth between fractions and mixed numbers can be found in the Bridges Grade 4 Practice Book on The Math Learning Center website: [www.mathlearningcenter.org](http://www.mathlearningcenter.org). The Practice Book can be found under the link for Bridges Support for Teachers > Grade 4 > Supplements 4.

# Simplify & Compare Game Board

Take turns:

- Spin the top spinner to get your numerator. Spin the bottom spinner to get your denominator.
- Record your fraction. Simplify it if you can. Change it to a mixed number if it is greater than 1.
- Use a  $<$ ,  $=$ , or  $>$  sign to compare the two fractions.
- Play 6 rounds. Then roll a More/Less cube to see which team wins each round. Circle the winning fraction and mark a point for the correct team on the score board each time.



	<b>Team 1</b>		<b>Team 2</b>
	<input style="width: 50px; height: 30px;" type="text"/>		<input style="width: 50px; height: 30px;" type="text"/>
	<input style="width: 50px; height: 30px;" type="text"/>		<input style="width: 50px; height: 30px;" type="text"/>
	↓		↓
Simplify and Compare	<input style="width: 100px; height: 80px;" type="text"/>	○	<input style="width: 100px; height: 80px;" type="text"/>

Scoreboard
Team 1
Team 2

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Simplify & Compare Record Sheet

Round 1	Round 2
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Team 1</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> <div style="text-align: center;"> <p><b>Team 2</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> </div> <p style="text-align: center;">Simplify and Compare <span style="margin: 0 20px;">○</span></p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Team 1</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> <div style="text-align: center;"> <p><b>Team 2</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> </div> <p style="text-align: center;">Simplify and Compare <span style="margin: 0 20px;">○</span></p>
Round 3	Round 4
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Team 1</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> <div style="text-align: center;"> <p><b>Team 2</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> </div> <p style="text-align: center;">Simplify and Compare <span style="margin: 0 20px;">○</span></p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Team 1</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> <div style="text-align: center;"> <p><b>Team 2</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> </div> <p style="text-align: center;">Simplify and Compare <span style="margin: 0 20px;">○</span></p>
Round 5	Round 6
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Team 1</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> <div style="text-align: center;"> <p><b>Team 2</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> </div> <p style="text-align: center;">Simplify and Compare <span style="margin: 0 20px;">○</span></p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Team 1</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> <div style="text-align: center;"> <p><b>Team 2</b></p> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 40px; height: 25px; margin: 0 auto;"></div> <p>↓</p> <div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto;"></div> </div> </div> <p style="text-align: center;">Simplify and Compare <span style="margin: 0 20px;">○</span></p>
Scoreboard	
Team 1	Team 2



# GRADE 4 SUPPLEMENT

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## Set A9 Number & Operations: Adding & Subtracting Fractions

### Includes

Independent Worksheet 1: Fractions through the School Day	A9.1
Independent Worksheet 2: Fractions on the Trail	A9.5
Independent Worksheet 3: Adding & Subtracting Fractions	A9.9

### Skills & Concepts

- ★ use fraction models to represent the addition and subtraction of fractions with like denominators
- ★ solve problems involving the addition and subtraction of fractions with like denominators
- ★ convert improper fractions to mixed numbers

**Bridges in Mathematics Grade 4 Supplement**

**Set A9** Numbers & Operations: Adding & Subtracting Fractions

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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P0310

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set A9 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

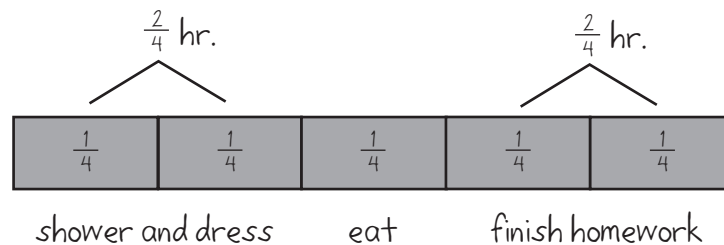
### Fractions through the School Day

Make a labeled sketch to solve each of the problems below. Use words to explain your answer, and write an equation to match. Use your fraction kit to help if you want.

Note: If the answer turns out to be an improper fraction, change it to a mixed number.

**example** Sam and Ali are friends. They're both in Mrs. Hill's fifth grade class. When Sam gets up on school days, it takes him  $\frac{2}{4}$  of an hour to take a shower and get dressed,  $\frac{1}{4}$  to eat breakfast, and  $\frac{2}{4}$  of an hour to finish his homework. How long does it take Sam to get ready for school?

**a** Labeled Sketch



**b** Explanation (in words):

2 fourths plus 1 fourth plus 2 more fourths is 5 fourths in all. There are 4 fourths in an hour, so it takes him 1 and  $\frac{1}{4}$  hours to get ready for school.

**c** Equation:

$$\frac{2}{4} + \frac{1}{4} + \frac{2}{4} = \frac{5}{4} \quad \frac{5}{4} = 1\frac{1}{4} \text{ hour}$$

(Continued on back.)

**Independent Worksheet 1** Fractions through the Day (cont.)

**1** Ali fixed eggs for her family this morning. She had  $\frac{5}{6}$  of a carton when she started, and  $\frac{2}{6}$  of a carton left when she finished. What fraction of the carton did Ali use?

**a** Labeled Sketch

**b** Explanation (in words):

**c** Equation:

**2** Sam and Ali's class had P.E. first thing this morning P.E. lasts  $\frac{4}{8}$  of an hour. They spent  $\frac{1}{8}$  of an hour running laps. What fraction of an hour did they have left after that?

**a** Labeled Sketch

**b** Explanation (in words):

**c** Equation:

(Continued on next page.)



**Independent Worksheet 1** Fractions through the Day (cont.)

**3** Ali had  $\frac{5}{6}$  of a granola bar in her lunchbox. She ate  $\frac{3}{6}$  of the bar at recess. What fraction of the bar did she have left for lunch?

**a** Labeled Sketch

**b** Explanation (in words):

**c** Equation:

**4** They had a math test after recess. Mrs. Hill said, "You have  $\frac{8}{12}$  of an hour to complete the test." After  $\frac{6}{12}$  of an hour, Sam only had 1 page left to go. How much of an hour did he have left to finish the last page?

**a** Labeled Sketch

**b** Explanation (in words):

**c** Equation:

(Continued on back.)

**Independent Worksheet 1** Fractions through the Day (cont.)

**5** The 5th graders at Sam and Ali's school take turns picking up trash on the playground after lunch each day. The chart below shows how many pounds of trash each class has picked up so far this week. How many pounds have they collected in all?

<b>Fifth Grade Class</b>	<b>Pounds of trash</b>
Mrs. Hill's Class	$2\frac{1}{6}$ pounds
Mr. Wong's Class	$1\frac{2}{6}$ pounds
Mrs. Tejada's Class	$1\frac{4}{6}$ pounds

**a** Labeled Sketch

**b** Explanation (in words):

**c** Equation:

**6** The 5th graders are painting a mural about recycling on one of the walls by the playground. So far, they've used  $1\frac{2}{8}$  gallons of red paint,  $2\frac{5}{8}$  gallons of yellow paint, and  $2\frac{3}{8}$  gallon of green paint. How many gallons of paint have they used in all?

**a** Labeled Sketch

**b** Explanation (in words):

**c** Equation:

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Set A9 ★ Independent Worksheet 2



### INDEPENDENT WORKSHEET

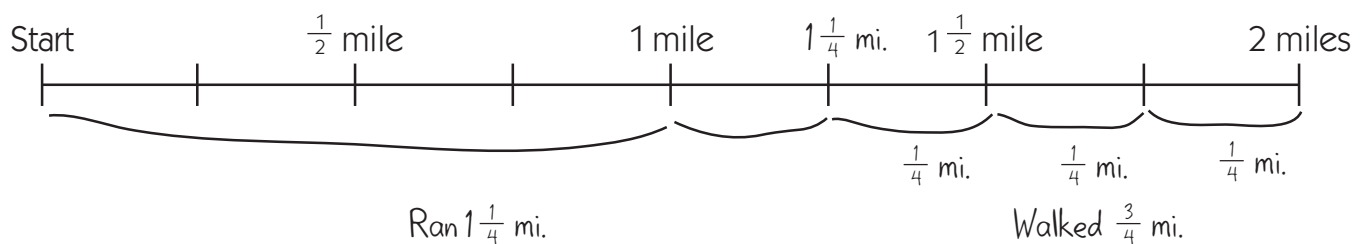
### Fractions on the Trail

There is a 2-mile hiking trail behind Kennedy School. Make a labeled sketch to solve each of the problems below. Add more marks and fractions to the line if you need to. Use words to explain your answer, and write an equation to match.

Note: If the answer turns out to be an improper fraction, change it to a mixed number.

**example** Marissa and her mom ran the first  $1\frac{1}{4}$  miles of the trail. They got tired, so they walked the rest of the way. How far did they walk?

**a** Labeled Sketch



**b** Explanation (in words):

They walked  $\frac{3}{4}$  of a mile because  $2 - 1$  leaves 1 mile, and then they ran another  $\frac{1}{4}$  of a mile. That left  $\frac{3}{4}$  of mile to go.

**c** Equation

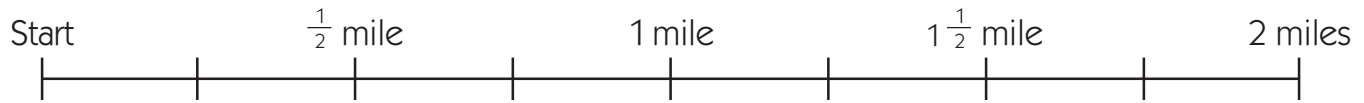
$$2 - 1\frac{1}{4} = \frac{3}{4} \text{ mile}$$

(Continued on back.)

**Independent Worksheet 2** Fractions on the Trail (cont.)

**1** Tonio took his little brother for a walk on the trail. They walked  $\frac{3}{4}$  of a mile. Then they turned around and went back to the start. How many miles did they walk in all?

**a** Labeled Sketch

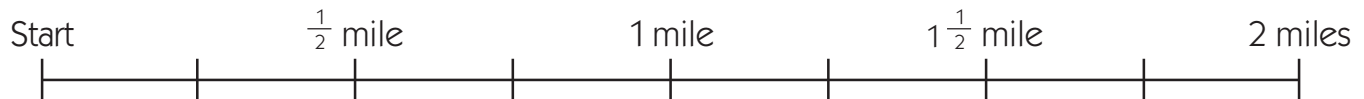


**b** Explanation (in words):

**c** Equation:

**2** Troy and Eric decided to run the whole 2 miles. Eric twisted his ankle after they'd gone  $1\frac{1}{8}$  of a mile. They decided to walk the rest of the way and call Eric's dad to come get them. How many eighths of a mile did they have to walk to get to the end of the trail?

**a** Labeled Sketch



**b** Explanation (in words):

**c** Equation:

(Continued on next page.)

**Fractions Independent Worksheet 2** Fractions on the Trail (cont.)

**3** Kendra and her grandma walked  $1\frac{3}{8}$  of a mile down the trail. Then they turned around and walked back to the start. How many miles did they walk in all?

**a** Labeled Sketch

A horizontal number line starting at 'Start' and ending at '2 miles'. There are four major tick marks labeled:  $\frac{1}{2}$  mile, 1 mile,  $1\frac{1}{2}$  mile, and 2 miles. There are also four minor tick marks between each major tick mark, dividing each  $\frac{1}{2}$  mile segment into four  $\frac{1}{8}$  mile segments.

<p><b>b</b> Explanation (in words):</p>	<p><b>c</b> Equation:</p>
---	---------------------------

**4** Carter was walking down the trail. When he got to the  $\frac{3}{4}$  mile marker, he realized that his glasses had slipped out of his pocket. He turned around and started to go back. He found his glasses right beside the  $\frac{2}{4}$  mile marker. Then he turned around and walked to the end of the trail to meet his friend. How many miles did he walk in all?

**a** Labeled Sketch

A horizontal number line starting at 'Start' and ending at '2 miles'. There are four major tick marks labeled:  $\frac{1}{2}$  mile, 1 mile,  $1\frac{1}{2}$  mile, and 2 miles. There are also four minor tick marks between each major tick mark, dividing each  $\frac{1}{2}$  mile segment into four  $\frac{1}{8}$  mile segments.

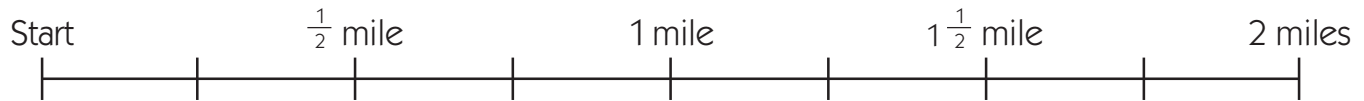
<p><b>b</b> Explanation (in words):</p>	<p><b>c</b> Equation:</p>
---	---------------------------

(Continued on back.)

**Independent Worksheet 2** Fractions on the Trail (cont.)

**5** Everyday, Mrs. Goodman starts at the beginning of the trail and walks  $1\frac{1}{4}$  miles. Then she turns around and walks back to the start. How many miles does she walk in 1 week (7 days)?

**a** Labeled Sketch



**b** Explanation (in words):

**c** Equation:

**CHALLENGE**

**6** Make up your own story problem about the hiking trail. Then give it to a classmate to solve. Be sure to check it first to make sure it works.

**a** My problem:

**b** Labeled Sketch

**c** Explanation (in words):

**d** Equation:

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set A9 ★ Independent Worksheet 3



## INDEPENDENT WORKSHEET

### Adding & Subtracting Fractions

Use numbers, words, *and* labeled sketches to solve each of the problems below. Show all of your work. Use your fraction kit to help if you want.

Note: If the answer turns out to be an improper fraction, change it to a mixed number.

Problem	Explanation
<p><b>example</b></p> $1\frac{3}{8} + 2\frac{6}{8} = 4\frac{1}{8}$	<div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <math>1\frac{3}{8}</math>  <math>2\frac{6}{8}</math> </div> <div style="border: 1px solid black; padding: 5px; width: 300px;"> <div style="border: 1px solid black; height: 20px; margin-bottom: 5px; text-align: center;">1</div> <div style="border: 1px solid black; height: 20px; margin-bottom: 5px; text-align: center;">1</div> <div style="border: 1px solid black; height: 20px; margin-bottom: 5px; text-align: center;">1</div> </div> <div style="margin-left: 20px;"> <p><math>\frac{3}{8} + \frac{6}{8} = \frac{9}{8}</math></p> <p><math>\frac{9}{8}</math> makes <math>1\frac{1}{8}</math> because there are <math>\frac{8}{8}</math> in 1, and then you have <math>\frac{1}{8}</math> left over.</p> <p style="text-align: center;"><math>1+2=3</math></p> <p style="text-align: center;"><math>3+1\frac{1}{8} = 4\frac{1}{8}</math></p> </div> </div>
<p><b>1</b></p> $\frac{5}{6} + \frac{3}{6} =$	Empty space for student work

(Continued on back.)

**Independent Worksheet 3** Adding & Subtracting Fractions (cont.)

Problem	Explanation
<b>2</b> $\frac{7}{8} + \frac{4}{8} =$	
<b>3</b> $2\frac{3}{4} + 3\frac{3}{4} =$	
<b>4</b> $1\frac{7}{8} - \frac{5}{8} =$	

(Continued on next page.)



**Independent Worksheet 3** Adding & Subtracting Fractions (cont.)

Problem	Explanation
<b>5</b> $\begin{array}{r} 3\frac{5}{6} \\ + 2\frac{3}{6} \\ \hline \end{array}$	
<b>6</b> $\begin{array}{r} 3\frac{4}{8} \\ - 2\frac{2}{8} \\ \hline \end{array}$	

**CHALLENGE**

<b>7</b> $\begin{array}{r} 4\frac{2}{6} \\ - 2\frac{5}{6} \\ \hline \end{array}$	
---	--





# GRADE 4 SUPPLEMENT

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## Set B1 Algebra: Equations & Operations

### Includes

Activity 1: Bowling for Equations	B1.1
Activity 2: Order of Operations	B1.6
Activity 3: Variables & Expressions	B1.13
Activity 4: Writing & Solving Equations	B1.21
Independent Worksheet 1: Bowling for Equations	B1.31
Independent Worksheet 2: Expressions, Variables & Situations	B1.33
Independent Worksheet 3: Solving & Writing Equations	B1.35

### Skills & Concepts

- ★ write and solve equations with ( $=$ ) to show equivalence and use variables to express mathematical relationships involving multiplication and division
- ★ model, explain, and solve open number sentences involving addition, subtraction, multiplication, and division
- ★ use real-world situations involving multiplication or division to represent number sentences
- ★ use number sense, properties of multiplication, and the relationship between multiplication and division to find values for the unknowns that make the number sentences true
- ★ recognize that a symbol represents the same number throughout an equation or expression (e.g.,  $\Delta + \Delta = 8$ ; thus,  $\Delta = 4$ )
- ★ use the order of operations to evaluate, simplify, and compare mathematical expressions involving the four operations, parentheses, and the symbols  $<$ ,  $>$ , and  $=$

## **Bridges in Mathematics Grade 4 Supplement**

### **Set B1** Algebra: Equations & Operations

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

#### References:

Mathematical Sciences Education Board, National Research Council, *Measuring Up: Prototypes for Mathematics Assessment*, 1993

Shoecraft, Paul J. (April, 1982). “Bowl-a-Fact: A game for reviewing the number facts,” *Arithmetic Teacher*

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# Set B1 ★ Activity 1



## ACTIVITY

### Bowling for Equations

#### Overview

The teacher introduces Roll-a-Fact, a game that provides opportunities to write and solve equations, as well as contexts for learning about the conventions of order of operations. To play the game, teams take turns to roll three dice (numbered 1 – 6) and make as many numbers from 1 to 10 as possible by adding, subtracting, multiplying, or dividing the numbers showing on the dice.

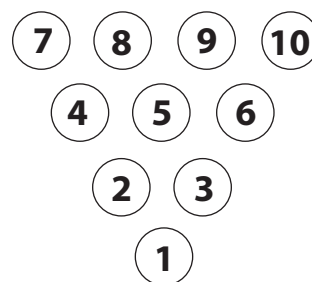
#### Skills & Concepts

- ★ write and solve equations with ( $=$ ) to show equivalence
- ★ model, explain, and solve open number sentences involving addition, subtraction, multiplication, and division
- ★ use the order of operations to evaluate, simplify, and compare mathematical expressions involving the four operations, parentheses, and the symbols  $<$ ,  $>$ , and  $=$

#### You'll need

- ★ The Roll-A-Fact Game (page B1.5, run one copy on a transparency)
- ★ 3 dice (numbered 1 – 6) for each group of 4 students
- ★ Student Math Journals or notebook paper
- ★ helper jar containing a popsicle stick for each child with his/her name on it
- ★ a timer

**Advance Preparation** Draw 10 circles on the board and number them from 1–10 as shown below.



#### Instructions for Bowling for Equations

1. Ask students if any of them have ever gone bowling. If so, what do they know about the game? After a few volunteers have shared, explain that in bowling, the objective is to knock down 10 pins with one or two rolls of a bowling ball. If you knock down all 10 pins with one roll, it's called a strike. If you knock them all down with two rolls, it's called a spare.
2. Now explain that you are going to play a new game called Roll-a-Fact today. This game is similar to bowling, except instead of rolling a ball, the class will roll 3 dice and knock down numbered pins by adding, subtracting, multiplying or dividing the numbers rolled to make 1 through 10. Each number rolled must be used exactly once on one side of an equation.
3. Work through an example together so students understand how to play the game. Draw their attention to the “bowling pins” you have drawn on the board. Rather than rolling the dice, ask students to pretend that the numbers that came up were 3, 4, and 6. Write these numbers on the board. Then work with input from the class to knock over the 7 pin by devising an equation that uses 3, 4, and 6 to make 7. Accept ideas for knocking over other pins as well during this initial discussion.

## Bowling for Equations (cont.)

**Teacher** Let's see if we can knock over the 7 pin in our bowling alley up here on the board. How can we use the 3, 4 and 6 to make 7? We can add, subtract, multiply or divide the numbers, but we have to use all 3 of them, and the answer has to be 7.

**Maria**  $3 + 4$  makes 7.

**Teacher** That's true, but we have to use all 3 numbers. Raise your hand when you have an idea.

**Donald** You could do  $4 - 3 = 7 - 6$ . That works, because it's  $1 = 1$ .

**Teacher** Yep, but you have to combine all three of the numbers to make 7.

**Students** Oh, I see a way! You can get 7 if you add 6 plus 4 and then take away 3. I have another idea. You could go  $4 \times 6$  and then divide by 3. No wait, that's 8.

4. Record students' ideas on the board, and cross out each pin they knock down. Reinforce the meaning of the equals sign by writing the pin number on the right or the left side of each equation. If a student announces she has found a way to make 7, place the 7 on the left-hand side of the equation (e.g.,  $7 = 6 + 4 - 3$ ). If another shares that  $4 + 3 - 6$  is 1, place the 1 on the right-hand side of the equation.

5. After you have recorded 3 or 4 equations, ask students to work on their own in their math journal or on a piece of notebook paper to see if they can devise a way to knock over any of the other pins. Although the roll 3, 4, 6 isn't a strike, it is possible to make 1, 2, 3, 5, 6, and 8 with these three numbers. Chances are, ideas for 1, 2, 3, and 8 will emerge first. If no one volunteers ways to knock over any of the other pins, let students know that it is possible to knock over 5 and 6. Can they figure out how? Let them wrestle with the problem for another minute or so, and then continue the discussion. Both numbers will provide an opportunity to open a discussion about the use of parentheses in writing equations. Students may come up with the equation  $6 - 4 + 3$  as a way to make 5, for instance, but what about  $6 - (4 - 3)$ ?

**Teacher** Did anyone come up with a way to make 5? What about 6?

**Students** I found a way to make 5, if you go  $6 - 4 + 3$ , because  $6 - 4$  is 2 and then add 3. And for 6, you can go  $3 \times 4 - 6$ , because  $3 \times 4$  is 12, and you get 6 if you take 6 away.

**Teacher** Let's write your equations up here. Did anyone find a different way to make 5 or 6? No? I have an idea I'd like to share for 5. I'll write it up here on the board:  $5 = 6 - (4 - 3)$ .

**Students** I respectfully disagree, Mrs. Dietz. I think  $6 - 4 - 3$  is impossible.  $6 - 4$  is 2, and you can't take 3 away from 2.

You can if you use negative numbers!  $6 - 4 - 3$  is negative 1!

But there's something with those parenthesis marks. Why did you put them there, Mrs. D?

**Teacher** Those parentheses are a way to signal that you need to do that operation first. What happens if you do  $4 - 3$  first, and then subtract that answer from 6?

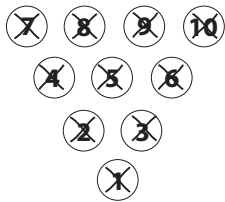
**Students**  $4 - 3$  is 1, and  $6 - 1$  is 5.

Oh yeah, it does work.

Hey, that gives me a new idea for 6. You can go  $6 \div 4 - 3$ , but you have to put parentheses around the  $4 - 3$ .

### Bowling for Equations (cont.)

6. Record any additional ideas that have come out of the discussion. When there is general agreement that only pins 1, 2, 3, 5, 6, and 8 can be knocked down with a roll of 3, 4, 6, remind students that they can still get a spare if they can knock down the rest of the pins with a second roll. Ask them to pretend that the second roll was 3, 3, and 4. Write these numbers on the board, and give students a minute to work. Record their ideas on the board.

	Roll 1: 3, 4, 6	Roll 2: 3, 3, 4
	$7 = 6 + 4 - 3$	$9 = 4 \times 3 - 3$
	$4 \times 6 \div 3 = 8$	$3 + 3 + 4 = 10$
	$3 \times 4 \div 6 = 2$	$4 \times (3 \div 3) = 4$
	$3 + 4 - 6 = 1$	$4 + (3 - 3) = 4$
	$5 = 6 - 4 + 3$	$4 - (3 - 3) = 4$
	$6 = 3 \times 4 - 6$	
	$6 - (4 - 3) = 5$	SPARE!
	$6 \div (4 - 3) = 6$	

7. Now display the Roll-A-Fact Game sheet and review the rules at the top together. Explain that you will play as Team 1, while the students work together as Team 2. Let them know that after both teams have rolled, you will set the timer for 3 minutes. When it rings, you and the students will take turns writing equations on the game sheet. Tell them that you will choose names out of the helper jar to share, so everyone will need to be prepared. Give them a choice of working alone or in pairs, and ask them to record their work in their journal or on the backside of the paper they have been using.

8. Roll the dice and record your numbers on the game sheet. Call on a student to do the same for the class. Set your timer for 3 minutes and go to work as students do the same. When the timer sounds, record one of your equations and cross out the pin you just knocked down. Then pull a name from the helper jar and ask that student to come up, record an equation for the class, and cross out the corresponding pin. Take turns back and forth. When you enter your equations, reinforce the fact that we generally work from left to right, but we can use parentheses to show that we need to do something else first.

Set B1 Algebra: Equations & Operations Blackline. Run 1 copy on a transparency.

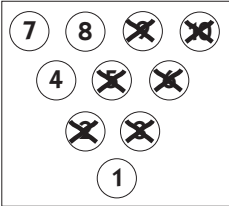
NAME \_\_\_\_\_ DATE \_\_\_\_\_

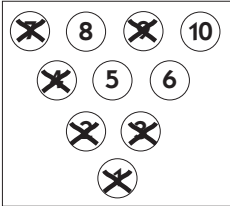
### Roll-A-Fact

Game Rules:

- Roll 3 dice numbered 1–6. Record the numbers you get.
- Add, subtract, multiply, or divide the 3 numbers to make as many numbers from 1–10 as possible.
- You must use all 3 numbers exactly once on one side of each equation.
- Strike beats a spare. If neither team gets a strike or a spare, the team that knocks down the most pins wins.

<p><b>Team 1</b></p> <p>1st Roll: <u>2, 4, 3</u></p> <p>2nd Roll: <u>   ,   ,   </u></p>	<p><b>Team 2</b></p> <p>1st Roll: <u>6, 5, 2</u></p> <p>2nd Roll: <u>   ,   ,   </u></p>
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$2 + (4 - 3) = 3$ $4 + 3 + 2 = 9$ $4 \times 2 - 3 = 5$ $10 = 3 \times 4 - 2$ $6 = 4 \times 3 \div 2$ $(4 - 3) \times 2 = 2$	$2 \times 5 - 6 = 4$ $6 \times 2 - 5 = 7$ $5 - (6 - 2) = 1$ $6 - (5 - 2) = 3$ $6 + 5 - 2 = 9$
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Remember: We solve equations from left to right. Use parentheses if you need to do something else first.

**Bowling for Equations** (cont.)

**PJ** How come you used parentheses on that last equation, Mrs. Dietz? I don't think you need them there.

**Teacher** That's a good question, PJ. It doesn't seem like I'd need them because  $4 - 3$  is 1, and  $1 \times 2$  is 2. We'll talk more about this tomorrow, but here's the deal. Even though we usually work equations from left to right, mathematicians have agreed to always do the multiplication or division first. Let me write the equation without any parentheses:  $4 - 3 \times 2$ . If I did the multiplication first, what would I get for an answer?

**Students**  $3 \times 2$  is 6.

Then it would be  $4 - 6$ . That's impossible.

No it isn't! It's negative 2, but there's no bowling pin for that one!

**Teacher** So with this equation, I need to use parentheses to show that I need to subtract first and then multiply.

9. Continue until neither team has any more equations to share. If one or both teams got a strike, you'll have a winner or a tie. If neither team got a strike, roll the dice again, and have a student do so for the class. Then repeat step 7 to see if either can get a spare. If neither team gets a spare, the team that knocked down the most pins wins.

**Extensions**

- Have students play a doubles version of Roll-a-Fact, 2 students against 2 students. Place the game sheet on display so they can see the rules, and have students draw the pins in their journal or on a piece of notebook paper. Each group of 4 will also need 3 dice numbered 1–6.
- Once students are familiar with the game, encourage them to develop variations. What happens if you use 2 dice numbered 1–6 and 1 die numbered 4–9? What happens if all 3 dice are numbered 4–9? The numbers on the pins can be changed as well, and even the number of pins themselves. What about Super Roll-a-Fact, with 15 pins numbered 1–15 and 3 or 4 dice? What about letting some of the pins be negative (e.g.,  $-4$ ,  $-3$ ,  $-2$ ,  $-1$ ,  $0$ ,  $1$ ,  $2$ ,  $3$ ,  $4$ ,  $5$ )? These are only some of the many possible variations students might explore.
- Roll-a-Fact provides a good context for investigating probability and combinatorics. For instance, given 3 dice numbered 1–6, how many different rolls are there? Which of these rolls produce a strike with a set of pins numbered 1–10? What is the probability of rolling a strike? What is the worst possible roll? Is there more than one “worst roll”? Any of these questions might lead to a full-fledged investigation by an interested individual or group. Results and new discoveries could then be shared with the rest of the class, or written up for inclusion on a class or school web site.
- NCTM's Illuminations web site features an online game called Krypto that is very similar to Roll-a-Fact. To access Krypto, go to <http://illuminations.nctm.org/> and click into the Activities section, where you can find the game quickly by typing the name into the Advanced Options search field. You might share this link with interested students and their families.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Roll-A-Fact

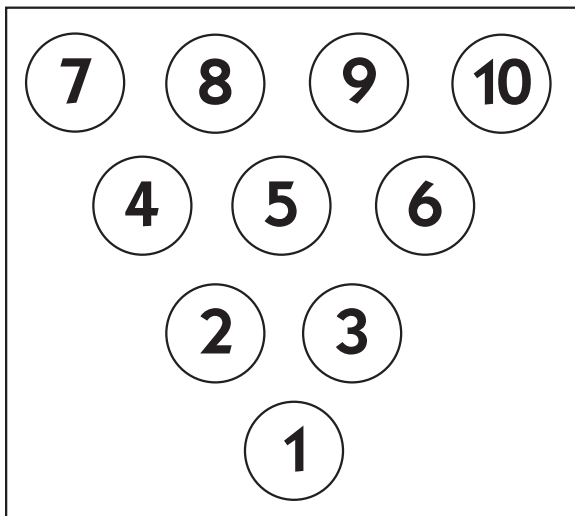
Game Rules:

- Roll 3 dice numbered 1–6. Record the numbers you get.
- Add, subtract, multiply, or divide the 3 numbers to make as many numbers from 1–10 as possible.
- You must use all 3 numbers exactly once on one side of each equation.
- Strike beats a spare. If neither team gets a strike or a spare, the team that knocks down the most pins wins.

## Team 1

1st Roll:    \_\_\_, \_\_\_, \_\_\_

2nd Roll:    \_\_\_, \_\_\_, \_\_\_




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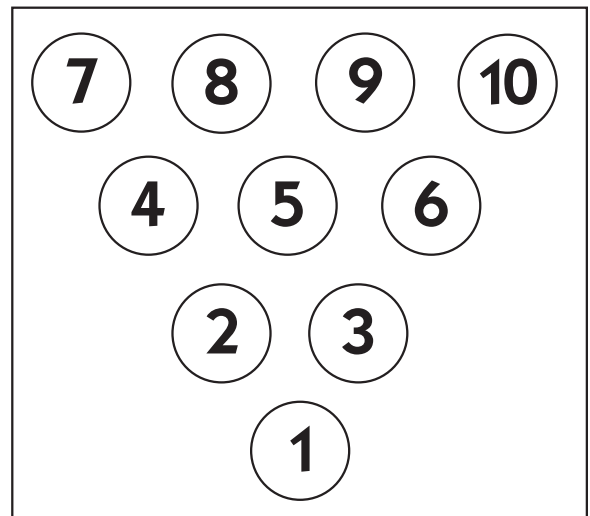
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## Team 2

1st Roll:    \_\_\_, \_\_\_, \_\_\_

2nd Roll:    \_\_\_, \_\_\_, \_\_\_




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# Set B1 ★ Activity 2



## ACTIVITY

### Order of Operations

#### Overview

Building on the Roll-a-Fact game introduced in the previous activity, the teacher introduces order of operations today. Students apply the set of rules as they evaluate and solve equations, first as a whole group, and then working individually or in pairs.

#### Skills & Concepts

- ★ write and solve equations with ( $=$ ) to show equivalence
- ★ model, explain, and solve open number sentences involving addition, subtraction, multiplication, and division
- ★ use the order of operations to evaluate, simplify, and compare mathematical expressions involving the four operations, parentheses, and the symbols  $<$ ,  $>$ , and  $=$
- ★ recognize that a symbol represents the same number throughout an equation or expression (e.g.,  $\Delta + \Delta = 8$ ; thus,  $\Delta = 4$ )

#### You'll need

- ★ Introducing Order of Operations (page B1.11, run one copy on a transparency)
- ★ Operations & Equations (page B1.12, run a class set)
- ★ a piece of paper to mask portions of the display master
- ★ notebook paper (class set)
- ★ whiteboard, marker, and eraser for each student (optional)
- ★ access to dice numbered 1–6

#### Instructions for Order of Operations

1. Place Introducing Order of Operations on display with everything but the top section masked. Give students a few moments to read the text on their own. Then read it aloud with the class, and ask students to consider the problem privately. Can they figure out how each boy got his answer? Do both solutions really work?

Set B1 Algebra: Equations & Operations Blackline Run 1 copy on a transparency	
NAME _____	DATE _____
<b>Introducing Order of Operations</b>	
<p>Samuel is playing a game of Roll-a-Fact with his friend, Teo. On his first roll, Teo got 6, 4, and 2. He said, "I see how to knock down the 5 pin!" He wrote this equation:</p> $6 + 4 \div 2 = 5$	
<p>Samuel said, "I respectfully disagree with you, Teo. I think the answer to that equation is 8, see?"</p> $6 + 4 \div 2 = 8$	
<p><b>1</b> How did each boy get his answer?</p>	

**Students** *I think the first one is right because  $6 + 4$  is 10. If you divide that by 2, you get 5.*

*I don't get how the other kid got 8.*

*I think I know. If you put parentheses around  $4 \div 2$ , it means to do that part first, right? If you do that, then  $4 \div 2$  is 2.*

*Oh, right! Then  $6 + 2$  is 8. Samuel's idea does work, but only if you do the division first.*

## Order of Operations (cont.)

2. Reveal the next section of the display master, and read it with the class. Then work with the class to decide which of the two answers is correct. Given these rules, is it 5 or 8?

**Order of operations** is a set of rules for solving equations. People use this set of rules so everyone will get the same answer.

1. Do anything inside parentheses first.
2. Multiply or divide in order, left to right.
3. Add or subtract in order, left to right.

**2** Which boy had the correct answer? Can you fix the incorrect equation so that it works?

**Jaime** Do those rules mean that you do multiplication or division first, wherever it is?

**Teacher** Yes, the rules are pretty simple. If there's anything in parentheses, you do it first. Then if there is any multiplication or division in the equation, you do it next. Last, you do any addition or subtraction in the equation.

**Students** That would mean you have to do  $4 \div 2$  first, which is 2, so the real answer is 8.

But don't you need parentheses around  $4 \div 2$  so it's okay to go out of order?

No, because the rules say you have to do that part first, so you don't need parentheses, right?

**Teacher** Yes, that's correct. So, given these rules, is there any way to fix Teo's equation so it's true? Talk with the person next to you for a moment, and then raise your hand if you have an idea. Sara?

**Sara** If you put parentheses around  $6 + 4$ , you have to do that first, no matter what.  $6 + 4$  is 10, and 10 divided by 2 is 5.

3. Reveal the next problem on the display master with just the first equation showing. Read the text with the class and clarify as needed.

Set B1 Algebra: Equations & Operations Blackline Run 1 copy on a transparency

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Introducing Order of Operations

Samuel is playing a game of Roll-a-Fact with his friend, Teo. On his first roll, Teo got 6, 4, and 2. He said, "I see how to knock down the 5 pin!" He wrote this equation:

$$6 + 4 \div 2 = 5$$

Samuel said, "I respectfully disagree with you, Teo. I think the answer to that equation is 8, see?"

$$6 + 4 \div 2 = 8$$

**1** How did each boy get his answer?  $6 + 4 = 10$  and  $10 \div 2 = 5$ , so  $6 + 4 \div 2 = 5$   
 $6 + (4 \div 2) = 6 + 2$  and  $6 + 2 = 8$

**Order of operations** is a set of rules for solving equations. People use this set of rules so everyone will get the same answer.

1. Do anything inside parentheses first.
2. Multiply or divide in order, left to right.
3. Add or subtract in order, left to right.

**2** Which boy had the correct answer? Can you fix the incorrect equation so that it works?  
 Samuel because you have to do the division first.  $(6 + 4) \div 2 = 5$

**3** Samuel got 2, 1, and 6 on his first roll. Here are some of the equations he wrote. Read each and decide if it is true or false. If it is false, see if you can fix it.

**a**  $1 \times 6 \div 2 = 3$       T or F      **b**  $6 \div 2 + 1 = 2$       T or F

4. Ask students to each write the equation on an individual whiteboard or a piece of notebook paper, and label it with a T if they believe it is true or an F if they believe it is false. Have them hold up their work as they finish, and then call on 2 or 3 students to explain their responses.

## Order of Operations (cont.)

**Students** *I said true because, look,  $1 \times 6$  is 6. Then divide by 2, and it makes 3. I did  $6 \div 2$  first because the rules say you have to do it that way. So  $6 \div 2$  is 3 and then  $1 \times 3$  is 3. But it says multiplication and division come first, so I said true because if you just do everything straight along, it makes 3.*

5. Reveal each of the other 4 equations one by one, and work through each with the class as described in step 4. Here are the answers for your reference:

$$6 \div 2 + 1 = 2 \quad \text{False} \quad \text{Fix: } 6 \div (2 + 1) = 2$$

$$6 - 2 \times 1 = 4 \quad \text{True}$$

$$6 + 2 \div 1 = 8 \quad \text{True}$$

$$6 - 1 \times 2 = 10 \quad \text{False} \quad \text{Fix: } (6 - 1) \times 2 = 10$$

6. Now show the last part of the display master. Read the problem with the class, and clarify as needed.

**4** On his second roll, Teo got 2, 3, and . Solve the equations below to figure out the third number Teo rolled.

**a**  $2 \times \square + 3 = 7$                       **b**  $(\square + 3) \times 2 = 10$

**c**  $3 \times \square \div 2 = 3$

Ask the students to work the 3 equations privately on their paper or whiteboard. After about a minute, have them share with the people sitting nearest them. Then ask the class to report the answer. What was the third number Teo rolled? If there is more than one answer, record all responses. Then work through the equations one by one with input from the students. As they will discover, the unknown number is 2 each time. Why is that?

**Students** *Because it works for every problem.*

*It has to be the same number because it's the last number he got when he rolled the 3 dice to play the game.*

*There's a little box in every problem. That kind of gives you a hint that they're all going to be the same.*

**Teacher** *But there are lots of times you've filled in boxes to solve problems, and the numbers have been different. Why are they all the same this time?*

**Students** *Because that's what works!*

*Because all the answers are 2.*

*They have to be. All of the equations he can make have to be with the same numbers.*

7. Give students each a copy of Operations & Equations. Review the sheet with the class. When students understand what to do, have them go to work. Consider giving them the choice of working alone or with a partner. Circulate to provide help as needed, or pull a small group of students who may need extra support.

## Order of Operations (cont.)

Set B1 Algebra: Equations & Operations Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Operations & Equations

**1** Shanti is playing a game of Roll-a-Fact with her friend, Kendra. On her first roll, Shanti got 4, 3, and 5. Below are some of the equations she wrote. Read each and decide if it is true or false according to the order of operations. If an equation is false, rewrite it on the line so it is true.

**ex**  $4 - 3 \times 5 = 5$  T or **(F)**  $(4 - 3) \times 5 = 5$

**a**  $3 \times 4 - 5 = 7$  T or F \_\_\_\_\_

**b**  $5 - 3 \times 4 = 8$  T or F \_\_\_\_\_

**c**  $5 + 4 - 3 = 6$  T or F \_\_\_\_\_

**d**  $5 + 4 \div 3 = 3$  T or F \_\_\_\_\_

**e**  $(5 + 3) \div 4 = 2$  T or F \_\_\_\_\_

**Order of operations**

1. Do anything inside parentheses first.
2. Multiply or divide in order, left to right.
3. Add or subtract in order, left to right.

**2** Kendra got 5, 3, and  on her first roll. Solve the equations below to figure out the third number Kendra rolled.

**a**  $(5 \times \square) \div 3 = 10$     **b**  $5 - 3 + \square = 8$     ~~4~~ ~~5~~ ~~6~~

**c**  $\square \div 3 + 5 = 7$     **d**  $5 \times 3 - \square = 9$     4 5 6

**e** Kendra rolled 5, 3, and .    2 3

1

**3** Use Kendra's 3 numbers to knock over the 2, 3, and 4 pins. Write your equations on the lines below. Cross out the pins.

**a**  $2 =$  \_\_\_\_\_    **b**  $3 =$  \_\_\_\_\_    **c**  $4 =$  \_\_\_\_\_

CHALLENGE

**4** Can Kendra get a strike with her first roll? If not, roll 3 dice numbered 1–6. Record the numbers below. Can you use these numbers to knock over the rest of the pins? Write your equations on the back of this sheet.

I got , , and

8. As students finish, have them check their work with at least one classmate. Challenge them to resolve any differences in their responses by reworking the problem(s) together or consulting with others in the room. When they are finished, have them play Roll-a-Fact in pairs or groups of 4 (2 against 2). You may want to post the Roll-a-Fact display master at this point to remind students of the game rules. Have them draw and number the pins, and record their rolls and equations, in their journal or on a piece of notebook paper.

### Extensions

- Invite students to make up their own mystery roll problems for classmates to solve, similar to problem 2 on the Operations & Equations blackline. To do this, a student needs to roll 3 dice and write 3 or 4 equations to make any of the numbers 1 – 10. Then he/she can write out the mystery set on a strip of paper for a classmate to solve.

Jon M.

Roll: 4, 3, and 5

$4 \times 3 - 5 = 7$

$(3 + 5) \div 4 = 2$

$5 \times (4 - 3) = 5$

$5 + 4 - 3 = 6$

→

Mystery Roll by Jon M.

$4 \times \square - 5 = 7$

$(\square + 5) \div 4 = 2$

$5 \times (4 - \square) = 5$

What was my third roll? \_\_\_\_\_

## Order of Operations (cont.)



### INDEPENDENT WORKSHEET

Use Set B1 Independent Worksheet 1 to provide students with more practice solving equations using order of operations.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Introducing Order of Operations

Samuel is playing a game of Roll-a-Fact with his friend, Teo. On his first roll, Teo got 6, 4, and 2. He said, "I see how to knock down the 5 pin!" He wrote this equation:

$$6 + 4 \div 2 = 5$$

Samuel said, "I respectfully disagree with you, Teo. I think the answer to that equation is 8, see?"

$$6 + 4 \div 2 = 8$$

**1** How did each boy get his answer?

**Order of operations** is a set of rules for solving equations. People use this set of rules so everyone will get the same answer.

1. Do anything inside parentheses first.
2. Multiply or divide in order, left to right.
3. Add or subtract in order, left to right.

**2** Which boy had the correct answer? Can you fix the incorrect equation so that it works?

**3** Samuel got 2, 1, and 6 on his first roll. Here are some of the equations he wrote. Read each and decide if it is true or false. If it is false, see if you can fix it.

- |                                  |        |                             |        |
|----------------------------------|--------|-----------------------------|--------|
| <b>a</b> $1 \times 6 \div 2 = 3$ | T or F | <b>b</b> $6 \div 2 + 1 = 2$ | T or F |
| <b>c</b> $6 - 2 \times 1 = 4$    | T or F | <b>d</b> $6 + 2 \div 1 = 8$ | T or F |
| <b>e</b> $6 - 1 \times 2 = 10$   | T or F |                             |        |

**4** On his second roll, Teo got 2, 3, and . Solve the equations below to figure out the third number Teo rolled.

**a**  $2 \times \square + 3 = 7$

**b**  $(\square + 3) \times 2 = 10$

**c**  $3 \times \square \div 2 = 3$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Operations & Equations

**1** Shanti is playing a game of Roll-a-Fact with her friend, Kendra. On her first roll, Shanti got 4, 3, and 5. Below are some of the equations she wrote. Read each and decide if it is true or false according to the order of operations. If an equation is false, rewrite it on the line so it is true.

**ex**  $4 - 3 \times 5 = 5$  T or **(F)**  $(4 - 3) \times 5 = 5$

**a**  $3 \times 4 - 5 = 7$  T or F \_\_\_\_\_

**b**  $5 - 3 \times 4 = 8$  T or F \_\_\_\_\_

**c**  $5 + 4 - 3 = 6$  T or F \_\_\_\_\_

**d**  $5 + 4 \div 3 = 3$  T or F \_\_\_\_\_

**e**  $(5 + 3) \div 4 = 2$  T or F \_\_\_\_\_

## Order of operations

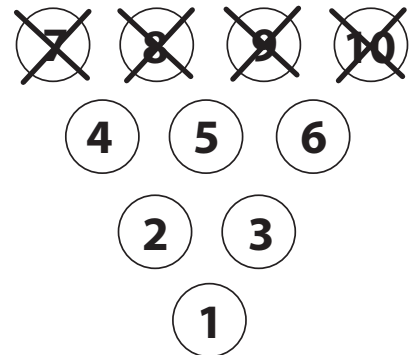
1. Do anything inside parentheses first.
2. Multiply or divide in order, left to right.
3. Add or subtract in order, left to right.

**2** Kendra got 5, 3, and  on her first roll. Solve the equations below to figure out the third number Kendra rolled.

**a**  $(5 \times \square) \div 3 = 10$       **b**  $5 - 3 + \square = 8$

**c**  $\square \div 3 + 5 = 7$       **d**  $5 \times 3 - \square = 9$

**e** Kendra rolled 5, 3, and .



**3** Use Kendra's 3 numbers to knock over the 2, 3, and 4 pins. Write your equations on the lines below. Cross out the pins.

**a**  $2 = \underline{\hspace{2cm}}$       **b**  $3 = \underline{\hspace{2cm}}$       **c**  $4 = \underline{\hspace{2cm}}$



## CHALLENGE

**4** Can Kendra get a strike with her first roll? If not, roll 3 dice numbered 1–6. Record the numbers below. Can you use these numbers to knock over the rest of the pins? Write your equations on the back of this sheet.

I got ,  and



# Set B1 ★ Activity 3



## ACTIVITY

### Variables & Expressions

#### Overview

This activity provides a formal introduction to variables and expressions. Students learn that an expression is a very short way to describe an amount. Expressions can be a number, a variable, or a combination of numbers, variables and/or operations. Students work together as a group, and then individually, to write and evaluate expressions about simple situations.

#### Skills & Concepts

- ★ model, explain, and evaluate expressions involving addition, subtraction, multiplication, and division
- ★ use the order of operations to evaluate, simplify, and compare mathematical expressions involving the four operations, parentheses, and the symbols  $<$ ,  $>$ , and  $=$
- ★ recognize that a symbol represents the same number throughout an equation or expression (e.g.,  $\Delta + \Delta = 8$ ; thus,  $\Delta = 4$ )
- ★ use real-world situations involving multiplication or division to represent number sentences
- ★ use number sense, properties of multiplication, and the relationship between multiplication and division to find values for the unknowns that make the number sentences true

#### You'll need

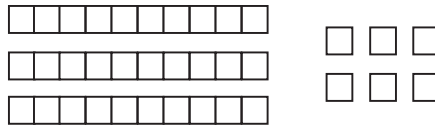
- ★ Variables & Expressions (page B1.17, run one copy on a transparency)
- ★ More Variables & Expressions (pages B1.18 & B1.19, run a class set)
- ★ a piece of paper to mask portions of the display master
- ★ Student Math Journals or notebook paper
- ★ overhead base ten pieces
- ★ 3 bags of base ten units, 40 in each bag
- ★ access to dice numbered 1–6

#### Instructions for Variables & Expressions

1. Let students know that they are going to do some work with expressions and variables today. Write the word *expression* on the board. Read it with the class and ask if anyone has heard or read the word before. If so, do they know its meaning? We often use the word *expression* in connection with feelings. We might give our mother a flower as an expression of love; we might show a surprised expression when we receive a gift, or an angry expression when something makes us mad. Just as a facial expression can be a very short way to show a complex emotion, a mathematical expression is a very short way to show an amount.

## Variables &amp; Expressions (cont.)

2. Illustrate this idea by placing a collection of base ten pieces on display: 3 strips and 6 units. Ask students to describe what they see. Record each expression as it is volunteered.



**Teacher** Please raise your hand if you have a way to describe this collection of base ten pieces. I'll write your ideas up here on the board.

**Students** It's 36.

It's 3 tens and 6 ones, or you could go  $30 + 6$

You could write  $3 \times 10 + 6$ .

**Teacher** Okay, any other ideas? What are some other ways to describe this collection?

**Students** You could do  $10 + 10 + 10 + 6$ .

I know! It's 36 so you could say  $6 \times 6$ .

$72 - 36$  would work too.

3. Let students know that each of the descriptions they have offered is a mathematical *expression*—a very short way to describe an amount. Now hold up one of the bags of base ten units, but do not tell students how many are in the bag. What expression might they use to describe the quantity in the bag?

**Students** But we don't know how many are in there!






There's no way we can tell about how many if we don't know the number.

Let's count them!

**Teacher** When we don't know what the number is, we can use a letter to represent the quantity instead. How about if we use the letter  $b$  to stand for the bag of units?

4. Hold up the quantities of base ten pieces listed below and work with students to devise an expression for each. Record the expressions on the board.

- 1 bag of base ten units and 3 extra units
- 2 bags of base ten units (assure students that each bag contains exactly the same number of units)
- 3 bags of base ten units and 5 extra units

Expression	Bag of units	
 $36$ $3 \times 10 + 6$ $30 + 6$ $10 + 10 + 10 + 6$ $6 \times 6$ $72 - 36$	 $b$	 $b + 3$
	 $2 \times b$ or $2b$	 $3b + 5$

An expression is a very short way to describe an amount.

## Variables &amp; Expressions (cont.)

5. Ask students to get out their math journals or notebook paper as you place Variables & Expressions on display with just the top section showing. Reveal the text one line or section at a time as you read and discuss it with the class.

Set B1 Algebra: Equations & Operations Blackline Run 1 copy on a transparency

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Variables & Expressions

In mathematics, an **expression** names an amount.

- Sometimes, an expression is a number, like 14.
- Sometimes, an expression is a variable, like  $n$  or  $x$  or  $\square$ .
- Sometimes an expression includes numbers, operations, and/or variables.

**example** James got a small bag of fish crackers in his lunch today. He gave 6 of the crackers to his friend. We can use the expression

$$c - 6$$

to show how many crackers James had left. (We use the letter  $c$  to stand for the number of crackers because we don't know how many crackers are in the bag.)

**1** Write an expression to represent each of these situations:

Situation	Expression
<b>a</b> Ashley had a full bag of fish crackers. Her sister gave her 3 more fish crackers.	
<b>b</b> Jason had a full bag of fish crackers. He gave 4 of them to his little brother.	
<b>c</b> There are 5 little bags of fish crackers in the cupboard. Each bag has exactly the same number of crackers.	
<b>d</b> Haley got a little bag of fish crackers in her lunchbox. She poured out the crackers and divided them evenly with her friend.	

**2** There are exactly 42 fish crackers in every bag. Use that information to evaluate each expression above and find the answer.

**example** James had  $c - 6$  crackers. Now we know  $c = 42$ , so we can write:

$$42 - 6 = 36 \text{ crackers, James had 36 crackers left.}$$

Have students record a response in their journal to each problem as it is displayed. Then call on volunteers to share and explain their thinking.

**Teacher** *Who would like to share the expression they wrote for our first situation. Jeffrey?*

**Jeffrey** *The girl has 1 bag of crackers and 3 more, so I wrote  $c + 3$  for that one.*

6. When you have worked through the sheet together, give students each a copy of More Variables & Expressions. Review both sheets with the class. When students understand what to do, have them go to work individually or in pairs. Circulate to provide help as needed, or pull a small group to provide extra support.

Variables & Expressions (cont.)

Set B1 Algebra: Equations & Operations Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**More Variables & Expressions** page 1 of 2

1 One of the prizes kids can win at the school carnival is a bag of stickers. Each bag has exactly the same number of stickers. Draw a line from each of the situations to the matching expression.

Situation	Expression
<b>ex</b> Alicia won a bag of stickers. Her friend gave Alicia 6 more stickers.	$4 \times b$ or $4b$
<b>a</b> Corey won 4 bags of stickers.	$b + 6$
<b>b</b> Neena won a bag of stickers. There was a hole in the bag and she lost 9 of the stickers.	$2b + 12$
<b>c</b> Andre won a bag of stickers. When he got home, he divided the bag of stickers evenly among his 3 cousins.	$b - 9$
<b>d</b> Raven won 2 bags of stickers. Her friend gave her 12 more stickers.	$b \div 3$

2 There are exactly 27 stickers in every bag. Use that information to evaluate each expression above and find the answer.

**example** Alicia had  $b + 6$  stickers. Now we know  $b = 27$ , so we can write  $27 + 6 = 33$  stickers, Alicia had 33 stickers in all.

<b>a</b>	Corey won ____ stickers in all.
<b>b</b>	Neena had ____ stickers left.
<b>c</b>	Each of Andre's cousins got ____ stickers.
<b>d</b>	Raven had ____ stickers in all.

3 Tyrone won 3 bags of stickers. He lost 15 of the stickers on the way home. Which expression shows how many stickers Tyrone had when he got home?

$3b + 15$         $3b$         $3b - 15$         $b - 15$

4 Evaluate the expression you just chose. Exactly how many stickers did Tyrone have when he got home? Show your work.

Set B1 Algebra: Equations & Operations Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

**More Variables & Expressions** page 2 of 2

5 To evaluate an expression, you have to replace the variable with a number so you can find the answer. Evaluate each of the expressions below.

Expression	Evaluate if $x = 12$	Evaluate if $x = 60$	Evaluate if $x = 120$
<b>ex</b> $x + 5$	$12 + 5 = 17$	$60 + 5 = 65$	$120 + 5 = 125$
<b>a</b> $4x$			
<b>b</b> $x - 8$			
<b>c</b> $x \div 3$			
<b>d</b> $3x + 5$			
<b>e</b> $(x \div 2) + 4$			

6 Write a situation to match each of the expressions below. The variable  $b$  stands for bag, but you can choose whatever you want to put in the bag.

Expression	Situation
<b>ex</b> $b - 3$	I got a bag of carrots. I gave 3 of the carrots to my friend, Max.
<b>a</b> $25 + b$	
<b>b</b> $2b$	
<b>c</b> $b \div 2$	
<b>d</b> $b + 43$	

**CHALLENGE**

<b>e</b> $3b - 10$	
<b>f</b> $(6b \div 2) + 4$	
<b>g</b> $(18b \div 3) - 12$	

7. As students finish the assignment, ask them to check their work with at least one other person in class. Challenge them to resolve any differences in their answers by talking with each other and consulting a third student if necessary.

8. Ask students who finish and check their work before the end of the period to continue or start a new game of Roll-a-Fact in their math journals or on a piece of notebook paper. You might also check the extension ideas on page B1.4 and B1.9 for more activity options to offer early finishers.



**INDEPENDENT WORKSHEET**

Use Set B1 Independent Worksheet 2 to provide students with more practice writing and evaluating expressions.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Variables & Expressions

In mathematics, an **expression** names an amount.

- Sometimes, an expression is a number, like 14.
- Sometimes, an expression is a variable, like  $n$  or  $x$  or  $\square$ .
- Sometimes an expression includes numbers, operations, and/or variables.

**example** James got a small bag of fish crackers in his lunch today. He gave 6 of the crackers to his friend. We can use the expression

$$c - 6$$

to show how many crackers James had left. (We use the letter  $c$  to stand for the number of crackers because we don't know how many crackers are in the bag.)

**1** Write an expression to represent each of these situations:

Situation	Expression
<b>a</b> Ashley had a full bag of fish crackers. Her sister gave her 3 more fish crackers.	
<b>b</b> Jason had a full bag of fish crackers. He gave 4 of them to his little brother.	
<b>c</b> There are 5 little bags of fish crackers in the cupboard. Each bag has exactly the same number of crackers.	
<b>d</b> Haley got a little bag of fish crackers in her lunchbox. She poured out the crackers and divided them evenly with her friend.	

**2** There are exactly 42 fish crackers in every bag. Use that information to evaluate each expression above and find the answer.

**example** James had  $c - 6$  crackers. Now we know  $c = 42$ , so we can write:

$$42 - 6 = 36 \text{ crackers, James had 36 crackers left.}$$

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## More Variables & Expressions page 1 of 2

**1** One of the prizes kids can win at the school carnival is a bag of stickers. Each bag has exactly the same number of stickers. Draw a line from each of the situations to the matching expression.

Situation	Expression
<b>ex</b> Alicia won a bag of stickers. Her friend gave Alicia 6 more stickers.	$4 \times b$ or $4b$
<b>a</b> Corey won 4 bags of stickers.	$b + 6$
<b>b</b> Neena won a bag of stickers. There was a hole in the bag and she lost 9 of the stickers.	$2b + 12$
<b>c</b> Andre won a bag of stickers. When he got home, he divided the bag of stickers evenly among his 3 cousins.	$b - 9$
<b>d</b> Raven won 2 bags of stickers. Her friend gave her 12 more stickers.	$b \div 3$

**2** There are exactly 27 stickers in every bag. Use that information to evaluate each expression above and find the answer.

**example** Alicia had  $b + 6$  stickers. Now we know  $b = 27$ , so we can write

$$27 + 6 = 33 \text{ stickers, Alicia had 33 stickers in all.}$$

<b>a</b>	Corey won _____ stickers in all.
<b>b</b>	Neena had _____ stickers left.
<b>c</b>	Each of Andre's cousins got _____ stickers.
<b>d</b>	Raven had _____ stickers in all.

**3** Tyrone won 3 bags of stickers. He lost 15 of the stickers on the way home. Which expression shows how many stickers Tyrone had when he got home?

$3b + 15$

$3b$

$3b - 15$

$b - 15$

**4** Evaluate the expression you just chose. Exactly how many stickers did Tyrone have when he got home? Show your work.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## More Variables & Expressions page 2 of 2

**5** To evaluate an expression, you have to replace the variable with a number so you can find the answer. Evaluate each of the expressions below.

Expression	Evaluate if $x = 12$	Evaluate if $x = 60$	Evaluate if $x = 120$
<b>ex</b> $x + 5$	$12 + 5 = 17$	$60 + 5 = 65$	$120 + 5 = 125$
<b>a</b> $4x$			
<b>b</b> $x - 8$			
<b>c</b> $x \div 3$			
<b>d</b> $3x + 5$			
<b>e</b> $(x \div 2) + 4$			

**6** Write a situation to match each of the expressions below. The variable  $b$  stands for bag, but you can choose whatever you want to put in the bag.

Expression	Situation
<b>ex</b> $b - 3$	I got a bag of carrots. I gave 3 of the carrots to my friend, Max.
<b>a</b> $25 + b$	
<b>b</b> $2b$	
<b>c</b> $b \div 2$	
<b>d</b> $b + 43$	



### CHALLENGE

<b>e</b> $3b - 10$	
<b>f</b> $(6b \div 2) + 4$	
<b>g</b> $(18b \div 3) - 12$	





# Set B1 ★ Activity 4



## ACTIVITY

### Writing & Solving Equations

#### Overview

Students determine whether pairs of expressions are equal. Then they practice solving equations and writing and solving equations to go with story situations. Finally, they play a new game in which they solve a series of equations.

#### Skills & Concepts

- ★ write and solve equations with (=) to show equivalence
- ★ use real-world situations involving multiplication or division to represent number sentences
- ★ use number sense, properties of multiplication, and the relationship between multiplication and division to find values for the unknowns that make the number sentences true
- ★ model, explain, and evaluate expressions involving addition, subtraction, multiplication, and division
- ★ use the order of operations to evaluate, simplify, and compare mathematical expressions involving the four operations, parentheses, and the symbols  $<$ ,  $>$ , and  $=$
- ★ recognize that a symbol represents the same number throughout an equation or expression (e.g.,  $\Delta + \Delta = 8$ ; thus,  $\Delta = 4$ )

#### You'll need

- ★ Writing & Solving Equations (page B1.26, run one copy on a transparency)
- ★ Algebra Puzzles, Games 1 & 2 (pages B1.27 & B1.28, see Advance Preparation)
- ★ Algebra Puzzles Record Sheet (page B1.29, run a class set)
- ★ overhead spinner overlay
- ★ red and blue overhead pens
- ★ 3" x 3" sticky notes (see Advance Preparation)
- ★ blue and red colored pencils for each student
- ★ a piece of paper to mask portions of the display master
- ★ Student Math Journals or notebook paper

**Advance Preparation** Run 1 copy each of pages B1.27 and B1.28 on a transparency. Cover each puzzle on both sheets with a sticky note trimmed to 3" x 1" so students will be able to focus more effectively on each set as it is presented. Do not cover the row of shapes at the bottom of each puzzle.

○ = ___ □ = ___ ⬠ = ___	○ = ___ □ = ___ ⬠ = ___
○ = ___ □ = ___ ⬠ = ___	○ = ___ □ = ___ ⬠ = ___

#### Instructions for Writing & Solving Equations

1. Let students know that they will be writing and solving equations today, as well as learning to play a new game. Ask them to get out their math journals or a piece of notebook paper as you place Writing and Solving Equations on display with all but the top section covered.

## Writing &amp; Solving Equations (cont.)

Set B1 Algebra: Equations & Operations Blackline Run 1 copy on a transparency

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Writing & Solving Equations

An *equation* is a mathematical sentence we use to show that two expressions are equal. Look at the examples below. For each equation, identify the two expressions, and decide whether or not they are equal. Remember to use order of operations.

**examples**  $2 + 5 = 7$                        $3 \times 6 = 29 - 11$   
 $1 + 6 \times 5 = 35$                        $40 = 3 \times 15 - 5$

2. Read the text at the top of the sheet with the class, and have them copy the first equation. Explain that there are two expressions, one on either side of the equals sign. What are they? Are they actually equal?

**Students** *The first expression is  $2 + 5$ , but there's only a 7 on the other side. But remember? An expression can be just a number, so the 7 is the other expression.  $2 + 5$  definitely equals 7.*

3. Repeat this process with each of the other equations at the top of the sheet. As students copy each, ask them to circle the two expressions and determine whether or not they are equal. The third equation will present an opportunity to discuss order of operations and to introduce the inequality sign.

**Students** *On that third one, I don't think it's equal on both sides. Yes it is!  $1 + 6$  is 7, then multiply  $7 \times 5$ , and you get 35. But remember? You have to do multiplication and division first, so it's really  $6 \times 5$  is 30, then add 1. The real answer is 31, not 35. We could put parentheses around the  $1 + 6$ . Then it would be right.*

**Teacher** *If we leave the two expressions exactly the way they are now, are they equal?*

**Jasmin** *No! You have to follow the rules, so the answer is 31, not 35.*

**Teacher** *Mathematicians actually have a symbol to show that two expressions are not equal. It is called an inequality sign, and it looks like this:  $\neq$ .*

**DJ** *Cool! It's just an equals sign with a slash through it!*

Jarod 4/25

$2 + 5 = 7$

$3 \times 6 = 29 - 11$

expressions

$1 + 6 \times 5 \neq 35$

$40 = 3 \times 15 - 5$

4. Reveal the next section of the display master. Read it with the class, and then ask the students to copy and solve each of the three equations.

To solve an equation, find the value of the variable that will make both expressions equal.

1 Solve each of the equations below:

$4 + r = 14$      $r = \underline{\quad}$     How did you solve it?

$125 \div m = 5$      $m = \underline{\quad}$     How did you solve it?

$z \times 6 = 600$      $z = \underline{\quad}$     How did you solve it?

## Writing &amp; Solving Equations (cont.)

5. As they finish, have students share their work with the people sitting nearest them. Then call on volunteers to share and explain their answers.

**Students** *I got 10 for the first one, because I know that  $4 + 10$  is 14.*

*That next one was hard, but then I thought, okay  $5 \times 20$  is 100, so it must be more than that. I tried 25 and it worked.*

*I counted by 5's on that one. I got 25, but it took a long time.*

*I thought about quarters, like 4 quarters makes a dollar and 1 more would be a dollar and 25 cents.*

*The last one was simple because  $6 \times 100$  makes 600.*

6. Now display the problems at the bottom of the sheet, one by one. Work with input from the class to write an equation for each situation. Ask students to record the equation, solve it, and share their thinking before you move to the next problem.

To solve an equation, find the value of the variable that will make both expressions equal.

**1** Solve each of the equations below:

$4 + r = 14$      $r = \underline{\quad}$     How did you solve it?

$125 \div m = 5$      $m = \underline{\quad}$     How did you solve it?

$z \times 6 = 600$      $z = \underline{\quad}$     How did you solve it?

To write an equation, think about which two amounts are equal, and write an expression for each amount.

**example** Jake had 34 marbles. He gave some to his brother. Now Jake has 18 marbles. How many marbles did Jake give to his brother?

$$34 - m = 18$$

**2** Write and solve an equation for each of the word problems below:

**a** Amber had 64 beads. She bought some more beads. Now she has 102 beads. How many beads did Amber buy?

$64 + b = 102$      $102 - 64 = 38$      $b = 38$     Amber bought 38 more beads.

**b** Mr. Smith had 100 pencils. He divided the pencils evenly among all of his students. Each student got 4 pencils. How many students are there in Mr. Smith's class?

$100 \div s = 4$      $4 \times 25 = 100$      $s = 25$     Mr. Smith had 25 students.

**c** T-shirts are on sale at the mall for \$12 each. Jasmin and her mom got shirts for the whole family. Their total was \$120. How many shirts did they buy?

$\$12 \times s = \$120$      $120 \div 10 = 12$      $s = 10$     They got 10 shirts.

7. Transition to the next activity by displaying the top portion of Algebra Puzzles, Game 1 while students put away their journals. Have a helper pass out a copy of the Algebra Puzzles Record Sheet during this time. Review the instructions on the game sheet and decide which team, you or the students, will be blue and which red.

8. Remove the sticky note from the first puzzle. Have students fill in the missing values on their record sheets for Puzzle One: 15, 30, 3, and 200. Then solve the first puzzle as a class, recording on your display master as students do the same on their own record sheets. The solution to each equation will provide the information necessary to solve the next equation. Note with students that the values of the circle and the square have to remain the same throughout Puzzle 1.

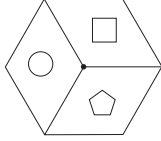
## Writing &amp; Solving Equations (cont.)

Set B1 Algebra: Equations & Operations Blackline Run 1 copy on a transparency  
NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Algebra Puzzles, Game 1

**Game Rules**

- Copy the numbers in the puzzle onto your own record sheet. Then work together to solve the puzzle and record the value of each shape below the puzzle box.
- Each team spins for a shape. (Spin again if both teams get the same shape.)
- Circle the shape at the bottom of the Puzzle 1 box with your team's color. Your team scores the value of the shape you spun.
- Repeat steps 1–3 for all four puzzles. Both teams add up their points. The team with the highest score wins.



Red Team	Blue Team
<b>1</b> $(15) + 15 = 30$ $(15) \div (5) = 3$ $(15) + (5) \times \square = 200$	<b>2</b> $4 \times \bigcirc = 24$ $\bigcirc + \square = 26$ $(\square - \bigcirc) \div \text{pentagon} = 2$
$\bigcirc = \underline{\quad}$ $\square = \underline{\quad}$ $\text{pentagon} = \underline{\quad}$	$\bigcirc = \underline{\quad}$ $\square = \underline{\quad}$ $\text{pentagon} = \underline{\quad}$

**Students** We know the circle is 15, and the square is 5.

Oh, I get it!  $15 + 5$  is 20. Then what times 20 makes 200?

It's 10! The square has to be 10!

9. When all the equations in Puzzle 1 are solved, and the value of each shape has been recorded in the box below the puzzle, set the spinner overlay on top of the spinner. Make a spin for yourself and invite a student to do the same for the class. (If the class spins the same shape as you did, have them spin again until they land on a different shape.) Use your colored pens to circle the shape spun by each team at the bottom of the Puzzle 1 box as students do the same on their own record sheets. Each team scores the number of points equal to the value of their shape.

10. Repeat steps 8 and 9 for each of the other three puzzles. As you play, reinforce the idea that although the values of the shapes change from one puzzle to the next, they have to remain the same throughout any particular puzzle. Record the value of each shape as it's determined, both inside the shape itself and in the box at the bottom of the puzzle. By the third or fourth puzzle, students may be ready to work in pairs to solve for all three shapes, sharing their solutions and strategies with the class when they are finished.

11. When all four puzzles have been solved, have students add up the points for each team and record the totals on the game sheet. The team with the highest score wins. Here are the solutions to each of the puzzles for your reference:

#### Algebra Puzzles, Game 1 Solutions

- Puzzle 1: Circle = 15, Square = 10, Pentagon = 5
- Puzzle 2: Circle = 6, Square = 20, Pentagon = 7
- Puzzle 3: Circle = 5, Square = 25, Pentagon = 4
- Puzzle 4: Circle = 35, Square = 7, Pentagon = 4

#### Extensions

- When time allows, play the second Algebra Puzzles game with your class. Here are the solutions to each of the puzzles in the second game for your reference:

## Writing & Solving Equations (cont.)

Algebra Puzzles, Game 2 Solutions

- Puzzle 1: Circle = 12, Square = 27, Pentagon = 10
  - Puzzle 2: Circle = 7, Square = 4, Pentagon = 30
  - Puzzle 3: Circle = 40, Square = 8, Pentagon = 7
  - Puzzle 4: Circle = 4, Square = 18, Pentagon = 2
- Invite interested students to make their own algebra puzzles for classmates to solve.



### INDEPENDENT WORKSHEET

Use Set B1 Independent Worksheet 3 to provide students with more practice writing and solving equations.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Writing & Solving Equations

An *equation* is a mathematical sentence we use to show that two expressions are equal. Look at the examples below. For each equation, identify the two expressions, and decide whether or not they are equal. Remember to use order of operations.

**examples**  $2 + 5 = 7$

$3 \times 6 = 29 - 11$

$1 + 6 \times 5 = 35$

$40 = 3 \times 15 - 5$

To solve an equation, find the value of the variable that will make both expressions equal.

**1** Solve each of the equations below:

$4 + r = 14 \quad r = \underline{\quad\quad}$  How did you solve it?

$125 \div m = 5 \quad m = \underline{\quad\quad}$  How did you solve it?

$z \times 6 = 600 \quad z = \underline{\quad\quad}$  How did you solve it?

To write an equation, think about which two amounts are equal, and write an expression for each amount.

**example** Jake had 34 marbles. He gave some to his brother. Now Jake has 18 marbles. How many marbles did Jake give to his brother?

$$34 - m = 18$$

**2** Write and solve an equation for each of the word problems below:

**a** Amber had 64 beads. She bought some more beads. Now she has 102 beads. How many beads did Amber buy?

**b** Mr. Smith had 100 pencils. He divided the pencils evenly among all of his students. Each student got 4 pencils. How many students are there in Mr. Smith's class?

**c** T-shirts are on sale at the mall for \$12 each. Jasmin and her mom got shirts for the whole family. Their total was \$120. How many shirts did they buy?

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Algebra Puzzles, Game 1

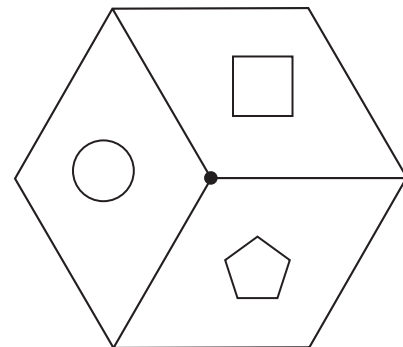
## Game Rules

1. Copy the numbers in the puzzle onto your own record sheet. Then work together to solve the puzzle and record the value of each shape below the puzzle box.

2. Each team spins for a shape. (Spin again if both teams get the same shape.)

3. Circle the shape at the bottom of the Puzzle 1 box with your team's color. Your team scores the value of the shape you spun.

4. Repeat steps 1–3 for all four puzzles. Both teams add up their points. The team with the highest score wins.



Red Team	Blue Team
<p><b>1</b> <math>\bigcirc + 15 = 30</math>  <math>\bigcirc \div \text{pentagon} = 3</math>  <math>(\bigcirc + \text{pentagon}) \times \square = 200</math></p>	<p><b>2</b> <math>4 \times \bigcirc = 24</math>  <math>\bigcirc + \square = 26</math>  <math>(\square - \bigcirc) \div \text{pentagon} = 2</math></p>
<p><math>\bigcirc = \underline{\quad}</math> <math>\square = \underline{\quad}</math> <math>\text{pentagon} = \underline{\quad}</math></p>	<p><math>\bigcirc = \underline{\quad}</math> <math>\square = \underline{\quad}</math> <math>\text{pentagon} = \underline{\quad}</math></p>
<p><b>3</b> <math>3 \times \bigcirc = 15</math>  <math>\square \div \bigcirc = 5</math>  <math>\bigcirc + \text{pentagon} \times \square = 105</math></p>	<p><b>4</b> <math>100 - \bigcirc = 65</math>  <math>\bigcirc \div \square = 5</math>  <math>(\bigcirc - \square) \div \text{pentagon} = 7</math></p>
<p><math>\bigcirc = \underline{\quad}</math> <math>\square = \underline{\quad}</math> <math>\text{pentagon} = \underline{\quad}</math></p>	<p><math>\bigcirc = \underline{\quad}</math> <math>\square = \underline{\quad}</math> <math>\text{pentagon} = \underline{\quad}</math></p>
<p>Red Team Total Score _____</p>	<p>Blue Team Total Score _____</p>

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Algebra Puzzles, Game 2

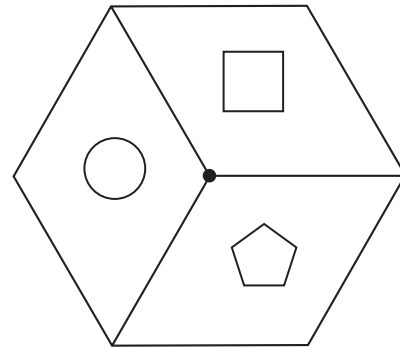
### Game Rules

1. Copy the numbers in the puzzle onto your own record sheet. Then work together to solve the puzzle and record the value of each shape below the puzzle box.

2. Each team spins for a shape. (Spin again if both teams get the same shape)

3. Circle the shape at the bottom of the Puzzle 1 box with your team's color. Your team scores the value of the shape you spun.

4. Repeat steps 1–3 for all four puzzles. Both teams add up their points. The team with the highest score wins.



Red Team	Blue Team
<b>1</b> $\bigcirc + 15 = 27$ $(\square - \bigcirc) \times 3 = 45$ $\text{pentagon} \times \bigcirc + \square = 147$	<b>2</b> $14 \div \bigcirc = 2$ $\bigcirc \times 3 + \square = 25$ $\text{pentagon} \div (\bigcirc - \square) = 10$
$\bigcirc = \underline{\quad}$ $\square = \underline{\quad}$ $\text{pentagon} = \underline{\quad}$	$\bigcirc = \underline{\quad}$ $\square = \underline{\quad}$ $\text{pentagon} = \underline{\quad}$
<b>3</b> $\bigcirc - 15 = 25$ $\bigcirc \div \square = 5$ $\square \times \text{pentagon} - \bigcirc = 16$	<b>4</b> $28 \div \bigcirc = 7$ $\square \div (\bigcirc + 2) = 3$ $(\text{pentagon} + \square) \div \bigcirc = 5$
$\bigcirc = \underline{\quad}$ $\square = \underline{\quad}$ $\text{pentagon} = \underline{\quad}$	$\bigcirc = \underline{\quad}$ $\square = \underline{\quad}$ $\text{pentagon} = \underline{\quad}$
Red Team Total Score _____	Blue Team Total Score _____



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Algebra Puzzles Record Sheet

## Game 1

Red Team	Blue Team
<b>1</b> $\bigcirc + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ $\bigcirc \div \text{pentagon} = \underline{\hspace{1cm}}$ $(\bigcirc + \text{pentagon}) \times \square = \underline{\hspace{1cm}}$	<b>2</b> $\underline{\hspace{1cm}} \times \bigcirc = \underline{\hspace{1cm}}$ $\bigcirc + \square = \underline{\hspace{1cm}}$ $(\square - \bigcirc) \div \text{pentagon} = \underline{\hspace{1cm}}$
$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$	$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$
<b>3</b> $\underline{\hspace{1cm}} \times \bigcirc = \underline{\hspace{1cm}}$ $\square \div \bigcirc = \underline{\hspace{1cm}}$ $\bigcirc + \text{pentagon} \times \square = \underline{\hspace{1cm}}$	<b>4</b> $\underline{\hspace{1cm}} - \bigcirc = \underline{\hspace{1cm}}$ $\bigcirc \div \square = \underline{\hspace{1cm}}$ $(\bigcirc - \square) \div \text{pentagon} = \underline{\hspace{1cm}}$
$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$	$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$
Red Team Total Score _____	Blue Team Total Score _____

## Game 2

Red Team	Blue Team
<b>1</b> $\bigcirc + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ $(\square - \bigcirc) \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ $\text{pentagon} \times \bigcirc + \square = \underline{\hspace{1cm}}$	<b>2</b> $\underline{\hspace{1cm}} \div \bigcirc = \underline{\hspace{1cm}}$ $\bigcirc \times 3 + \square = \underline{\hspace{1cm}}$ $\text{pentagon} \div (\bigcirc - \square) = \underline{\hspace{1cm}}$
$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$	$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$
<b>3</b> $\bigcirc - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ $\bigcirc \div \square = \underline{\hspace{1cm}}$ $\square \times \text{pentagon} - \bigcirc = \underline{\hspace{1cm}}$	<b>4</b> $28 \div \bigcirc = \underline{\hspace{1cm}}$ $\square \div (\bigcirc + \underline{\hspace{1cm}}) = \underline{\hspace{1cm}}$ $(\text{pentagon} + \square) \div \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$	$\bigcirc = \underline{\hspace{1cm}}$ $\square = \underline{\hspace{1cm}}$ $\text{pentagon} = \underline{\hspace{1cm}}$
Red Team Total Score _____	Blue Team Total Score _____



# Set B1 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### Bowling for Equations

**1** Jose is playing a game of Roll-a-Fact with his brother, Marco. On his first roll, Jose got 2, 1, and 4. Below are some of the equations he wrote. Read each and decide if it is true or false according to the order of operations. If an equation is false, rewrite it on the line so it is true.

**ex**  $2 \times 4 - 1 = 6$  T or **F**  $2 \times (4 - 1) = 6$

**a**  $4 \div (1 \times 2) = 2$  T or F \_\_\_\_\_

**b**  $1 + 4 \times 2 = 10$  T or F \_\_\_\_\_

**c**  $4 \times 2 \div 1 = 8$  T or F \_\_\_\_\_

**d**  $4 + 2 - 1 = 5$  T or F \_\_\_\_\_

#### Order of operations

1. Do anything inside parentheses first.
2. Multiply or divide in order, left to right.
3. Add or subtract in order, left to right.

**2** Marco got 4, 2, and  on his first roll. Solve the equations below to figure out the third number Marco rolled. Remember to use the order of operations.

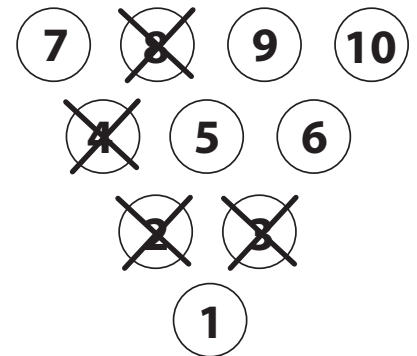
**a**  $2 \times 4 - \square = 2$

**b**  $\square + 4 \div 2 = 8$

**c**  $\square - 4 \div 2 = 4$

**d**  $2 \times \square \div 4 = 3$

**e** Marco rolled 4, 2, and .



**3** Use Marco's 3 numbers to knock over the 1, 5, and 7 pins. Write your equations on the lines below. Cross out the pins.

**a**  $1 = \underline{\hspace{2cm}}$

**b**  $5 = \underline{\hspace{2cm}}$

**c**  $7 = \underline{\hspace{2cm}}$



# Set B1 ★ Independent Worksheet 2



## INDEPENDENT WORKSHEET

### Expressions, Variables & Situations

**1** To evaluate an expression, you have to replace the variable with a number so you can find the answer. Evaluate each of the expressions below.

Expression	Evaluate if $x = 8$	Evaluate if $x = 24$	Evaluate if $x = 400$
<b>ex</b> $3x$	$3 \times 8 = 24$	$3 \times 24 = 72$	$3 \times 400 = 1,200$
<b>a</b> $4x$			
<b>b</b> $x - 8$			
<b>c</b> $x \div 4$			
<b>d</b> $2x + 5$			
<b>e</b> $(x \div 2) + 29$			

**2** Mr. Brown got 3 boxes of envelopes. He gave 4 of the envelopes to his son. Which expression shows how many envelopes Mr. Brown has left?

- $3b \times 4$      
   $3b + 4$      
   $3b \div 4$      
   $3b - 4$

**3** Eloise and Dylan are picking cherries. So far, they have picked 5 boxes of cherries, and Dylan has 2 more cherries in his hand. Which expression shows how many cherries Eloise and Dylan have picked?

- $2b + 5$      
   $5b + 2$      
   $2 \times 5b$      
   $7b$

**4** Write a situation to match each of the expressions below. The variable  $b$  stands for box, but you can choose whatever you want to put in the box.

Expression	Situation
<b>ex</b> $b \div 2$	Kara got a box of jellybeans. She divided the jellybeans evenly with her sister.
<b>a</b> $19 + b$	
<b>b</b> $2b$	
<b>c</b> $b + 12$	



# Set B1 ★ Independent Worksheet 3



## INDEPENDENT WORKSHEET

### Solving & Writing Equations

#### Order of Operations

1. If there are parentheses, do whatever is inside them first.
2. Multiply and divide left to right.
3. Add and subtract from left to right.

**1** Find the answer to each problem below. Use the order of operations. Show your work.

**example**  $25 + 2 \times 6 = \underline{37}$

$$\begin{array}{r} 2 \times 6 = 12 \\ 25 + 12 = 37 \end{array}$$

**a**  $20 \div 4 \times 3 = \underline{\quad}$       **b**  $6 + 15 \div 3 = \underline{\quad}$       **c**  $12 \times (2 + 3) = \underline{\quad}$

**d**  $(12 + 16) \div 7 = \underline{\quad}$       **e**  $14 \times 3 \div 6 = \underline{\quad}$       **f**  $63 \div 9 \times 7 = \underline{\quad}$

**2** Circle the letter to show whether each equation below is true or false. Remember to use the order of operations.

**a**  $25 = 5 \times 3 + 10$       T or F      **b**  $5 \times 4 \times 3 = 4 \times 3 \times 5$       T or F

**c**  $12 - 6 \times 2 = 129 - 129$       T or F      **d**  $100 \div 2 + 3 = 20$       T or F

**e**  $27 = 9 \times 6 \div 2$       T or F      **f**  $3 + 5 \times 8 = 64$       T or F

**3** Solve each of the equations below:

**a**  $z \times 10 = 700$        $z = \underline{\quad}$       **b**  $18 = 3x$        $x = \underline{\quad}$

**c**  $15 + 3 \times 3 = 6y$        $y = \underline{\quad}$       **d**  $120 \div m = 20$        $m = \underline{\quad}$

**Independent Worksheet 3** Solving & Writing Equations (cont.)

**4** Write and solve an equation for each of the word problems below:

**ex** Ebony had 45 stickers. She gave some of the stickers to her sister. Now Ebony has 20 stickers. How many stickers did Ebony give to her sister?

$$45 - s = 20 \quad s = 25 \quad \text{Ebony gave 25 stickers to her sister.}$$

**a** Mrs. Grace had 75 erasers. She divided the erasers evenly among all of her students. Each student got 3 erasers. How many students are there in Mrs. Grace's class?

**b** Bottled water is on sale for \$13 a case. Jon and his mom got several cases for the soccer team. They spent \$65. How many cases of bottled water did they buy?

**c** Mrs. Jones brought 3 of the cases of bottled water to the soccer tournament. There were 72 bottles of water in all. How many bottles were there in each case?

**CHALLENGE**

**5** Solve these algebra puzzles.

<p><b>a</b> <math>3 \times \bigcirc = 27</math>  <math>\square \div \bigcirc = 4</math>  <math>(\bigcirc + \text{pentagon}) \times \square = 360</math></p>	<p><b>b</b> <math>200 \div \bigcirc = 20</math>  <math>\bigcirc \times \square = 600</math>  <math>\square - \bigcirc \div \text{pentagon} = 58</math></p>
<p><math>\bigcirc = \underline{\quad}</math> <math>\square = \underline{\quad}</math> <math>\text{pentagon} = \underline{\quad}</math></p>	<p><math>\bigcirc = \underline{\quad}</math> <math>\square = \underline{\quad}</math> <math>\text{pentagon} = \underline{\quad}</math></p>

**6** Circle the word to show whether each equation below is true or false.

**a**  $47 = 3n + 2$  if the value of  $n$  is 15.      T or F

**b**  $4z \div (3 + 3) = 10$  if the value of  $z$  is 12.      T or F





# GRADE 4 SUPPLEMENT

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## Set C1 Geometry: Parallel, Perpendicular & Intersecting

### Includes

Activity 1: Dots & Lines	C1.1
Independent Worksheet 1: Lines & Designs	C1.9
Independent Worksheet 2: Alphabet Lines	C1.11

### Skills & Concepts

- ★ identify, compare, and analyze attributes of two-dimensional shapes
- ★ identify and describe parallel, perpendicular, and intersecting lines in two-dimensional shapes

**Bridges in Mathematics Grade 4 Supplement**

**Set C1** Geometry: Parallel, Perpendicular & Intersecting

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at [www.mathlearningcenter.org](http://www.mathlearningcenter.org).

# Set C1 ★ Activity 1



## ACTIVITY

### Dots & Lines

#### Overview

Students review the terms *parallel*, *intersecting*, and *perpendicular*, and then play a game with the teacher to practice building and drawing parallel and perpendicular lines.

#### Skills & Concepts

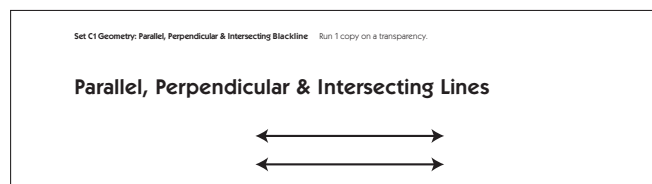
- ★ identify, compare, and analyze attributes of two-dimensional shapes
- ★ identify and describe parallel, perpendicular, and intersecting lines in two-dimensional shapes

#### You'll need

- ★ Parallel, Perpendicular & Intersecting Lines (page C1.5, run 1 copy on a transparency)
- ★ Dots & Lines Gameboard (page C1.6, run 1 copy on a transparency)
- ★ Dots & Lines Game Record Sheet (page C1.7, run a class set)
- ★ single spinner overlay
- ★ black overhead pen
- ★ a piece of paper to mask parts of the overhead
- ★ game markers (16 red and 16 blue)
- ★ 10 red and 10 blue rubber bands
- ★ geoboards and rubber bands (class set)
- ★ a red and a blue colored pencil or marker for each student

#### Instructions for Dots & Lines

1. Display the top portion of Parallel, Perpendicular & Intersecting Lines, keeping the rest of the overhead covered for now. Ask students to pair-share any mathematical observations they can make about the display. Then invite volunteers to share their ideas with the class.



**Students** *There are 2 straight lines up there and they both have arrows at the ends. I think they're never going to cross. They're kind of like train tracks. Those lines are parallel. I know because you can tell they won't cross.*

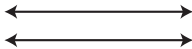
2. Reveal the information below the 2 parallel lines on the overhead and read it with the class. Then give each student a geoboard and rubber bands. Ask them to build examples of parallel lines on their boards and share them with the people sitting nearest them.

## Activity 1 Dots &amp; Lines (cont.)

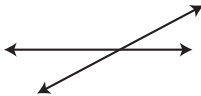
3. Repeat steps 1 and 2 until you've reviewed all the information on the overhead. Be sure students take note of the square drawn at the intersection of the perpendicular lines. This is used to indicate that the two lines are crossing each other at right angles.

Set C1 Geometry: Parallel, Perpendicular & Intersecting Blackline Run 1 copy on a transparency.

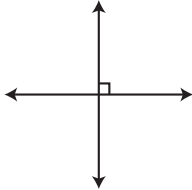
### Parallel, Perpendicular & Intersecting Lines



**Parallel Lines** are lines that are always the same distance apart. They will never cross or intersect. Can you explain why? Make 2 parallel lines on your geoboard. Make 3 lines on your geoboard that are all parallel.



**Intersecting Lines** are lines that intersect or cross each other. Make 2 intersecting lines on your geoboard.



**Perpendicular Lines** are special intersecting lines. Where they cross, they form a right angle. Make 2 lines on your geoboard that are perpendicular.

4. Collect students' geoboards and bands, and give them each a Dots & Lines Record Sheet. Explain that you're going to play a game that will help them remember the terms you just reviewed. They'll play as the Red Team against you, and you'll play as the Blue Team. Have them record the team color assignments on their sheet while you do so on the Dots & Lines Gameboard overhead.

5. Place the spinner overlay on top of the spinner and set a clear geoboard below the spinner. Use your overhead pen to draw a black line either vertically or horizontally across the board, following one of the lines of pegs. This is the *starting line*. Make an asterisk beside the line. Ask students to use a regular pencil to draw a line in the same location on their record sheet and mark it with an asterisk.

6. Explain that you're going to take the first turn so students can see how to play the game. Spin the spinner. Read the results with the class, and use a blue rubber band to build a line all the way across the board, either parallel or perpendicular to the starting line, depending on what the spinner indicated. Ask students to use a blue pencil or marker to record the results of your turn on their sheets.

**Teacher** Okay, the spinner landed on "parallel." That means I have to use a blue rubber band to make a line that's parallel to the starting line. I can put it anywhere on the board, as long as it's parallel to that line, but I think I'll put it right beside the starting line.

Activity 1 Dots & Lines (cont.)

Set C1 Geometry: Parallel, Perpendicular & Intersecting Blackline Run 1 copy on a transparency.

### Dots & Lines Gameboard

Blue Team Mr. R Red Team The Kids

Set C1 Geometry: Parallel, Perpendicular & Intersecting Blackline Run a class set. NAME Shantell DATE 1/26

### Dots & Lines Game Record Sheet

Blue Team Mr. R Red Team The Kids

<p><b>Game 1</b></p> <p>Score: Blue _____ Red _____</p>	<p><b>Game 2</b></p> <p>Score: Blue _____ Red _____</p>
<p><b>Game 3</b></p> <p>Score: Blue _____ Red _____</p>	<p><b>Game 4</b></p> <p>Score: Blue _____ Red _____</p>

7. Before students take their turn, explain that the object of the game is to capture the most small squares (i.e., squares without any pegs between their corners). Anytime a team forms 1 or more squares during their move, you'll mark those squares with game markers in the team's color. Ask them if they think they'll be able to form a square during this turn.

*Isaac* Nope. If we land on "parallel" there will just be 3 parallel lines in a row on the board. If we land on "perpendicular" we can build a line across, but it won't make a square, no matter where we put it.

*Erica* Mr. R might be able to make a square on his next turn. I think it's better to be the first team to go.

8. Have students take their turn, and then take turns back and forth until no more rubber bands can be placed and all 16 squares have been formed. If a team spins "parallel" and all the lines parallel to the starting line have already been made, they lose that turn.

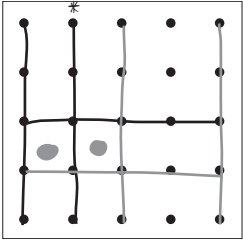
It's possible to form more than 1 square during a single move, and students may get more strategic about where they're placing their rubber bands as the game proceeds. Be sure to mark the squares with game markers and have students use colored dots to mark them on their record sheets. The sample record sheet on the next page shows how the game might look midway through and again at the end.

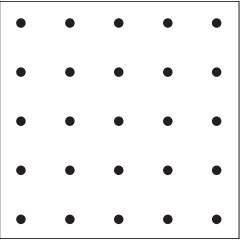
## Activity 1 Dots &amp; Lines (cont.)

Set C1 Geometry: Parallel, Perpendicular & Intersecting Blackline Run a class set.  
 NAME Shantell DATE 1/26

### Dots & Lines Game Record Sheet

Blue Team Mr. R Red Team The Kids

Game 1  


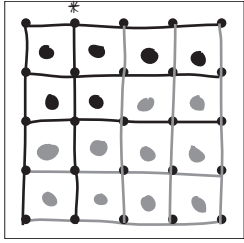
Game 2  


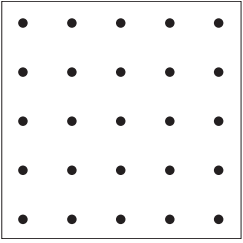
Score: Blue \_\_\_\_\_ Red \_\_\_\_\_

Set C1 Geometry: Parallel, Perpendicular & Intersecting Blackline Run a class set.  
 NAME Shantell DATE 1/26

### Dots & Lines Game Record Sheet

Blue Team Mr. R Red Team The Kids

Game 1  


Game 2  


Score: Blue 10 Red 6

**Students** *Mr. R really lucked out on that last move.*

*Too bad he didn't get "parallel" that last time. Then it would have been our turn again, and if we'd gotten "perpendicular" we would have won.*

*Can we play it again?*

9. Dots & Lines goes very quickly, and students have room to record the results of 4 games. Take turns with the class to be the starting team. The team that starts first gets to erase the starting line and draw a new one anywhere they want on the board.

Here are a few important rules to remember about Dots & Lines:

- The starting line has to go all the way across the board, either horizontally or vertically.
- A rubber band can be placed anywhere on the board, as long as it's oriented correctly with respect to the starting line.
- Rubber bands have to go all the way across the board.
- The object of the game is to capture the most small squares; squares that have pegs between corners are not allowed.
- Remember to mark every square a team forms on a given turn.
- Count the squares captured by each team at the end of the game to determine the winner.

### Extensions

- If your students enjoy this game, run another set of the record sheets and play it again. A single game makes a nice sponge activity, and you can have students save their record sheets for repeated use over the course of a week.
- Challenge students to explain why there are no intersecting lines *that are not perpendicular* in this game.
- Leave the materials out, along with extra copies of the record sheet so students can play the game with each other at the overhead during their free time.



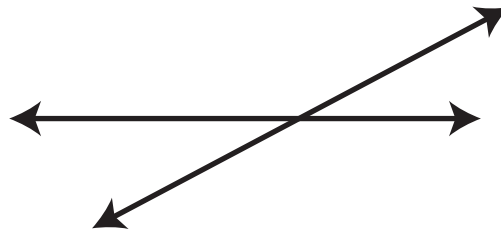
### INDEPENDENT WORKSHEET

See Set C1 Independent Worksheets 1 and 2 for more practice identifying and describing parallel, perpendicular, and intersecting lines using concrete objects and pictorial models.

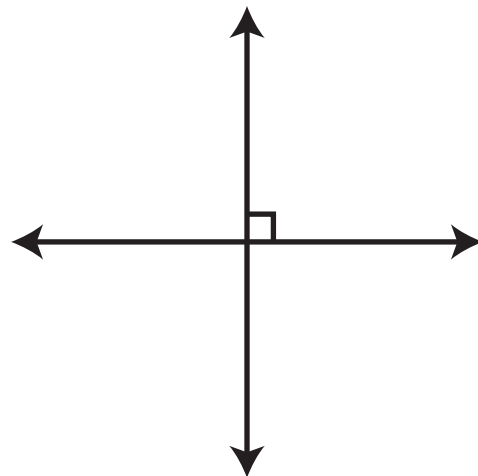
## Parallel, Perpendicular & Intersecting Lines



**Parallel Lines** are lines that are always the same distance apart. They will never cross or intersect. Can you explain why? Make 2 parallel lines on your geoboard. Make 3 lines on your geoboard that are all parallel.



**Intersecting Lines** are lines that intersect or cross each other. Make 2 intersecting lines on your geoboard.

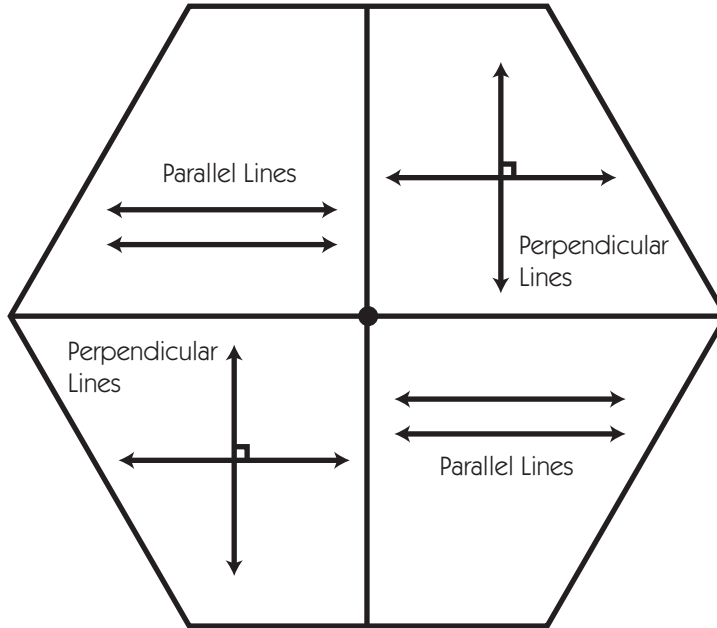


**Perpendicular Lines** are special intersecting lines. Where they cross, they form a right angle. Make 2 lines on your geoboard that are perpendicular.

# Dots & Lines Gameboard

Blue Team \_\_\_\_\_

Red Team \_\_\_\_\_





NAME \_\_\_\_\_

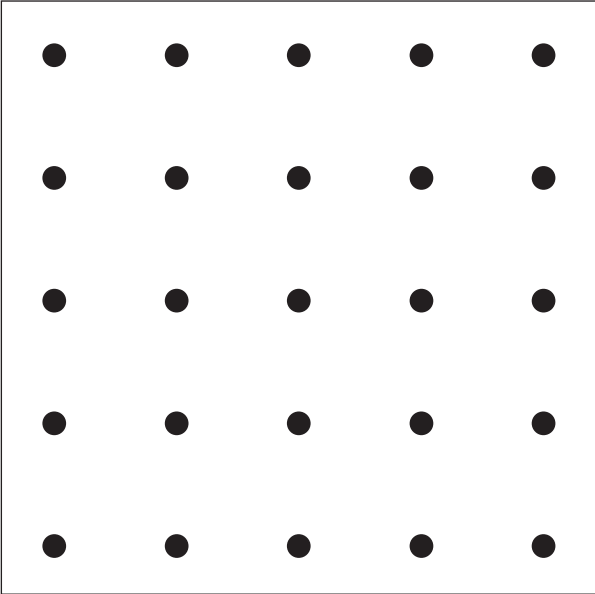
DATE \_\_\_\_\_

# Dots & Lines Game Record Sheet

Blue Team \_\_\_\_\_

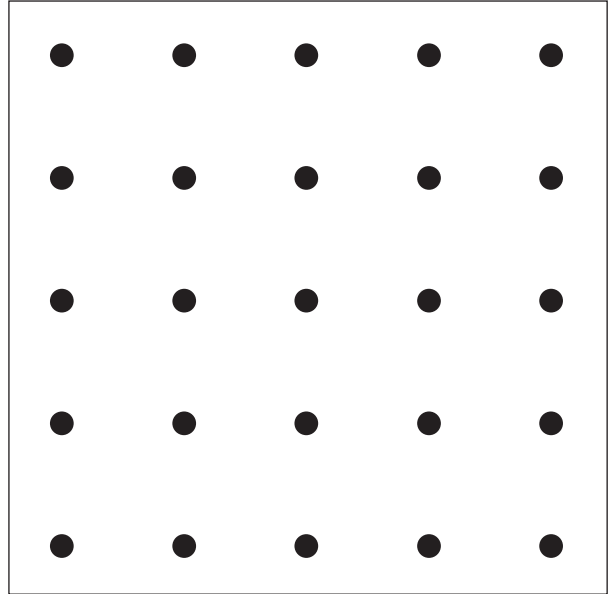
Red Team \_\_\_\_\_

## Game 1



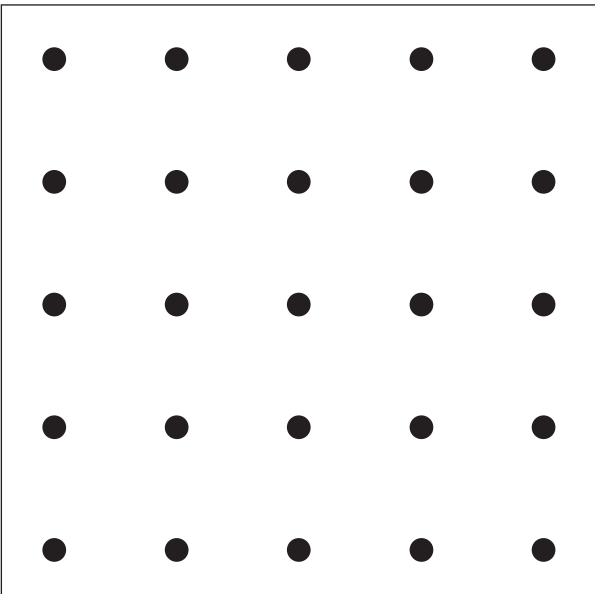
Score: Blue \_\_\_\_\_ Red \_\_\_\_\_

## Game 2



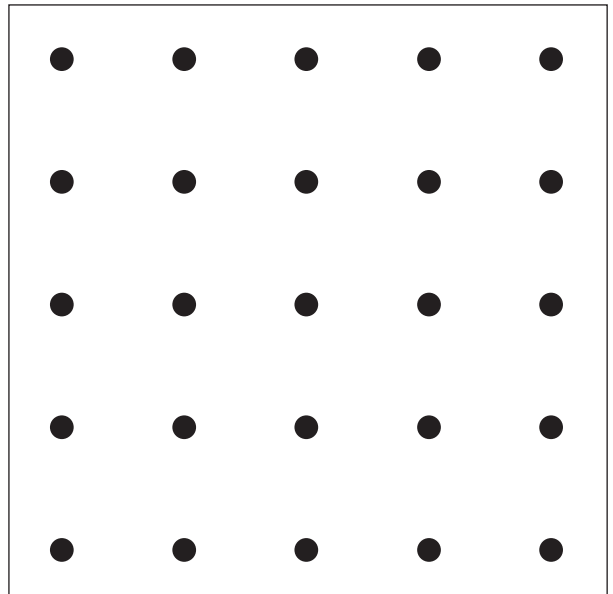
Score: Blue \_\_\_\_\_ Red \_\_\_\_\_

## Game 3



Score: Blue \_\_\_\_\_ Red \_\_\_\_\_

## Game 4



Score: Blue \_\_\_\_\_ Red \_\_\_\_\_



NAME \_\_\_\_\_

DATE \_\_\_\_\_



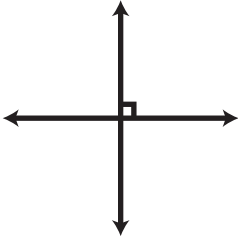
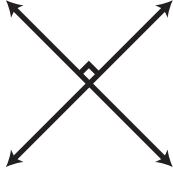
# Set C1 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### Lines & Designs

1 Fill in the bubbles in front of the words that describes each set of lines below. Then explain your answer. How do you know? The first one is done for you.

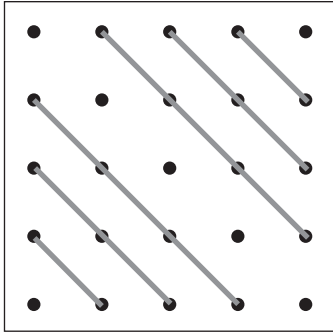
<p><b>example</b></p>  <p> <input checked="" type="radio"/> intersecting lines  <input type="radio"/> parallel lines  <input type="radio"/> perpendicular lines         </p> <p>How do you know?          I know these are intersecting lines because they cross. I know they're not perpendicular because they don't cross at right angles.</p>	<p><b>a</b></p>  <p> <input type="radio"/> intersecting lines  <input type="radio"/> parallel lines  <input type="radio"/> perpendicular lines         </p> <p>How do you know?</p>
<p><b>b</b></p>  <p> <input type="radio"/> intersecting lines  <input type="radio"/> parallel lines  <input type="radio"/> perpendicular lines         </p> <p>How do you know?</p>	<p><b>c</b></p>  <p> <input type="radio"/> intersecting lines  <input type="radio"/> parallel lines  <input type="radio"/> perpendicular lines         </p> <p>How do you know?</p>

(Continued on back.)

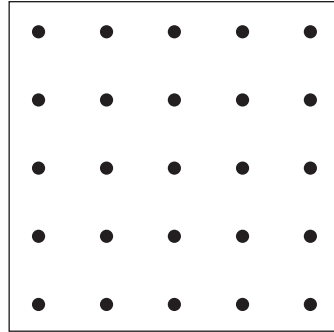
**Independent Worksheet 1** Lines & Designs (cont.)

**2** Get a geoboard and some colored rubber bands. Use them to make each of the designs described below. Then use regular and colored pencils to record your work on this sheet.

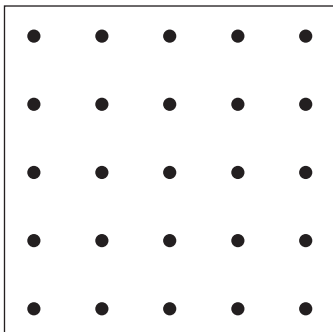
**example** Make a design with 6 gray parallel lines.



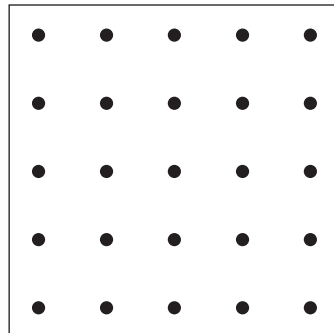
**a** Make a design with 6 red intersecting lines.



**b** Make a horizontal blue line all the way across the board. Then add 4 green lines that are all perpendicular to the blue line.



**c** Make a yellow diagonal line all the way across the board. Then add 4 blue lines that intersect with the yellow line.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

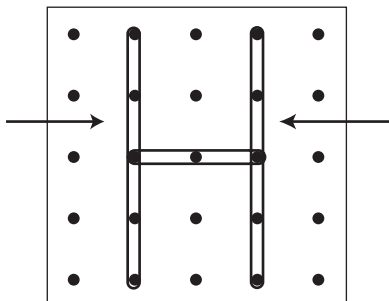
# Set C1 ★ Independent Worksheet 2



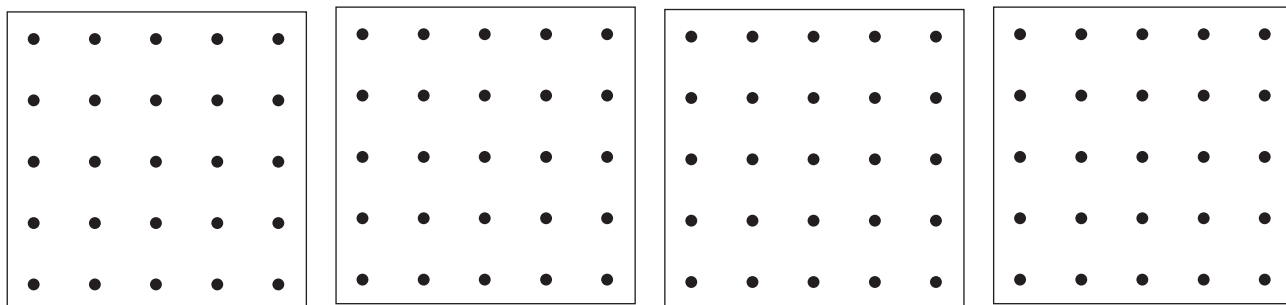
## INDEPENDENT WORKSHEET

### Alphabet Lines

**1** The kids in Mrs. Odell’s fourth grade were learning about different kinds of lines. Hector made the letter H on his geoboard and said, “Hey look! These 2 lines I’m pointing to are parallel.”



**a** Get a geoboard and some colored rubber bands. On your geoboard, make 4 other capital letters that have 2 or 3 parallel lines in them. Use red rubber bands to make the lines that are parallel to each other. Use a ruler and colored pencils to record your work below. Show the parallel lines in red.

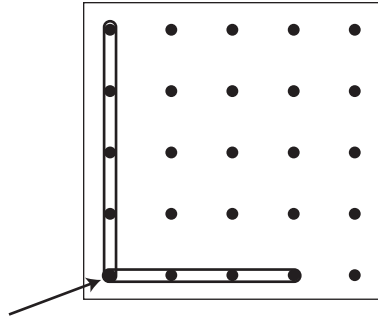


**b** How do you know for sure that the lines you made in red are parallel?

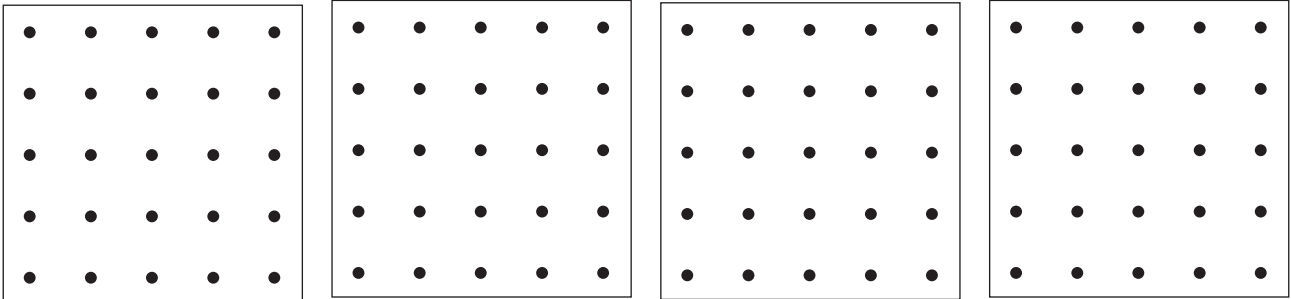
(Continued on back.)

**Independent Worksheet 2** Alphabet Lines (cont.)

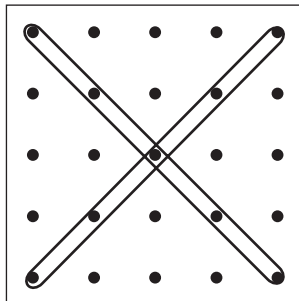
**2** Then Lani said, “The two lines in the first letter of my name are perpendicular. You can see that they meet at a right angle on the board.”



On your geoboard, make 4 other capital letters that have perpendicular lines. Record your work below. Draw arrows to show where the lines meet at right angles.



**3** Then Xavier said, “I think the first letter of my name has intersecting lines.”



**a** Do you agree with him? Why or why not? If you do, draw an arrow to show where the 2 lines intersect.

(Continued on next page.)

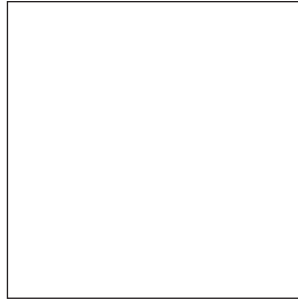
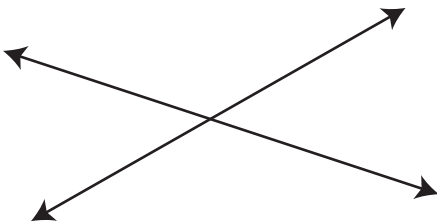
NAME \_\_\_\_\_

DATE \_\_\_\_\_

**Independent Worksheet 2** Alphabet Lines (cont.)**3b** Circle the letter that has 2 intersecting lines.

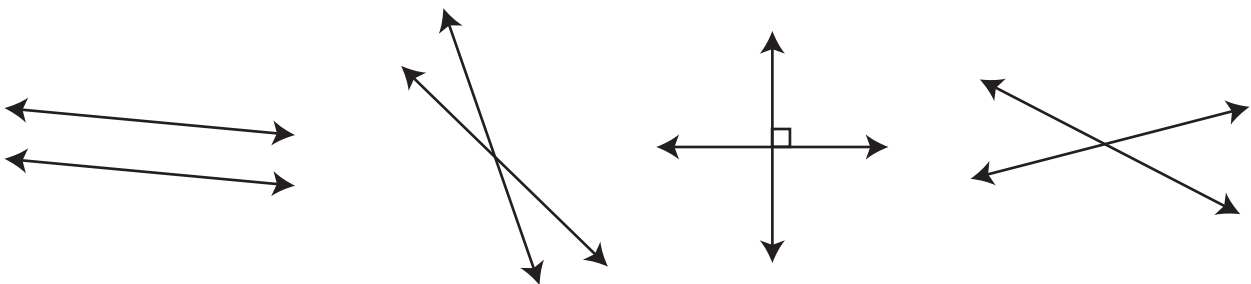
c      j      x      i      s      l

**4** Write the first letter of your first name in this box. Label it to show any lines that are parallel, perpendicular, or intersecting. If the first letter of your first name is completely curved (like O or C), choose a different letter in your first or last name that has straight lines.

**CHALLENGE****5** Circle True or False to show which statements below correctly describe these lines.

- a** The two lines above are parallel.      True      False
- b** The two lines above are perpendicular.      True      False
- c** The two lines above are intersecting.      True      False

**6** Two lines that are not parallel and not perpendicular are called oblique lines. Circle all the pairs of oblique lines below.









# GRADE 4 SUPPLEMENT

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## Set C2 Geometry: 2- & 3-Dimensional Shapes

### Includes

Independent Worksheet 1: Analyzing Quadrilaterals & Drawing Figures	C2.1
Independent Worksheet 2: Quadrilaterals & Transformations	C2.5
Independent Worksheet 3: Nets & Quadrilaterals	C2.9
Independent Worksheet 4: Illustrating Paths & Angles	C2.11

### Skills & Concepts

- ★ analyze the quadrilaterals, such as squares, rectangles, trapezoids, rhombuses, and parallelograms, according to their properties
- ★ analyze the relationship between three-dimensional geometric shapes in the form of cubes, rectangular prisms, and cylinders and their two-dimensional nets
- ★ represent the two-dimensional shapes trapezoids, rhombuses, and parallelograms and the three-dimensional shapes cubes, rectangular prisms, and cylinders
- ★ represent points, lines, line segments, rays, angles, and polygons
- ★ illustrate possible paths from one point to another along vertical and horizontal grid lines in the first quadrant of the coordinate plane
- ★ use appropriate tools to measure objects to the nearest unit: quarter and eighth inches, centimeters, and millimeters.
- ★ compare angle measures with referent angles of 45 degrees, 90 degrees, and 180 degrees to estimate angle measures

**Bridges in Mathematics Grade 4 Supplement**

**Set C2** Geometry: 2- & 3-dimensional Shapes

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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P0509

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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# Set C2 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### Analyzing Quadrilaterals & Drawing Figures

A quadrilateral is any polygon that has 4 sides. There are many kinds of quadrilaterals, including:



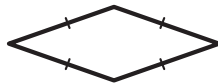
**trapezoid** a quadrilateral with exactly 1 pair of parallel sides



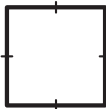
**parallelogram** a quadrilateral with 2 pairs of parallel sides



**rectangle** a parallelogram with 4 right angles



**rhombus** a parallelogram with 4 congruent sides



**square** a parallelogram with 4 congruent sides and 4 right angles

**1** Use a ruler marked in inches to draw the following figures in the boxes below.






**a** A trapezoid with one side that is  $1\frac{1}{8}$  inches long

**b** A parallelogram with two sides that are each  $1\frac{3}{4}$  inches long

(Continued on back.)

**Independent Worksheet 1** Analyzing Quadrilaterals & Drawing Figures (cont.)

**2** Look carefully at the figures below. Decide how many right angles, pairs of parallel sides, and pairs of congruent sides each has. Then circle the words that describe what kind of figure it is. You might circle more than one word for some figures.

Figure	Right angles	Pairs of congruent sides (Measure to nearest millimeter to be sure.)	Pairs of parallel sides	Word(s) that describe(s) the figure
a 				trapezoid square parallelogram, rectangle rhombus
b 				trapezoid square parallelogram, rectangle rhombus
c 				trapezoid square parallelogram, rectangle rhombus
d 				trapezoid square parallelogram, rectangle rhombus
e 				trapezoid square parallelogram, rectangle rhombus

(Continued on next page.)

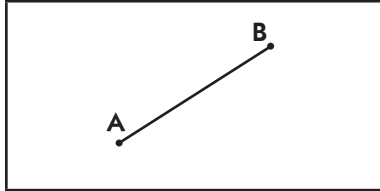
NAME \_\_\_\_\_

DATE \_\_\_\_\_

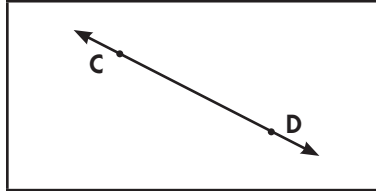
**Independent Worksheet 1** Analyzing Quadrilaterals & Drawing Figures (cont.)

**3** Use a ruler marked in centimeters and millimeters to draw the line segments, lines, and rays described below. For each one, mark the two points and make sure to use arrows correctly for rays and lines.

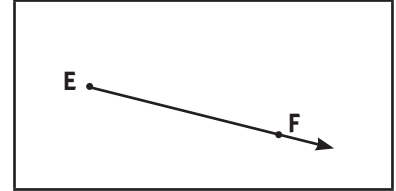
A **line segment** connects two points.



A **line** passes through two points and keeps going in both directions.



A **ray** begins at one point and keeps going in just one direction.



<p><b>a</b> A line segment that is 3 cm long.</p>	<p><b>b</b> A line segment that is 45 mm long.</p>
<p><b>c</b> A line that passes through two points that are 4 cm apart.</p>	<p><b>d</b> A ray that starts at one point and passes through another point that is 35 mm away from the first point.</p>



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set C2 ★ Independent Worksheet 2



## INDEPENDENT WORKSHEET

### Quadrilaterals & Transformations

**1a** Draw a line from each description to the quadrilateral it describes.

**b** Write each word below in the space beside the figure it best describes. Use each word only once.

rectangle

parallelogram

trapezoid

rhombus

It has 4 congruent sides  
and no right angles.



It has 2 pairs of congruent  
sides and no right angles.



It has 1 pair of parallel sides.



It has 2 pairs of congruent  
sides and 4 right angles.




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**2** Use a ruler marked in inches to draw each figure described below.

**a** A parallelogram with 2 sides that are each  $2\frac{3}{8}$  inches long

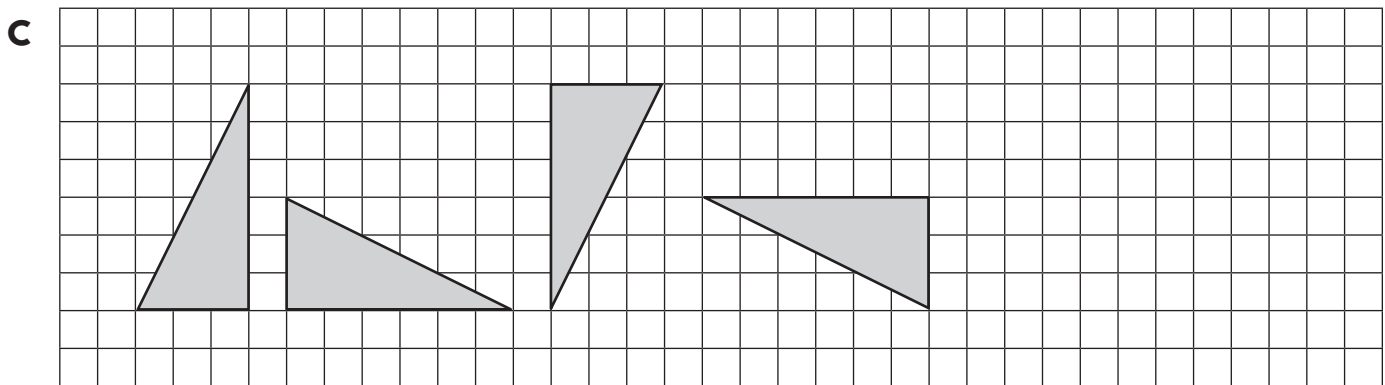
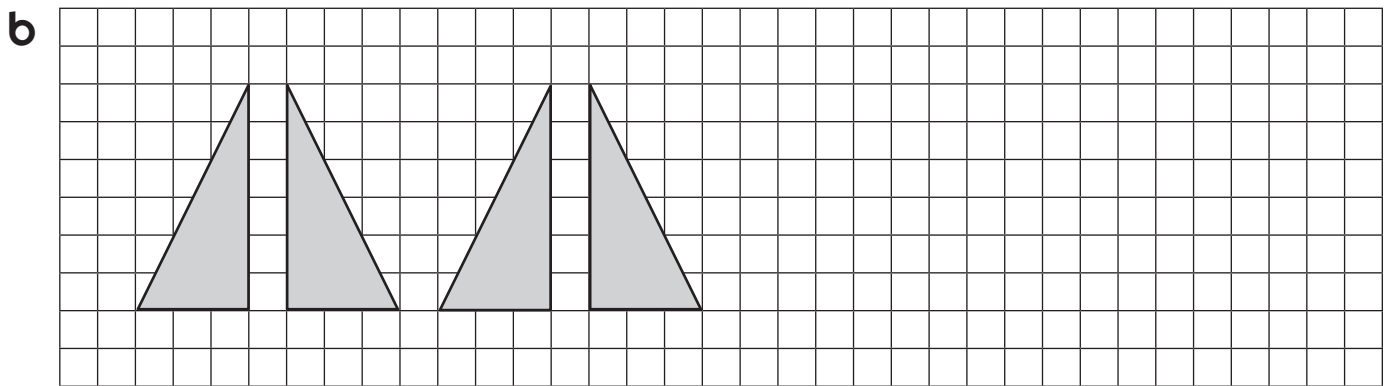
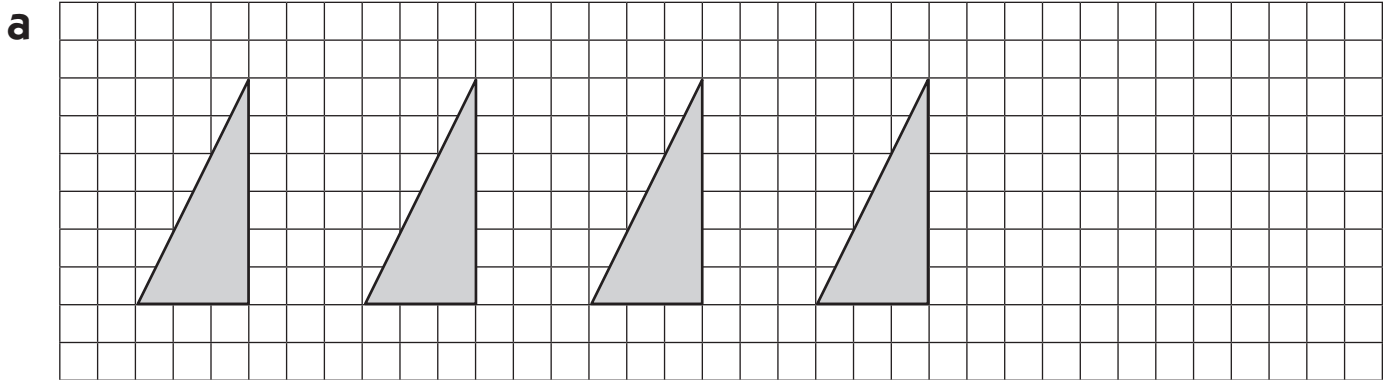
**b** A trapezoid with 1 side that is  $2\frac{3}{4}$  inches long

<p><b>a</b> A parallelogram with 2 sides that are each <math>2\frac{3}{8}</math> inches long</p>	<p><b>b</b> A trapezoid with 1 side that is <math>2\frac{3}{4}</math> inches long</p>
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(Continued on back.)

**Independent Worksheet 2** Quadrilaterals & Transformations (cont.)

**3** The triangles below have been reflected (flipped), rotated (turned), or translated (slid) to make a sequence. Look at each one carefully, and then continue the pattern.



**4** Write the letter of the sequence above to answer each question below.

**a** Which sequence shows reflections (flips)? \_\_\_\_\_

**b** Which sequence shows rotations (turns)? \_\_\_\_\_

**c** Which sequence shows translations (slides)? \_\_\_\_\_

(Continued on next page.)



NAME \_\_\_\_\_

DATE \_\_\_\_\_

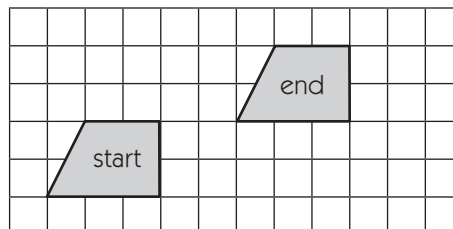
**Independent Worksheet 2** Quadrilaterals & Transformations (cont.)



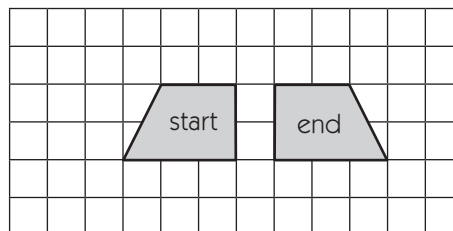
**CHALLENGE**

**5** The trapezoid in each picture has been reflected (flipped), rotated (turned), or translated (slid) three times. Draw a line from each description to the picture it best describes.

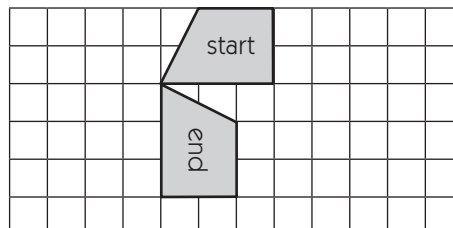
**a** The trapezoid has been reflected horizontally three times.



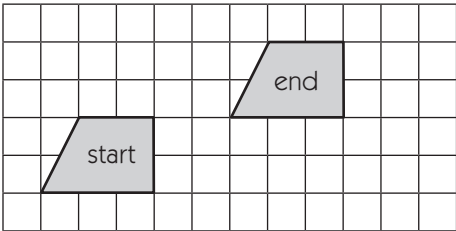
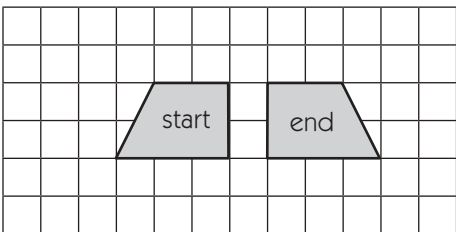
**b** The trapezoid has been rotated 90 degrees three times, going counter-clockwise.



**c** The trapezoid has been translated horizontally, vertically, and then horizontally again.



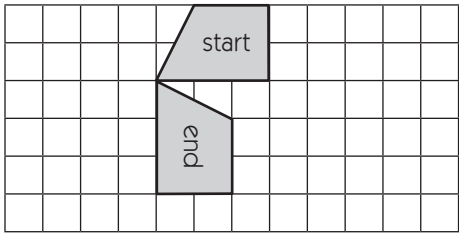
**6** Each transformation above could have been done in just one move instead of three. Describe how you could get the trapezoid from its start position to its end position with just one flip, slide, or turn. Write in the space next to each picture and draw on the picture to help explain your thinking.

<b>a</b>		
<b>b</b>		

(Continued on back.)

**Independent Worksheet 2** Quadrilaterals & Transformations (cont.)

6c



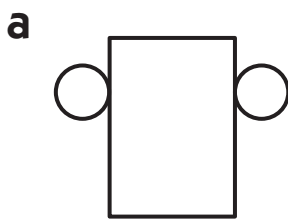
# Set C2 ★ Independent Worksheet 3



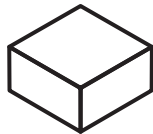
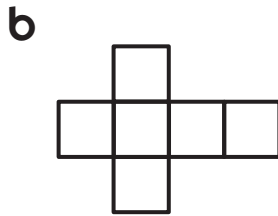
## INDEPENDENT WORKSHEET

### Nets & Quadrilaterals

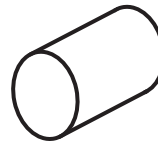
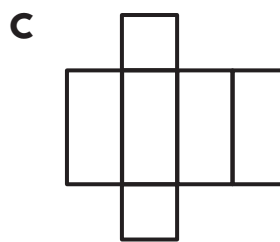
1 Draw a line from each net to the figure it could make if you cut it out and turned it into a 3-dimensional shape.



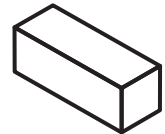
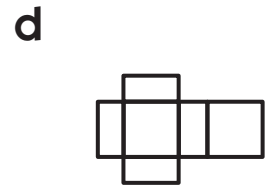
cube



rectangular prism

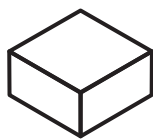


cylinder

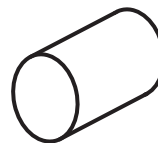


rectangular prism

2 Look carefully at the nets for these two figures.



rectangular prism



cylinder

**a** Write two things about them that are similar.

**b** Write two things about them that are different.

(Continued on back.)

**Independent Worksheet 3** Nets & Quadrilaterals (cont.)

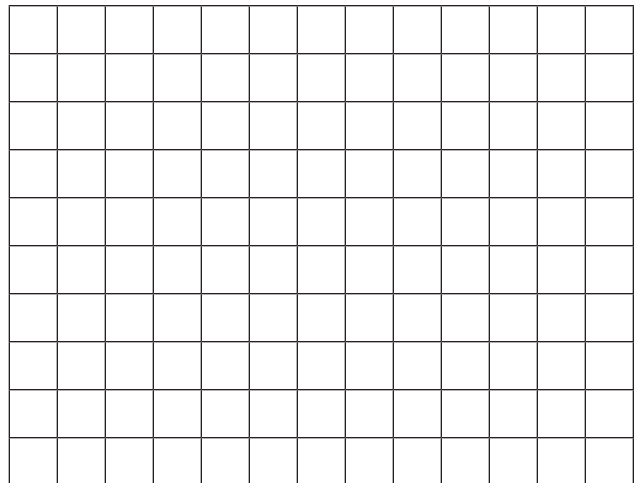
**3** Use a ruler marked in inches to draw the following figures in the boxes below.

**a** A rhombus that is not a square with 4 sides that are each  $1\frac{1}{4}$  inch long.

**b** A parallelogram that is not a rectangle with 2 sides that are each  $2\frac{7}{8}$  inch long.

**CHALLENGE**

**4** Raven says it's impossible for a trapezoid to have parallel sides that are also the same length. Remember that a trapezoid is any quadrilateral with exactly 1 pair of parallel sides. Explain why you agree or disagree with her. Draw on the grid to help explain your answer.



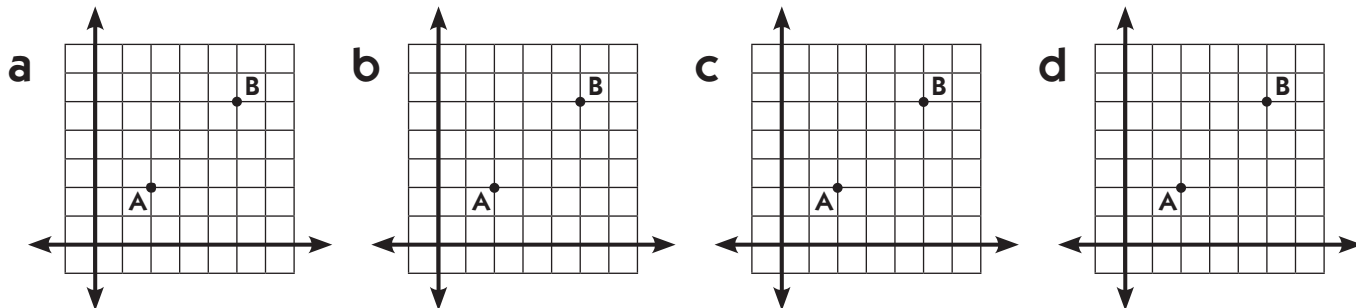
# Set C2 ★ Independent Worksheet 4



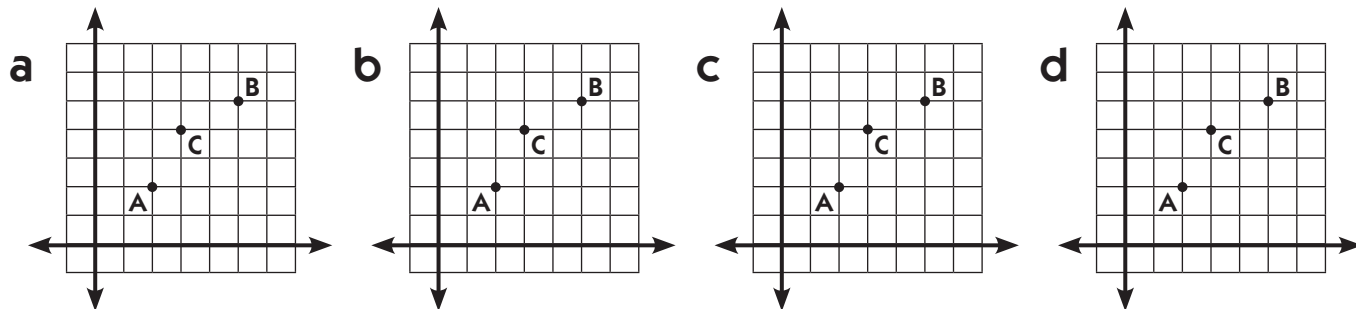
## INDEPENDENT WORKSHEET

### Illustrating Paths & Angles

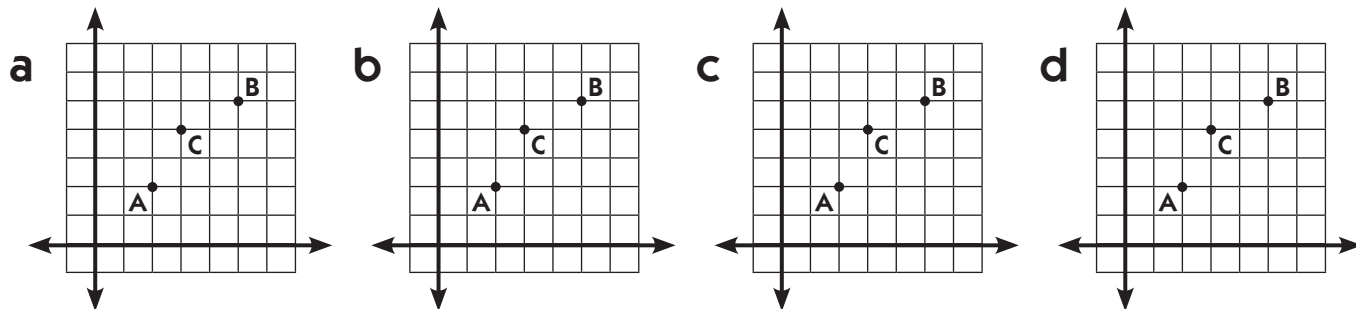
**1** Draw four different paths from point A to point B along the grid lines (no diagonals).



**2** Draw four different paths from point A to point B that also pass through point C. Move along the grid lines only. Do not use diagonals.



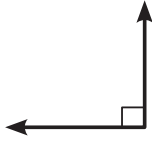
**3** Draw four different paths from point A to point B that do not pass through point C. Move along the grid lines only. Do not use diagonals.



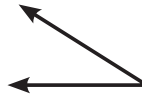
(Continued on back.)

**Independent Worksheet 4** Illustrating Paths & Angles (cont.)

**4** The lines on the grids can help you see right angles and straight angles. Use them to help you estimate and draw some other angle measures. The first side of each angle is drawn for you. Then circle whether the angle you drew is *acute* or *obtuse*.



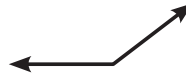
A **right angle** measures exactly 90 degrees.



An **acute angle** measures less than 90 degrees.

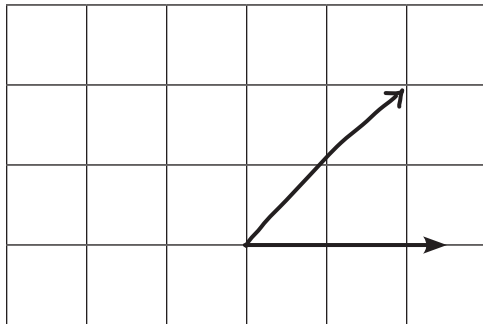


A **straight angle** measures exactly 180 degrees.



An **obtuse angle** measures more than 90 degrees and less than 180 degrees.

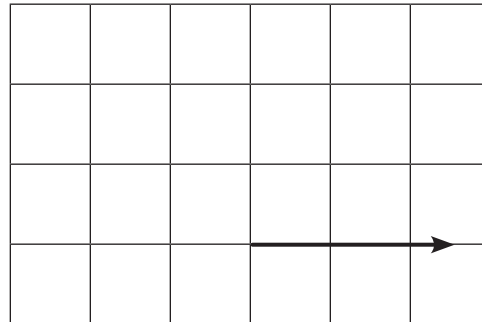
**example** Draw an angle that is *about* 45 degrees.



acute

obtuse

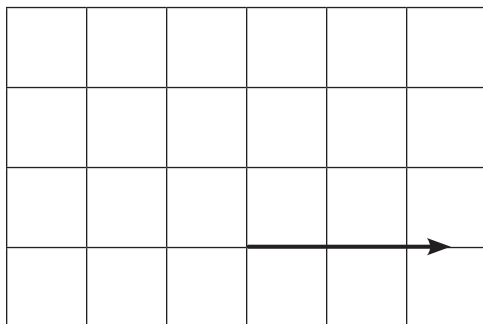
**a** Draw an angle that is *about* 30 degrees.



acute

obtuse

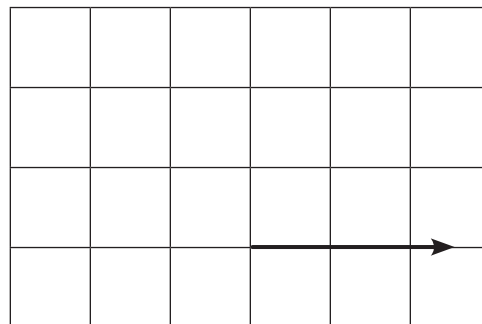
**b** Draw an angle that is *about* 135 degrees.



acute

obtuse

**c** Draw an angle that is *about* 170 degrees.



acute

obtuse



# GRADE 4 SUPPLEMENT

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## Set C3 Geometry: Circles & Angles

### Includes

Activity 1: Pattern Block Angles	C3.1
Activity 2: Human Angles	C3.7
Activity 3: Measuring Circles	C3.13
Independent Worksheet 1: Measuring Interior Angles of Polygons	C3.21
Independent Worksheet 2: Angles in the Classroom	C3.23
Independent Worksheet 3: Drawing Polygons	C3.25
Independent Worksheet 4: Drawing Angles of Rotation	C3.27
Independent Worksheet 5: Drawing & Measuring Circles	C3.29

### Skills & Concepts

- ★ measure angles in geometric figures
- ★ develop benchmark angles including  $60^\circ$ ,  $90^\circ$ , and  $120^\circ$  to estimate angle measurement
- ★ identify the angles associated with different fractions of a complete turn
- ★ identify and describe the center, radius, circumference, and diameter of a circle
- ★ exemplify points and line segments
- ★ use appropriate tools to measure and draw line segments to the nearest quarter-inch, eighth-inch, and millimeter

**Bridges in Mathematics Grade 4 Supplement**

**Set C3** Geometry: Circles & Angles

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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# Set C3 ★ Activity 1



## ACTIVITY

### Pattern Block Angles

#### Overview

Students review the terms right angle, straight angle, and interior angle. Then they use right and straight angles as benchmarks to determine the interior angles of each pattern block. Finally, they use pattern blocks to measure angles of rotation on a clock face and determine the fraction of a complete turn represented by each angle of rotation.

#### Skills & Concepts

- ★ measure angles in geometric figures
- ★ develop benchmark angles including  $60^\circ$ ,  $90^\circ$ , and  $120^\circ$
- ★ identify the angles associated with different fractions of a complete turn

#### You'll need

- ★ a set of pattern blocks for each pair of students consisting of at least: 1 hexagon, 2 trapezoids, 2 squares, 3 triangles, 3 blue rhombuses, and 3 white rhombuses
- ★ pattern blocks for display
- ★ a protractor for each pair of students, plus one for display (Optional. See note below.)
- ★ Pattern Block Angles (page C3.4, 1 copy for display, plus a class set)
- ★ Using Pattern Blocks to Measure Angles on a Clock Face (pages C3.5 and C3.6, 1 copy for display, plus a class set)

**Advance Preparation** Consider assigning student pairs ahead of time so that students who may struggle with spatial relationships are paired with peers who can help them.

**Note** If you have access to protractors and want students to use them, you might have them check their angle measures with protractors at the end of this activity. The deductive reasoning required to determine angle measures without a protractor is very valuable, so don't skip this activity. Also, reasoning about angle measurements will provide students with a reality check as they get accustomed to the conventions of using and reading a protractor properly.

#### Instructions for Pattern Block Angles

1. Begin by displaying a copy of Pattern Block Angles. Explain that today students are going to work in pairs to determine what the measurements of the interior angles of each pattern block are. Review the terms *interior angle* (angle on the inside of a shape), *right angle* (exactly 90 degrees), and *straight angle* (exactly 180 degrees).

2. Now give each pair of students a small set of pattern blocks and 2 copies of Pattern Block Angles. Ask them to talk to each other about how they could use the right and straight angles at the bottom of the page to determine the interior angle measurements of the triangle. Give them a few moments to work,

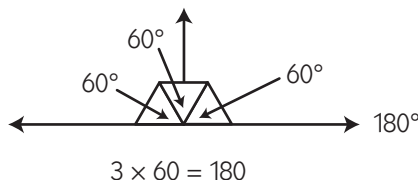
**Activity 1** Pattern Block Angles (cont.)

and then invite a few pairs to share their ideas with the whole group. It's fine if they have not yet calculated the exact angle measurements: the point is to make sure that everyone has some ideas about how to start this activity.

**Students** *We put triangles on the straight angle until they filled it up. These three angles are each a third of a straight angle.*

*A straight angle is  $180^\circ$ , so each of the triangles must be  $60^\circ$ , right?*

*That's what we think because  $3 \times 60$  is 180.*



3. Give students time to work in pairs to determine all the interior angles of the pattern blocks and label them on their sheets. Circulate around the room to see how students are working and to listen to their conversations. If you like, you might ask students to pause so you can share some helpful strategies you've observed. For example, "I saw some people finding angles on some of the pattern blocks that are equal to the angles they'd already figured out on another block. That helped them figure out those angles quickly."

4. If some students finish quite a bit earlier than the rest of the group, you can invite them to tour the room and help others. Ask them to suggest strategies for finding the angle measurements rather than simply sharing the answers with their classmates. You might also ask them to turn over their papers and trace the sides of the pattern blocks to show how they can make other angles by adding the interior angles of different blocks. Here is an example:



We can make a 150-degree angle by putting these two angles together.  $90 + 60 = 150$

5. When students have completed their sheets, reconvene the group and review the page to make sure everyone has their pattern block angles labeled correctly. Explain that they will use the blocks to measure other angles in this activity and the next, so it's important that they are working with the correct angle measures.

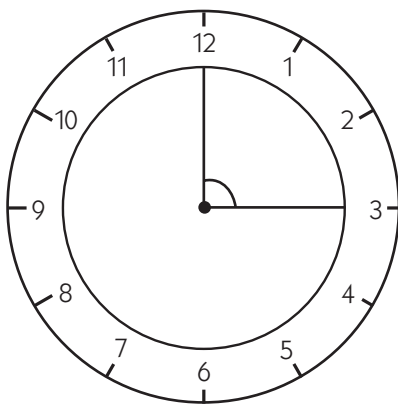
6. Now explain that angles measure the amount of rotation. For example, in the course of an hour, the minute hand on the clock rotates all the way around the clock face. Ask students to follow along using a pencil as you model this on the projector. Start with the pencil at the 12 position and rotate it a full 360 degrees, keeping the eraser anchored in one place so that you're not sliding the pencil, just rotating it about the eraser. Ask students how many degrees they rotated the pencil when they turned it one full turn. (360 degrees) Many students may connect this to a full turn on a skateboard or snowboard, referred to as a 360.

**Activity 1** Pattern Block Angles (cont.)

7. Now ask students to rotate their pencils one-fourth of a full turn. If they start at the 12 position, where does the pencil end up pointing after one-fourth of a turn? (the 3 position)
8. Post the display copy of Using Pattern Blocks to Measure Angles on a Clock Face and read the directions out loud. Explain that the students are now going to use the interior angles of the pattern blocks to measure different angles of rotation on the clock face. Use the square pattern block, and then three white rhombuses, to show how they can measure the example angle with different combinations of pattern blocks.
9. Invite students to ask any questions they might have, and then give them the rest of the period to complete the two pages. If students finish before the period is over, review the sheets as a whole group. If not, review the sheets at the beginning of the next activity in this set.
10. Save, or have students save, their completed sheets for use in Activity 2.

**Extension**

- When reviewing the answers, invite students to express the rotations not only in terms of the fraction of a whole turn, but also as equivalent fractions based on the numbers on the clock face and on the number of degrees. You'll need to gauge your students' comfort level with fractions to determine whether this would be a worthwhile exercise for the group, or for just a few students.



$$\frac{1}{4} = \frac{90}{360} \text{ and } \frac{1}{4} = \frac{3}{12}$$

**INDEPENDENT WORKSHEET**

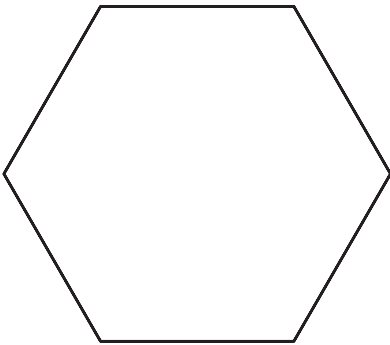
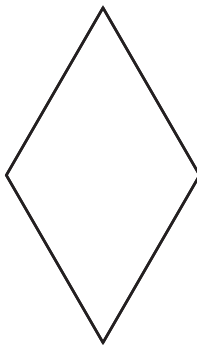
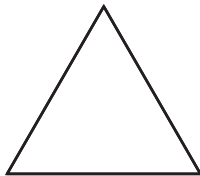


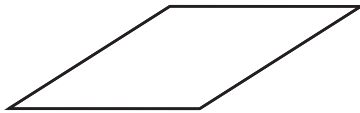
Use Set C3 Independent Worksheet 1 (page C3.21) to provide students with practice measuring the interior angles of polygons using pattern blocks (or protractors if you prefer). Use Independent Worksheet 2 (page C3.23) to provide students with practice estimating angle measures against benchmarks of  $90^\circ$ ,  $60^\circ$ , and  $180^\circ$ . Use Independent Worksheet 3 (pages C3.25 and C3.26) to provide students with practice drawing polygons with specified angles and side lengths.

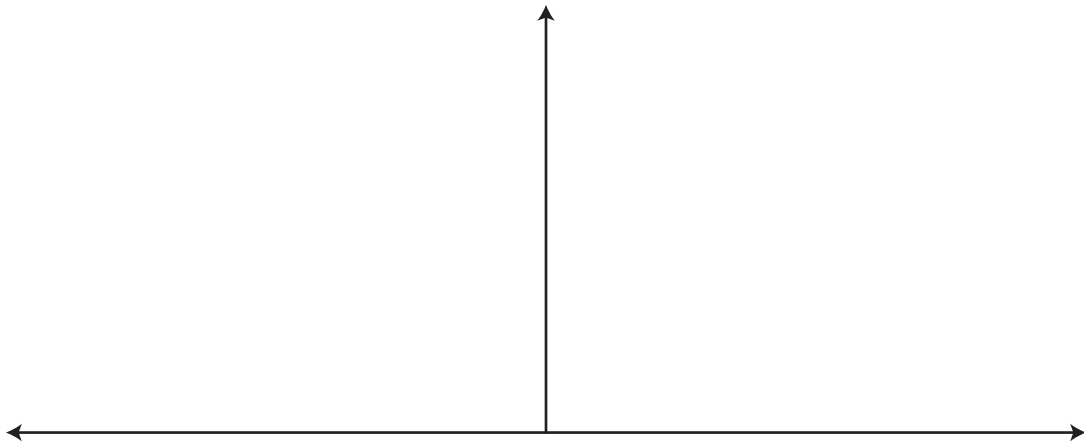
NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Pattern Block Angles

Label the interior angles of each pattern block shown below. Use the straight and right angles below to help determine what the angles are.

<b>1</b> 	<b>2</b> 	<b>3</b> 
<b>4</b> 	<b>5</b> 	<b>6</b> 

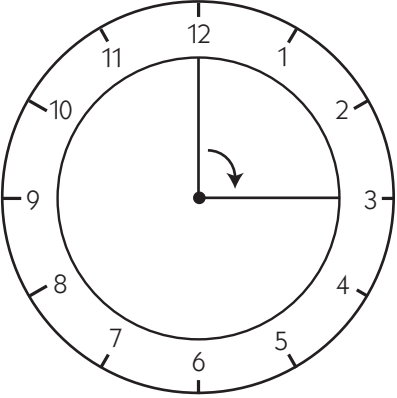
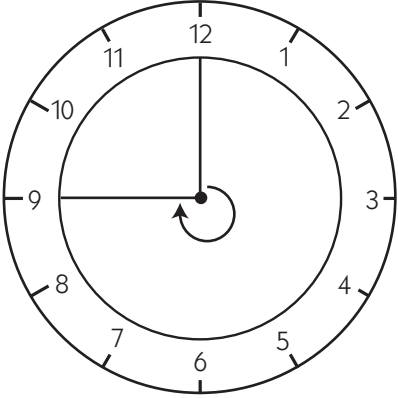
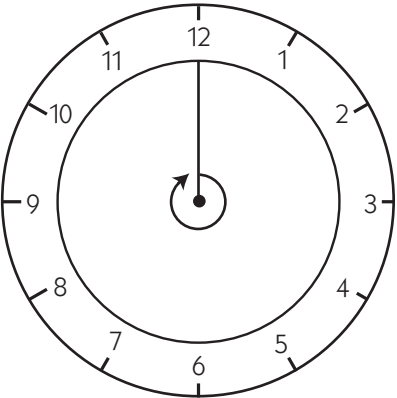
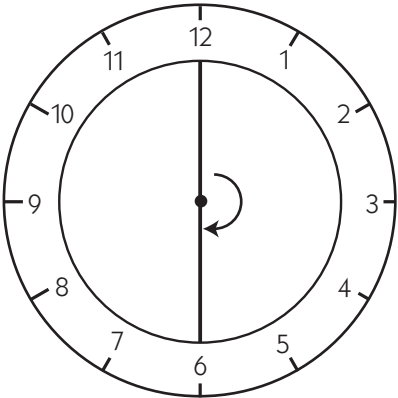


NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Using Pattern Blocks to Measure Angles on a Clock Face

Use your pattern blocks to measure each angle on the clock faces below. Then write the fraction of a whole turn each angle represents.

<p><b>ex a</b> angle measure _____</p> <p><b>b</b> fraction of a whole turn _____</p> 	<p><b>1a</b> angle measure _____</p> <p><b>b</b> fraction of a whole turn _____</p> 
<p><b>2a</b> angle measure _____</p> <p><b>b</b> fraction of a whole turn _____</p> 	<p><b>3a</b> angle measure _____</p> <p><b>b</b> fraction of a whole turn _____</p> 

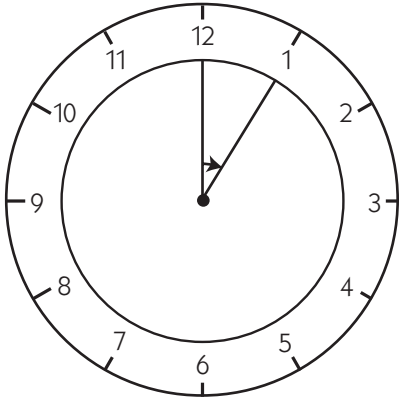
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### Using Pattern Blocks to Measure Angles on a Clock Face (cont.)

Use your pattern blocks to measure each angle on the clock faces below. Then write the fraction of a whole turn each angle represents.

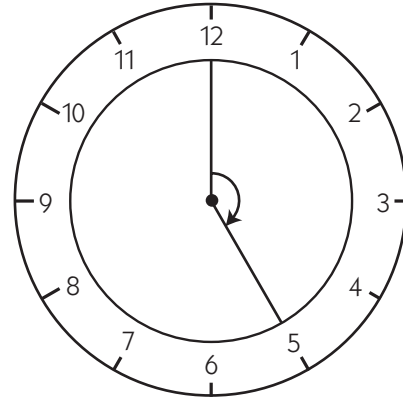
**4a** angle measure \_\_\_\_\_

**b** fraction of a whole turn \_\_\_\_\_



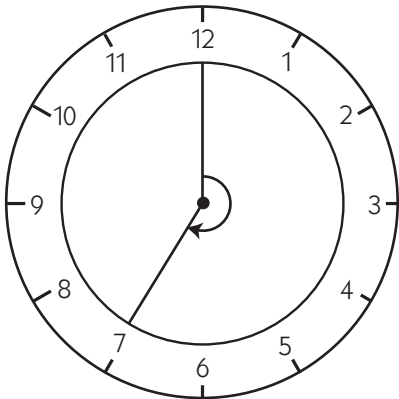
**5a** angle measure \_\_\_\_\_

**b** fraction of a whole turn \_\_\_\_\_



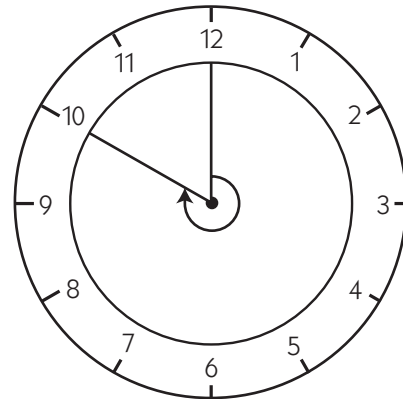
**6a** angle measure \_\_\_\_\_

**b** fraction of a whole turn \_\_\_\_\_



**7a** angle measure \_\_\_\_\_

**b** fraction of a whole turn \_\_\_\_\_



# Set C3 ★ Activity 2



## ACTIVITY 2

### Human Angles

#### Overview

Students work in pairs to sketch and then estimate the angle of rotation for a number of different joints in their bodies, again using right angles, straight angles, and the interior angles of the pattern blocks as benchmarks. They also estimate the approximate fraction of a complete turn represented by each angle.

#### Skills & Concepts

- ★ measure angles in geometric figures
- ★ use benchmark angles including  $60^\circ$ ,  $90^\circ$ , and  $120^\circ$  to estimate angle measurements
- ★ identify the fraction of a complete turn represented by different angles

#### You'll need

- ★ a set of pattern blocks for each pair of students consisting of at least: 1 hexagon, 2 trapezoids, 2 squares, 3 triangles, 3 blue rhombuses, and 3 white rhombuses
- ★ pattern blocks for display
- ★ a protractor for each pair of students, plus one for display (Optional. See note below.)
- ★ Using Pattern Blocks to Measure Angles on a Clock Face (pages C3.5 and C3.6, completed copies from Activity 1)
- ★ Range of Motion in Human Joints (page C3.10, 1 copy for display)
- ★ Measuring the Range of Motion of Your Joints, pages 1 and 2 (pages C3.11 and C3.12, 1 copy for display, plus a class set)

.....  
**Note** Since today's activity involves students' bodies, it is probably best to let students choose their own partners to ensure they are working with a classmate they like and feel comfortable with.

If you have access to protractors and want students to use them, you might have students use them to help estimate the range of motion for each joint. Do remind them, however, that although they can measure the angles in their sketches with great precision using the protractor, their angle measures are approximate because they are working from sketches. Even if they use the protractors to help make estimates, those estimates should only be to the nearest ten degrees.  
 .....

#### Instructions for Human Angles

1. If you did not have time in Activity 1 to review students' completed sheets, Using Pattern Blocks to Measure Angles on a Clock Face, do so now. Before working on today's activity, students will need to make sure that they have identified the angles and fractions of a turn correctly.

**Activity 2** Human Angles (cont.)

2. Now explain that in today's activity, students will be estimating the range of motion in some different joints in their bodies, including their wrists, elbows, knees, and shoulders. Explain that different kinds of joints can rotate different amounts. Sometimes, when people are injured, they go to physical therapy to help regain the full range of motion in the injured joint. For example, if a soccer player hurts her knee, she might need physical therapy to regain the full range of motion in her knee, and if a quarterback injures his shoulder, he also might need physical therapy to move his shoulder the way he needs to in order to make a long pass.

Physical therapists use a device called double-armed goniometer to measure the exact range of motion of their patients' joints. A goniometer consists of a stationary arm holding a protractor that is placed parallel with a stationary body segment, a pin (the axis of the goniometer) that is placed over the joint, and a movable arm that moves along a moveable body segment. (If you or the students do an Internet search for *goniometer*, you can find a variety of illustrations and photos of this measuring device.)

3. Place the Range of Motion in Human Joints sheet on display and explain that students will work in pairs to test the range of motion of different joints in their own bodies. Each student will move his or her joints as shown on this display, and his or her partner will sketch where the motion ended. Then they will use the pattern blocks and their sheets from yesterday to estimate the angle of rotation and fraction of a full turn for each joint movement.

4. Now invite a volunteer to show how to perform each movement shown on the display and help correct them if they don't do it quite right. Emphasize that they are to rotate their joints only as far as it is comfortable. If they start to feel like they are straining, they must stop. Explain that they can injure themselves if they try to push their joints farther than they should go.

5. Now show the display copy of Measuring the Range of Motion of Your Joints. Have a volunteer show the knee motion again, and model how to sketch the ending point of that rotation. Then model how to use the interior angles of the pattern blocks to estimate the angle of rotation to the nearest ten degrees. While the volunteer is doing the motion and while you are sketching it, model how students can use 90 degrees as a benchmark in their sketch and in making their estimates. Ask students to refer to their sheets from yesterday to help estimate the fraction of a complete turn this angle represents.

6. Give each student a copy of the sheets and answer questions they have about the activity. Then give them most of the rest of the period to work in pairs. Circulate around the room to answer questions and to make sure students are conducting the activity safely and respectfully.

7. When you have five or ten minutes left in the period, reconvene the class and ask them to share their work by asking questions like the following:

- Which joint had the greatest range of motion?
- Which joint had the smallest range of motion?
- Which fractions of a full turn were most difficult to estimate? How did you handle it?
- Did any of your estimates surprise you?

You might also ask students to share and compare the estimates for the joints of their choice.



## Activity 2 Human Angles (cont.)

### Extensions

- Have students research the different kinds of joints in the body. Each kind of joint performs a different kind of motion and, as a result, has a different possible range of motion.
- Invite students to research different birds, who have an impressive range of motion in their necks. Ask them to draw sketches of each bird's range of neck motion.
- Invite students to make sketches showing different angles of rotation in skateboarding, ice skating, and snowboarding tricks. You might consider having them make posters and present the information to the class.



### INDEPENDENT WORKSHEET

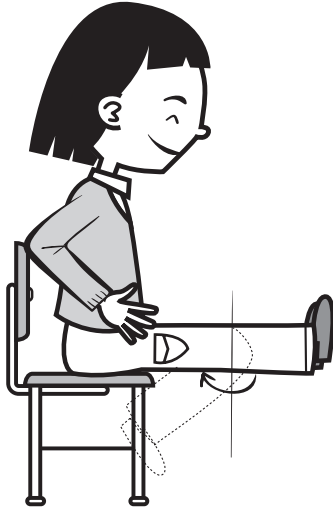
Use Independent Worksheet 4 (pages C3.27 and C3.28) to provide students with more practice identifying and drawing different angles of rotation and relating them to fractions of a complete turn about a circle.

NAME \_\_\_\_\_

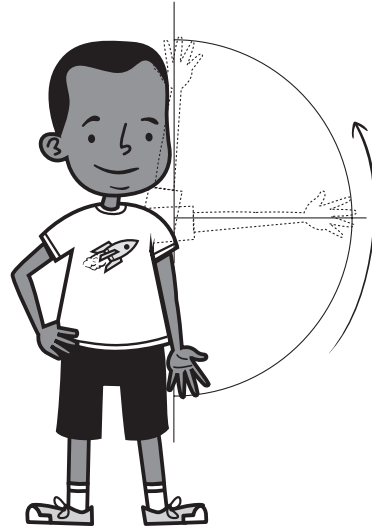
DATE \_\_\_\_\_

# Range of Motion in Human Joints

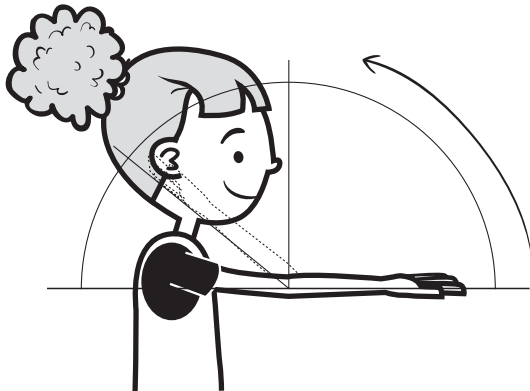
1 Knee



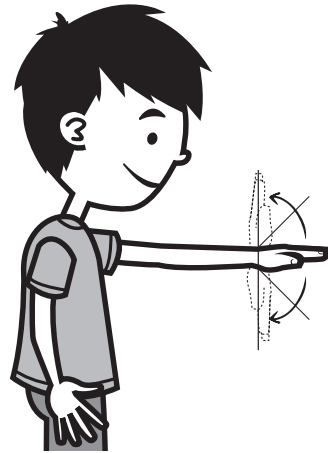
2 Shoulder: To the Side



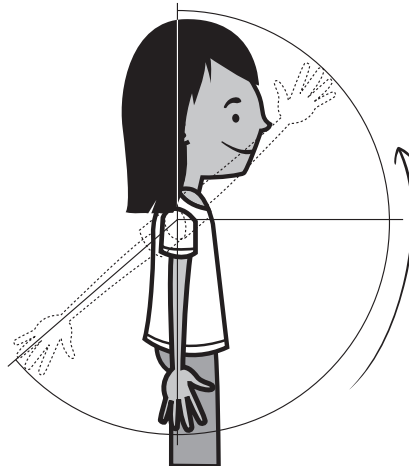
3 Elbow



4 Wrist



5 Shoulder: Back and Front



NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Measuring the Range of Motion of Your Joints, page 1 of 2

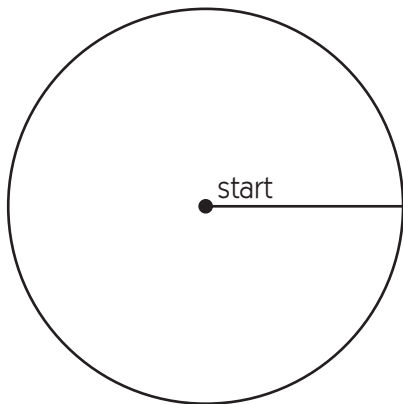
Work with a partner to test how much you can rotate each of the joints shown below. Each of you will sketch. First sketch the ending points of the joint's rotation. Then use your pattern blocks to estimate the degree of rotation to the nearest 10 degrees. When testing your joints, only bend as far as is comfortable: don't rotate your joints until it feels difficult or painful!

### 1 Knee

**a** approximate degrees of rotation

\_\_\_\_\_

**b** approximate fraction of a complete turn \_\_\_\_\_

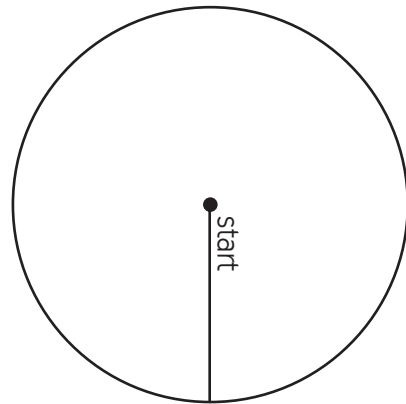


### 2 Shoulder: To the Side

**a** approximate degrees of rotation

\_\_\_\_\_

**b** approximate fraction of a complete turn \_\_\_\_\_



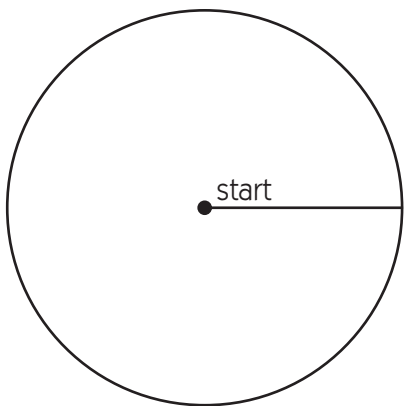
(continued on next page.)

Measuring the Range of Motion of Your Joints, page 2 of 2 (cont.)

**3** Elbow

**a** approximate degrees of rotation  
\_\_\_\_\_

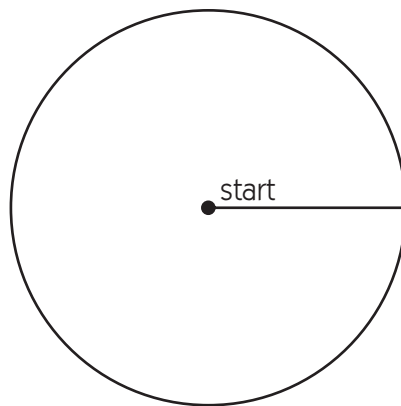
**b** approximate fraction of a complete turn \_\_\_\_\_



**4** Wrist

**a** approximate degrees of rotation  
\_\_\_\_\_

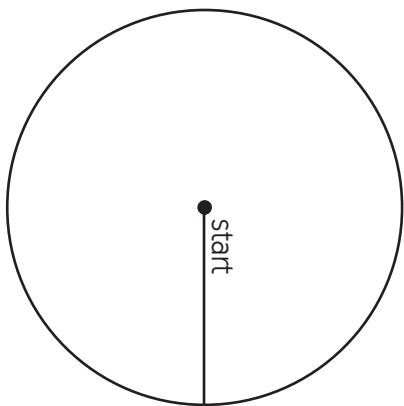
**b** approximate fraction of a complete turn \_\_\_\_\_



**5** Shoulder: Back and Front

**a** approximate degrees of rotation  
\_\_\_\_\_

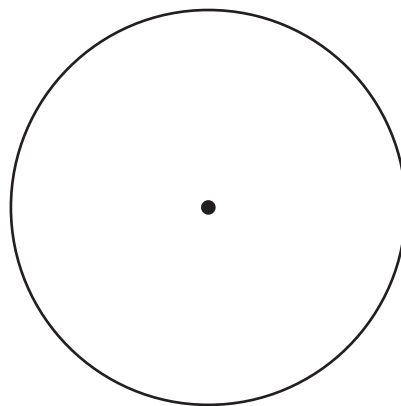
**b** approximate fraction of a complete turn \_\_\_\_\_



**6** Your Choice \_\_\_\_\_

**a** approximate degrees of rotation  
\_\_\_\_\_

**b** approximate fraction of a complete turn \_\_\_\_\_



# Set C3 ★ Activity 3



## ACTIVITY

### Measuring Circles

#### Overview

Students share what they already know about circles. The teacher introduces a set of circle words and works with input from the class to label a circle at the overhead. Students then measure the radius and diameter of several circles and share ideas about how these dimensions might relate to each other.

#### Skills & Concepts

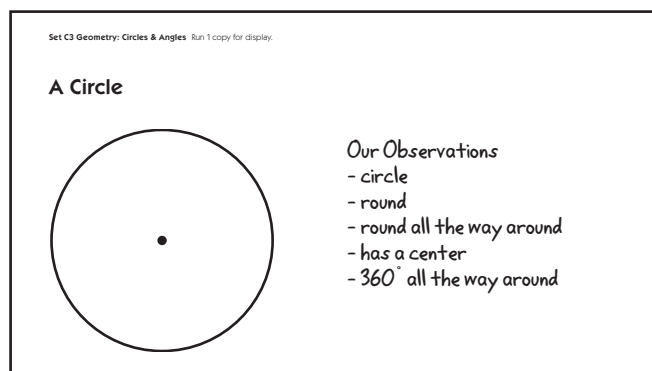
- ★ identify and describe the center, radius, circumference, and diameter of a circle
- ★ exemplify points and line segments
- ★ use appropriate tools to measure to the nearest quarter-inch

#### You'll need

- ★ A Circle (page C3.16, 1 copy for display)
- ★ Circles (page C3.17, enough copies so that each student gets 1 circle when cut apart)
- ★ Circles to Measure & Label (pages C3.18 and C3.19, class set)
- ★ class set of rulers
- ★ scissors and pencils
- ★ a piece of paper to mask parts of the overhead
- ★ 2 feet of string for each pair of students (optional)

#### Instructions for Measuring Circles

1. Display only the top portion of A Circle. Ask students to pair-share what they already know and what they notice about the shape. Then call on volunteers to share their ideas with the class as you record at the overhead.



2. Reveal the first word on the vocabulary list at the bottom of the overhead: *center*. Ask students to explain where the center of the circle is and how they know. Is there any way they can *prove* that it is the center? After a bit of discussion, give each student a copy of the circle and explain that it is an exact copy of the one on the overhead. Ask them to work in pairs to see if the point that appears to be in the middle of this circle is actually in the middle.

3. When they have had a few minutes to work, ask students to share their conclusions and strategies. Is the point actually at the center of the circle? What did they do to find out?

## Activity 3 Measuring Circles (cont.)

**Students** We cut out the circle and folded it in half. The point landed right on the fold, so we said it must be the center.

We measured from the point to the edge of the circle. It was exactly an inch and a half on one side and then on the other side. That means the dot is right in the middle.

We kept measuring from the point to different places on the circle. It was an inch and a half every time. It must be in the center.

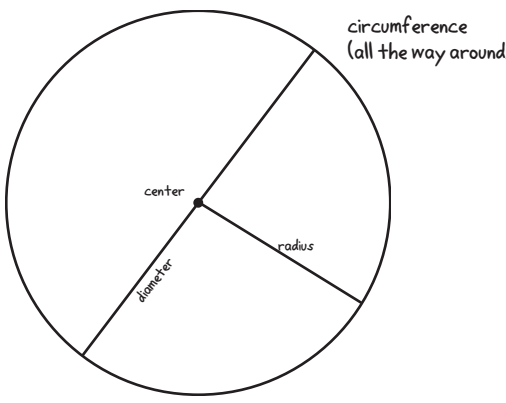
4. Affirm students' experiments and explanations by explaining that a circle is a set of points that are all the same distance from the center. Give students each a copy of Circles to Label & Measure. Label the center of your circle as students label the center of the top circle on their sheets.

5. Reveal the other vocabulary words at the bottom of the Circle display one by one. As you show each one, read and discuss the word and its definition with the class. Challenge students to use what they already know about points and line segments to figure out how to construct and label these dimensions on the first circle. Provide as much support as needed, but encourage them to think for themselves.

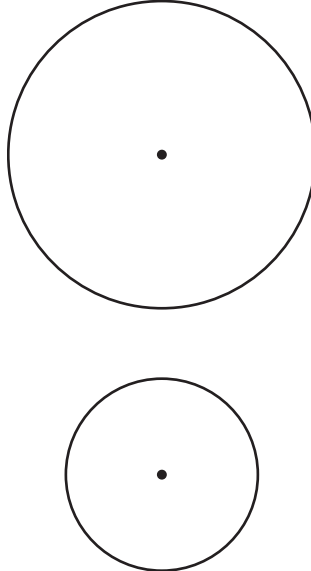
Set C3 Geometry: Circles & Angles Blackline Run 1 copy for display, plus a class set back-to-back with page C3.23.  
NAME Chris DATE May 21

**Circles to Measure & Label**

Use the inch side of a ruler to measure the radius and diameter of each circle below. Label the radius and diameter with their measurements on each circle.



Set C3 Geometry: Circles & Angles Blackline Run 1 copy for display, plus a class set back-to-back with page C3.22.  
**Circles to Measure & Label (cont.)**



6. Have students use the inch side of their ruler to measure the radius and the diameter of the circle on the first page. Ask them to measure carefully to the nearest half-inch and record the measurements on their sheets. How do the two measurements compare? Why? Students will notice that the radius is exactly half the diameter (the diameter is exactly twice the length of the radius).

7. Ask students to test any theories they develop about the relationship between the radius and diameter of the circle by marking and measuring both dimensions on the other two circles on their sheets. Is the length of the radius always exactly half the length of the diameter?

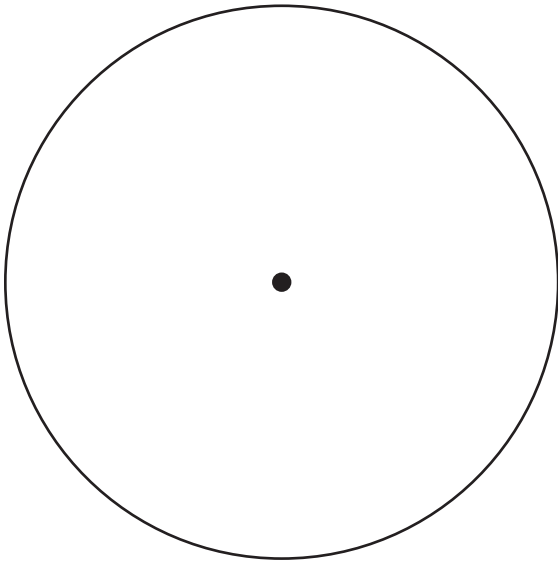
**Activity 3** Measuring Circles (cont.)**Extensions**

Give each pair of students a 2-foot length of string. Have them use it to measure the circumference of each circle. Advise them to start with the largest circle on their sheets and work their way down to the smallest. That way, they can keep cutting the string and won't need more than the original length. Ask them to record the circumference of each circle on the sheet, and then reflect on their results. What do they notice? (If you try this for yourself, you will see that the circumference is just a little more than 3 times the diameter of every circle. This is a good, hands-on demonstration of the formula for finding the circumference of a circle, which can be expressed as either  $\text{diameter} \times \pi$  or  $2\pi r$ .)

**INDEPENDENT WORKSHEET**

Use Set C3 Independent Worksheet 5 (page C3.29) to provide students with more practice identifying and drawing diameters and radii of circles, as well as drawing specific angles of rotation and measuring to the nearest millimeter.

# A Circle

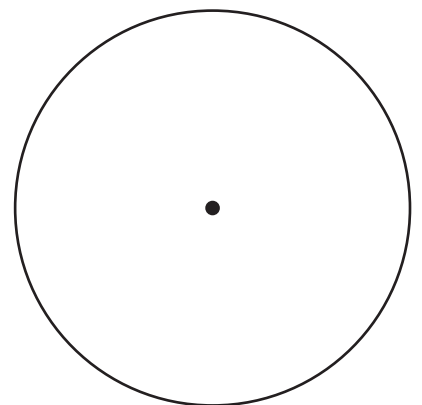
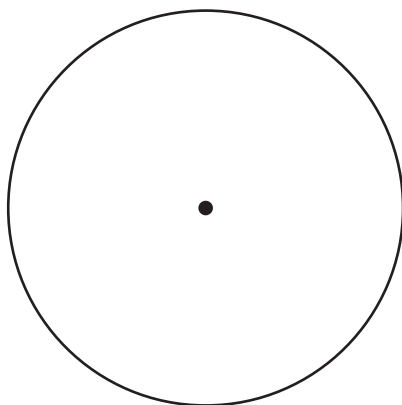
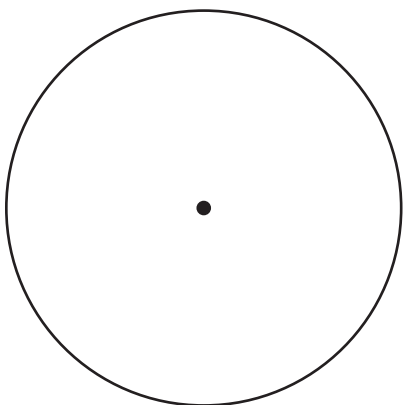
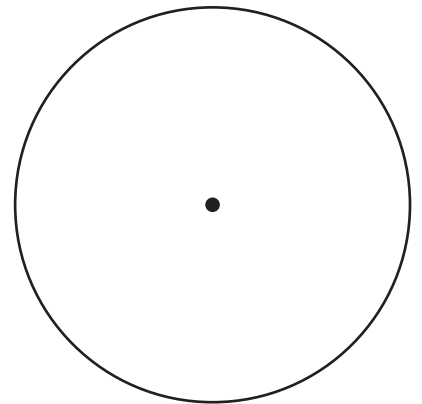
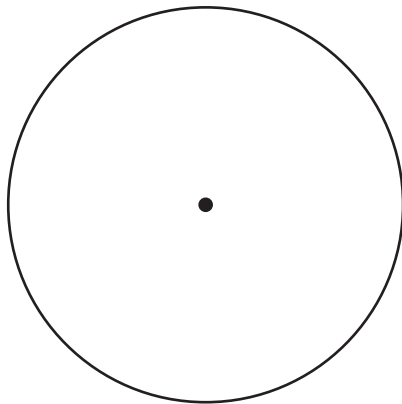
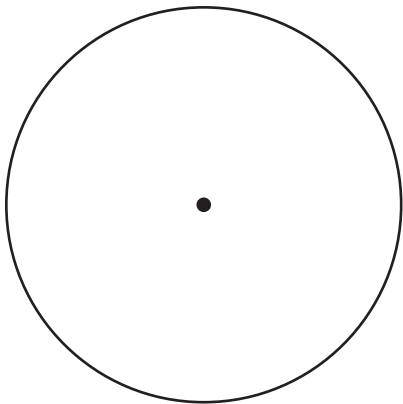
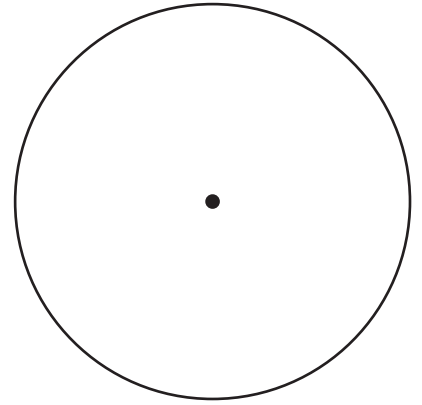
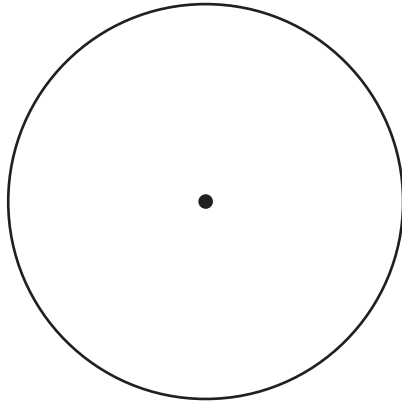
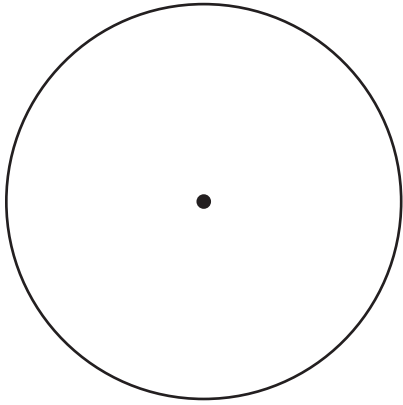


## Circle Words

- center
- radius—a line segment from the center of the circle to any point on the circle
- diameter—a line segment that passes through the center of the circle and has endpoints on the circle
- circumference—the distance around a circle



# Circles

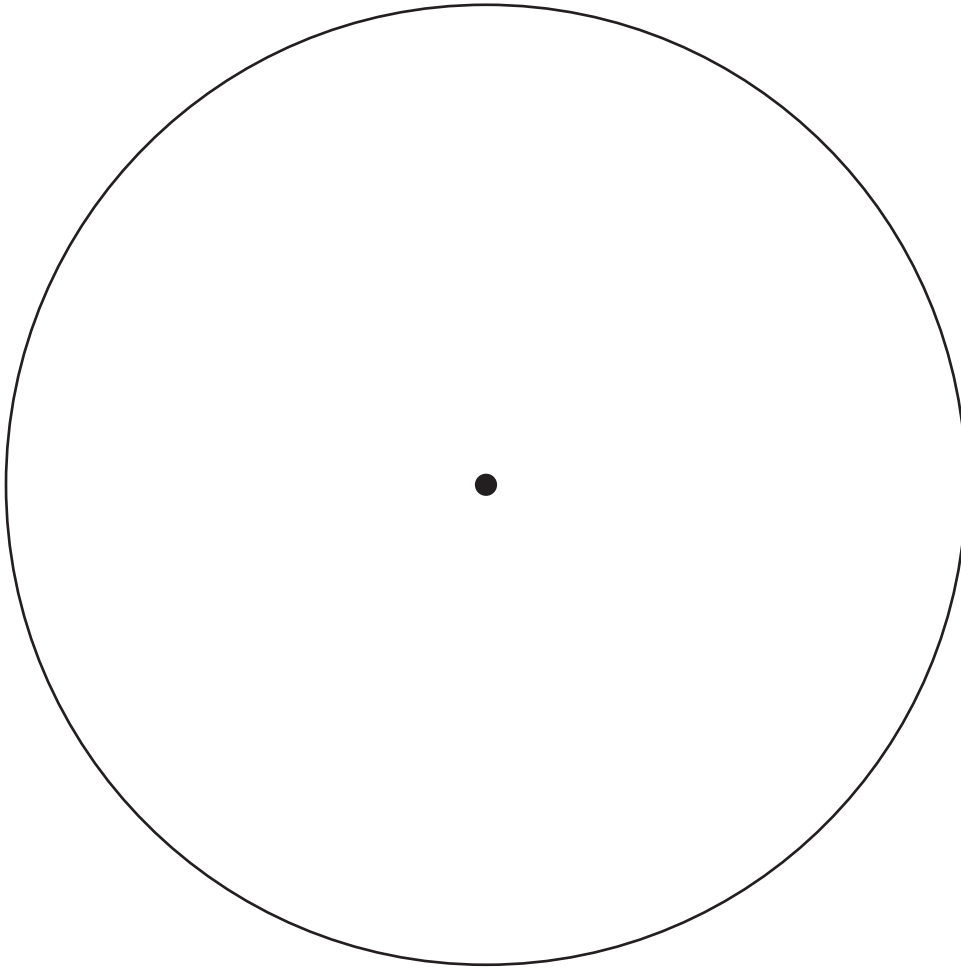


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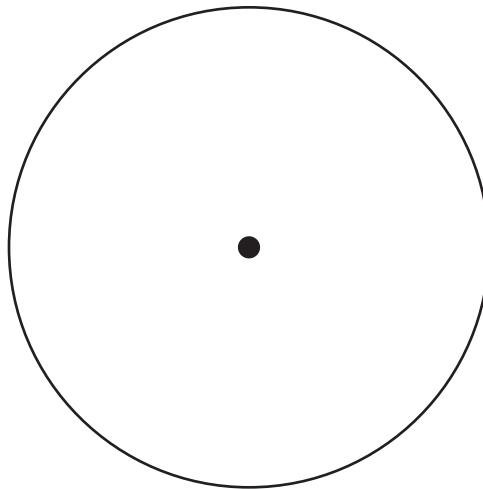
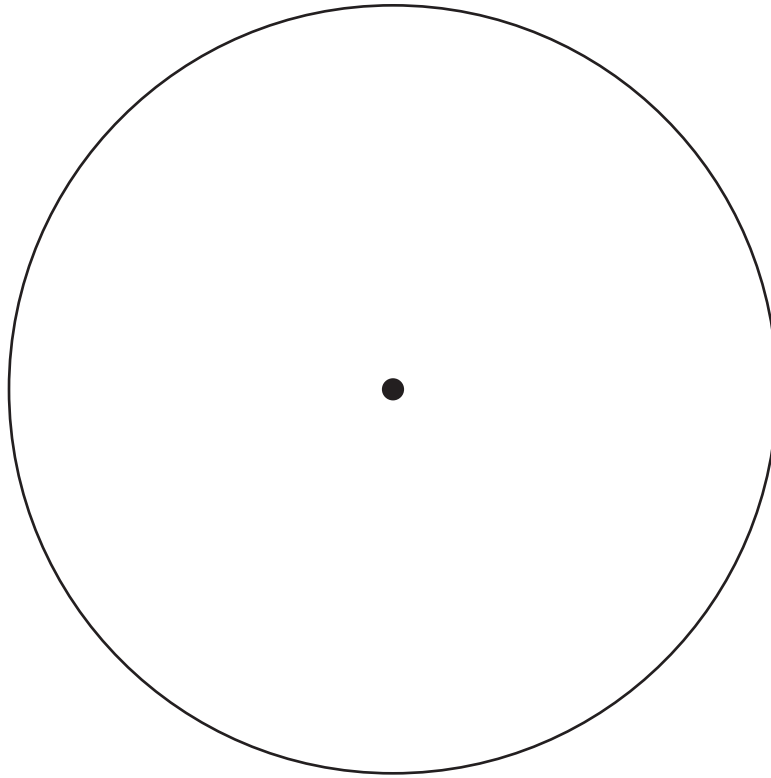
DATE \_\_\_\_\_

## Circles to Measure & Label, page 1 of 2

Use the inch side of a ruler to measure the radius and diameter of each circle. Label the radius and diameter with their measurements on each circle.



**Circles to Measure & Label, page 2 of 2** (cont.)





NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set C3 ★ Independent Worksheet 1

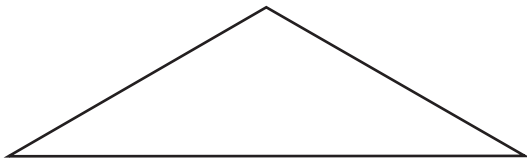


## INDEPENDENT WORKSHEET

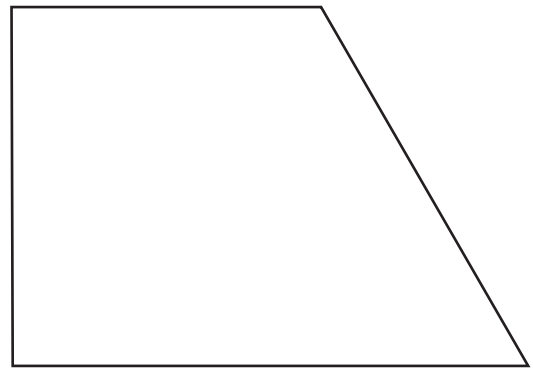
### Measuring Interior Angles of Polygons

Use your pattern blocks to measure the interior angles of each polygon below. Label each angle with its measurement. Then write the name of the polygon.

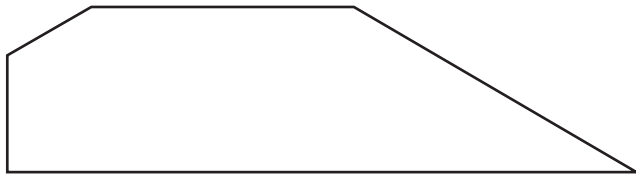
1 \_\_\_\_\_



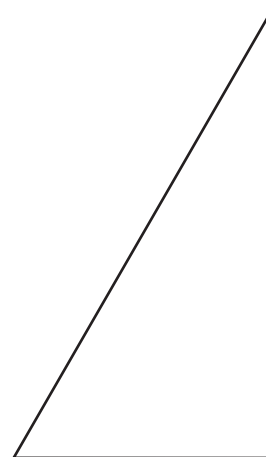
2 \_\_\_\_\_



3 \_\_\_\_\_



4 \_\_\_\_\_





NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set C3 ★ Independent Worksheet 2




## INDEPENDENT WORKSHEET

### Angles in the Classroom

Search your classroom for objects with the angles described below. Complete the chart by sketching each object, labeling it, and drawing an arrow to the angle that is less than, equal to, or greater than the benchmark angle. Use pattern blocks to help.

#### 1 Benchmark Angle: $90^\circ$

Less than $90^\circ$	Equal to $90^\circ$	Greater than $90^\circ$
 <p>This angle on the side of my eraser.</p>		

#### 2 Benchmark Angle: $60^\circ$

Less than $60^\circ$	About Equal to $60^\circ$	Greater than $60^\circ$

#### 3 Benchmark Angle: $180^\circ$

Less than $180^\circ$	Equal to $180^\circ$	Greater than $180^\circ$





NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set C3 ★ Independent Worksheet 3



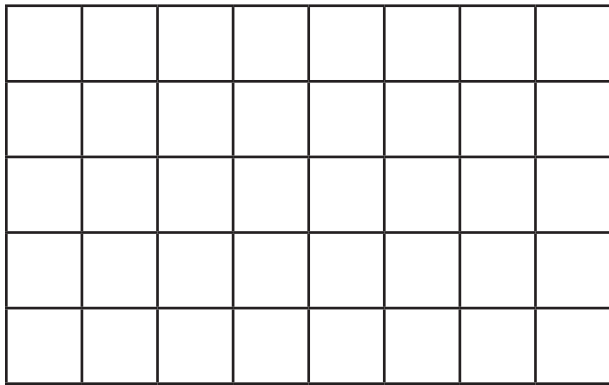
## INDEPENDENT WORKSHEET

### Drawing Polygons, page 1 of 2

Use a ruler and pattern blocks to draw a polygon that fits each description. Each square on the grid is 1 cm by 1 cm.

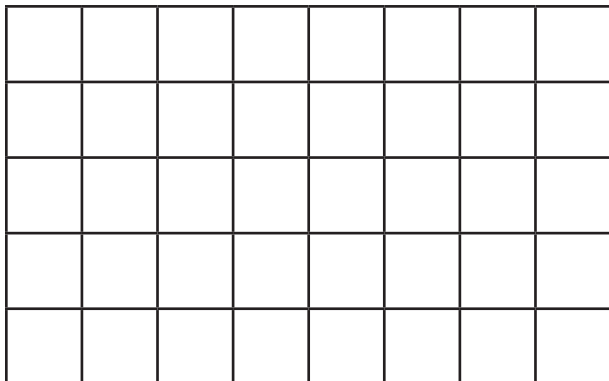
**1a** A rectangle that is 2.5 cm by 5.5 cm

**b** Label each angle and side length in the rectangle below.



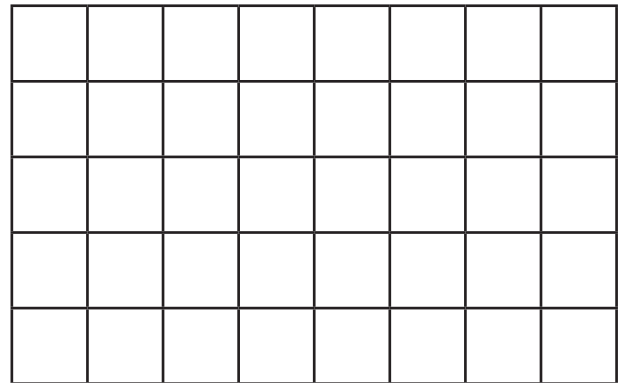
**3a** A trapezoid with one side exactly 2.5 cm, another side 3 cm, and angles  $90^\circ$ ,  $90^\circ$ ,  $120^\circ$  and  $60^\circ$

**b** Label each angle and side length in the trapezoid below.



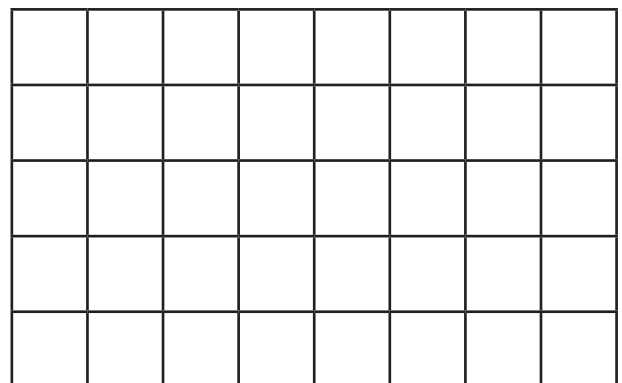
**2a** An equilateral triangle with sides that are each 3 cm

**b** Label each angle and side length in the triangle below.



**4a** A rhombus with all sides 3.5 cm, two  $60^\circ$  angles, and two  $120^\circ$  angles

**b** Label each angle and side length in the rhombus below.



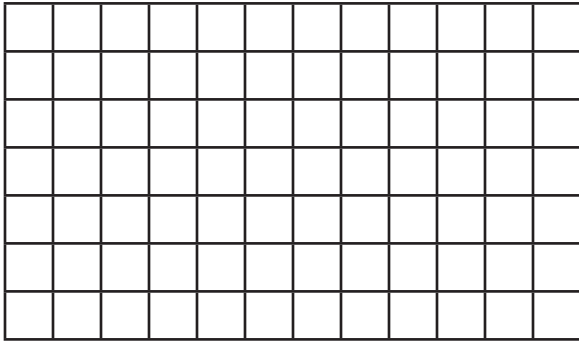
(Continued on next page.)

## Drawing Polygons, page 2 of 2 (cont.)

Use a ruler and pattern blocks to draw a polygon that fits each description. Each square on the grid is a quarter inch by a quarter inch.

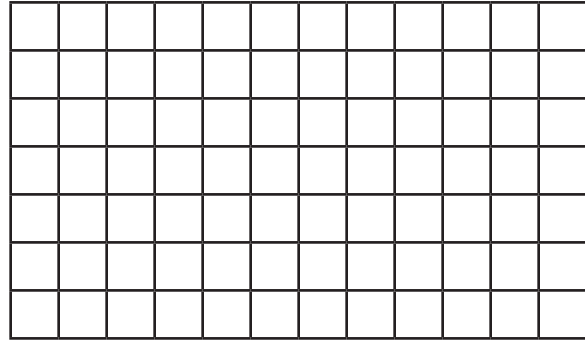
**5a** A rectangle that is  $1\frac{1}{2}$  in. by  $2\frac{1}{4}$  in.

**b** Label each angle and side length in the rectangle below.



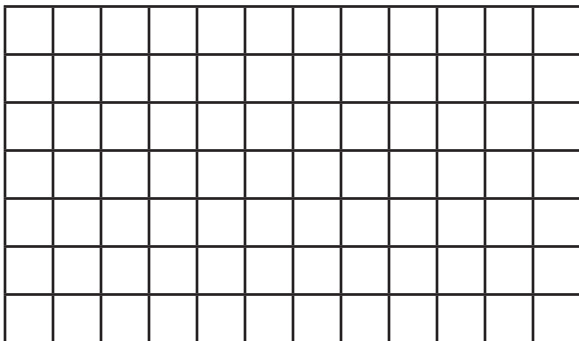
**6a** An isosceles triangle with two  $30^\circ$  angles

**b** Label each angle and side length in the triangle below.



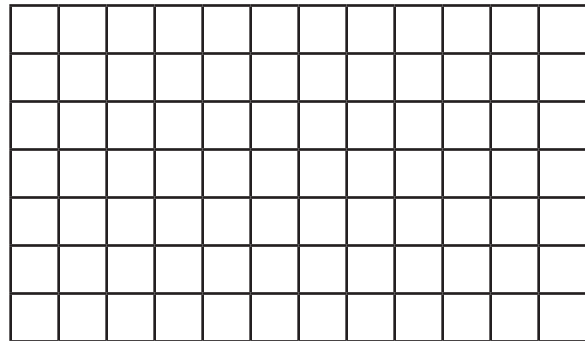
**7a** A trapezoid with one side exactly 2 in., another side exactly 1 in., and two  $60^\circ$  angles

**b** Label each angle and side length in the trapezoid below.



**8a** A rhombus with two  $120^\circ$  angles

**b** Label each angle and side length in the rhombus below.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set C3 ★ Independent Worksheet 4

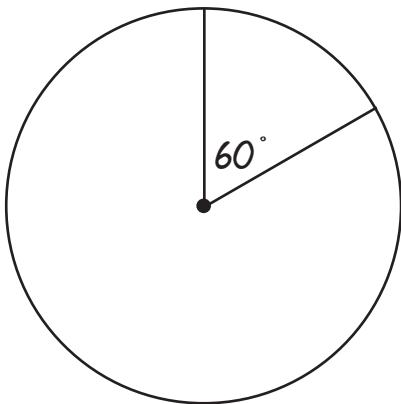


## INDEPENDENT WORKSHEET

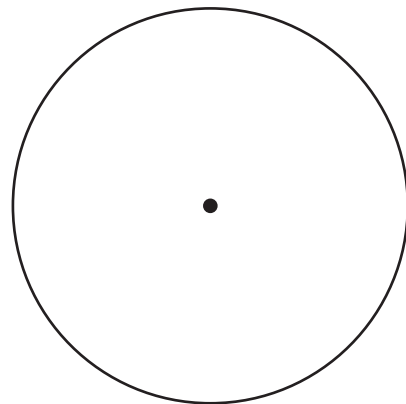
### Drawing Angles of Rotation, page 1 of 2

Draw and label the angles that are equal to each fraction of a whole turn around the circle. Use your pattern blocks to make the angles exact. Remember that there are 360 degrees in a full turn around the circle.

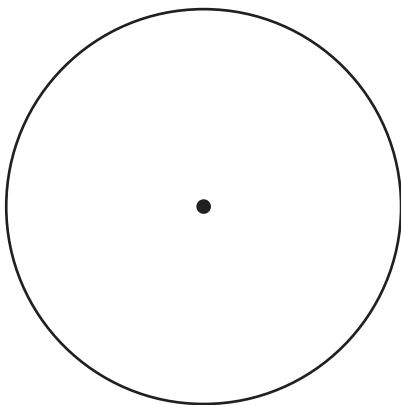
**ex** Draw and label  $\frac{1}{6}$  turn.



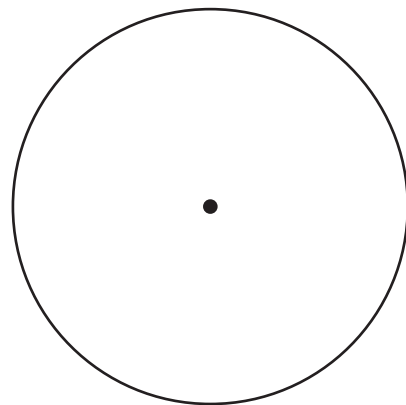
**1** Draw and label  $\frac{1}{2}$  turn.



**2** Draw and label  $\frac{1}{4}$  turn.



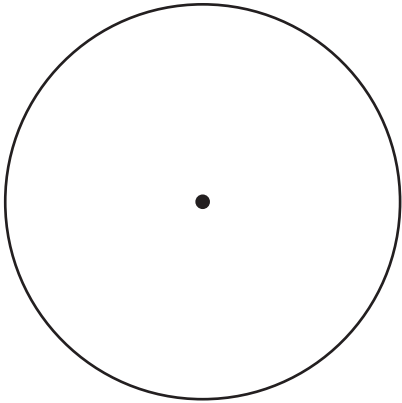
**3** Draw and label  $\frac{3}{4}$  turn.



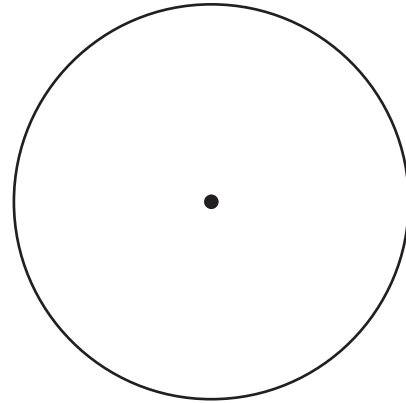
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## Drawing Angles of Rotation, page 2 of 2 (cont.)

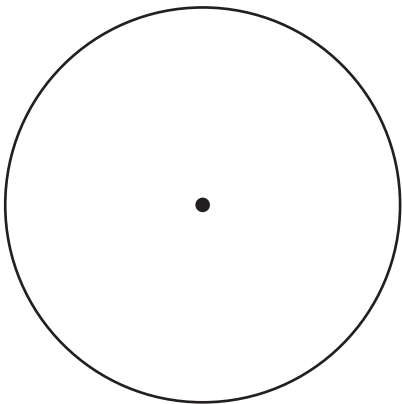
**4** Draw and label  $\frac{1}{3}$  turn.



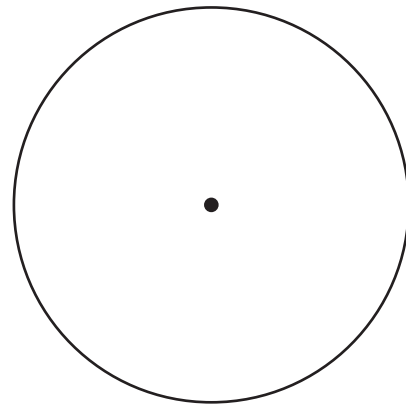
**5** Draw and label  $\frac{2}{3}$  turn.



**6** Draw and label  $\frac{5}{6}$  turn.



**7** Draw and label  $\frac{5}{12}$  turn.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set C3 ★ Independent Worksheet 5

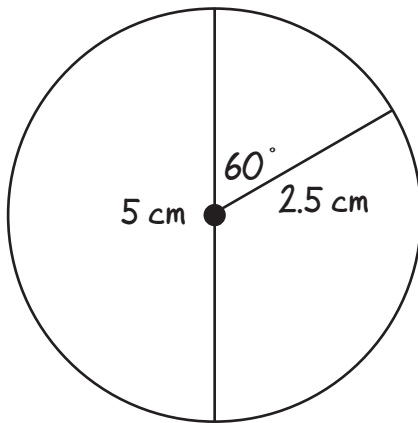


## INDEPENDENT WORKSHEET

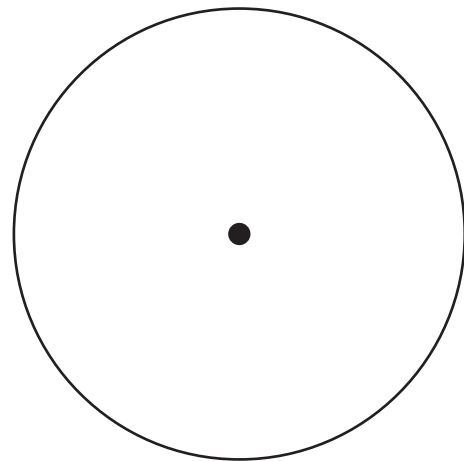
### Drawing & Measuring Circles

Draw, measure, and label the radius and diameter of each circle below. Use the centimeter side of your ruler, and measure to the nearest millimeter if necessary. Use your pattern blocks to draw each radius at the given angle from the diameter.

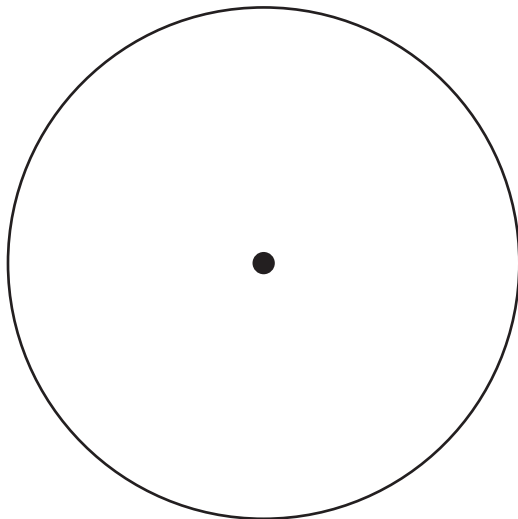
**ex** Draw the radius at a  $60^\circ$  angle to the diameter.



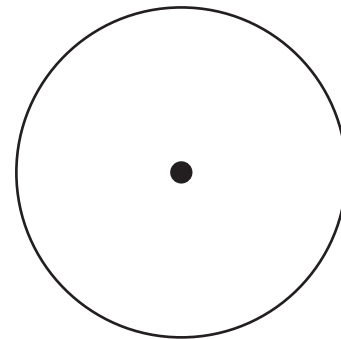
**1** Draw the radius at a  $30^\circ$  angle to the diameter.



**2** Draw the radius at a  $90^\circ$  angle to the diameter.



**3** Draw the radius at a  $120^\circ$  angle to the diameter.







# GRADE 4 SUPPLEMENT

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## Set D1 Measurement: Weight & Mass

### Includes

Activity 1: The Bread Dough Dilemma	D1.1
Activity 2: Estimate, Measure & Compare the Mass	D1.5
Activity 3: No Screamin' over Ice Cream	D1.11
Activity 4: The Sack of Groceries	D1.15
Activity 5: Kitten & Cat Weights	D1.19
Activity 6: Line Them Up By Weight	D1.21

### Skills & Concepts

- ★ estimate and determine mass using metric units
- ★ estimate and determine weight using U.S. customary units
- ★ explore the difference between weight and mass
- ★ carry out a simple conversion within a system of measurement such as ounces to pounds

**Bridges in Mathematics Grade 4 Supplement**

**Set D1** Measurement: Weight & Mass

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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# Set D1 ★ Activity 1



## ACTIVITY

### The Bread Dough Dilemma

#### Overview

Students use a balance and gram masses to help you divide a lump of “bread dough” into 4 equal parts.

#### Skills & Concepts

- ★ estimate and determine mass using metric units
- ★ explore the difference between weight and mass

#### You'll need

- ★ a balance scale
- ★ gram masses or five boxes of 100 2" paperclips (see Advance Preparation)
- ★ about a pound of modeling clay or playdough (see Advance Preparation)
- ★ a table knife and a cutting board covered with plastic or oilcloth
- ★ Student Math Journals

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**Advance Preparation** If you don't have gram masses, use jumbo paperclips, which each have a mass of about 1 gram. Bundle some of the paperclips into groups of 10, using a small rubber band or a piece of tape to secure them so that students can count them more efficiently. Make a lump of “bread dough” using modeling clay or playdough. You'll need 430–450 grams (roughly a pound) of “dough.”

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**Background for the Teacher: The Difference between Mass and Weight** Mass is the measure of how much matter an object contains. Weight is a measure of how heavy an object is, or more specifically, a measure of the pull of gravity on an object. The mass of an object doesn't change when the location of the object changes, but weight does vary with location. For instance, your weight would be less on the moon since the moon is smaller and exerts less gravitational pull. Your mass, however, would remain the same. Mass is generally measured by using a balance to compare a known amount of matter to an unknown amount of matter. Weight is generally measured on a scale. Since this activity utilizes a balance rather than a scale, we refer to mass rather than weight. Although students are likely to use the words “weight” and “weighing” at first, guide them toward using the words “mass” and “finding the mass” as you conduct the activity.

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#### Instructions for The Bread Dough Dilemma

1. Explain to the class that you have a problem and you need their help to solve it. Tell them that you're planning to bake some bread. You want to make a large batch and then divide it into 4 equal parts so you come out with 4 loaves of bread. The problem is, you don't know how to divide the dough into 4 equal portions. Do they have any ideas?

**Activity 1** The Bread Dough Dilemma (cont.)

**Jace** *Just divide it in half and then in half again. Make fourths!*

**Teacher** *I've been trying to do that, but with a big lump of dough, it's hard for me to decide when it's even.*

2. Take out the “dough” and place it on your cutting board. Have a volunteer use the table knife to cut it into 4 equal parts. Ask the class how they can be absolutely sure the 4 parts are equal. If the dough isn't divided accurately, some of your loaves of bread will be a lot bigger or smaller than other loaves when they're done.

**Students** *Those pieces look even to me.*

*I don't think so.*

*You could weigh them and see.*

**Teacher** *How are you thinking about that, Amie?*

**Amie** *You could weigh the parts to make sure they're the same.*

**Teacher** *I have a balance scale here. Would that work?*

**Students** *No, because that won't tell you a number like when you weigh stuff.*

*But we could use that scale to see if the pieces are even.*

3. Explain that you'd need a regular scale to weigh the dough, but that you can use the balance to find the *mass* of the dough. Mass is a measure of how much matter there is in an object. In order to measure mass, people set the item they want to measure on one side of the balance and then place objects of a known mass on the other until the balance is level.

4. Then show students the paperclips. Tell them that a jumbo paperclip has a mass of about 1 gram. Hold up a bundle of 10 paperclips and ask them how many grams are in one bundle. Tell them that each box of paperclips holds 100 and ask them how many grams are in a box. Have several volunteers take turns coming up, picking up the dough and paperclips, and estimating the mass of the entire lump of dough in relation to the mass of the paperclips. Record estimates on the whiteboard.

5. Ask volunteers to help you find the mass of the dough using the balance scale and paperclips. Then ask them to use the information to estimate what the mass of each piece should be if you divide the dough into 4 equal parts.

6. Then work with input from the class to divide the “dough” into 4 parts of equal mass. Although there are a variety of ways to do this, here's one method the students may suggest. Divide the dough into two portions and place them on opposite ends of the balance scale, adding and subtracting to each portion until they balance. Then divide each of these two portions into two smaller portions, using the same methods. Finally, use the paperclips to find the mass of each piece. Are they equal? If not, make adjustments as needed until they are. What is the mass of each?

7. Ask students to get out their pencils and math journals. Have them use pictures, numbers, and words to remind you of what you need to do the next time you bake bread if you want your loaves to come out even.

## Activity 1 The Bread Dough Dilemma (cont.)

### Extension

- Present students with the following variation of the bread dough problem:

“My friend was telling me about a similar bread dough problem that he’s been having. He’s using the same recipe, but he needs to divide the dough into 6 parts because he wants to make 6 loaves in small pans for 6 of his friends at work. He needs some instructions as to how he might use his measuring tools—he has the same measuring tools that we do—to make 6 loaves of bread that have the same mass. Use pictures, numbers, and words to give my friend some ideas.”



# Set D1 ★ Activity 2



## ACTIVITY

### Estimate, Measure & Compare the Mass

#### Overview

Students estimate the mass of different geoblocks and then use a balance scale and gram weights to find the actual mass. This activity is designed for use by small groups of students during Work Places or other work periods.

#### Skills & Concepts

- ★ estimate and determine mass using metric units
- ★ explore the difference between weight and mass

#### Recommended Timing

Anytime after Set D1 Activity 1

#### You'll need

- ★ Estimate, Measure & Compare the Mass Instructions (page D1.7, several copies, see Advance Preparation)
- ★ Estimate, Measure & Compare the Mass Record Sheet 1 (page D1.8, class set)
- ★ Estimate, Measure & Compare the Mass Record Sheet 2 (page D1.9, optional, run as needed)
- ★ 3 balance scales
- ★ 3 sets of geoblocks
- ★ gram masses or 6 boxes of 100 2" paperclips, some bundled in groups of 10

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**Advance Preparation** If you don't have gram masses, use jumbo paperclips, which each have a mass of about 1 gram. Bundle some paperclips in groups of ten, using a small rubber band or piece of tape to secure them, so that students can count them more efficiently. Set up 3 work stations around the room where pairs of students can work independently over the next few weeks as time allows. At each station, place a balance scale, a set of geoblocks, gram masses (1 full box of 100 jumbo clips, and 9 or 10 bundles of 10 if you don't have gram masses), a copy of the Estimate, Measure & Compare the Mass Instructions, and 8–10 copies of Estimate, Measure & Compare the Mass Record Sheet 1.

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#### Instructions for Estimate, Measure & Compare the Mass

1. Explain that you've set up some measuring stations around the room to give students more practice estimating and measuring mass. Show students a balance, a set of geoblocks, and the gram masses or paperclips. Ask what they'd need to do to find the mass of one of the geoblocks. As you discuss this with the class, review the concept of mass and help students articulate some of the differences between mass and weight.

***Teacher** I've set up some balances, geoblocks, and paperclips at the back of the room so you can practice measuring mass. How could you use the balance and the paperclips to find the mass of one of these geoblocks?*

**Activity 2** Estimate, Measure & Compare the Mass (cont.)

**Students** Put the block on one side and find out how many paperclips it takes until the balance is level. Those paperclips are each a gram, so if you know how many paperclips it takes to balance the block, you know how heavy it is.

**Teacher** Do you know how heavy it is or how much mass it has?

**Kiara** How much mass, but I don't really get the difference between mass and weight.

**Teacher** Can anyone help Kiara with this question?

**Students** They're kind of the same, but mass is how much stuff there is in something. When people go to the moon, they're not as heavy—like they can jump really high and stuff. But they stay the same size so their mass doesn't change.

**Teacher** That's right. Their mass stays the same, even though their weight changes. Does anyone have other ideas about the difference between mass and weight?

**Carlos** We use a scale with numbers on it at home. I just step on the scale and the number shows how much I weigh.

**Teacher** Yes, people use scales to measure weight. You might have a kitchen scale at home at shows how many ounces or grams something weighs. Or maybe you have a bathroom scale that shows your weight in pounds or kilograms. You have to use a balance instead of a scale to measure mass, though.

2. Show students a copy of the Estimate, Measure & Compare the Mass Instructions and Estimate, Measure & Compare the Mass Record Sheet 1. Review the instructions with the class. Let students know where to find the materials and explain that you've set up 3 stations in the room for them to use in pairs. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

**Extension**

- When everyone in class has had a chance to complete the first record sheet, introduce Estimate, Measure & Compare the Mass Record Sheet 2. This sheet is just like the first except it allows students to choose the 5 geoblocks they want to measure.


# Estimate, Measure & Compare the Mass Instructions

## To do this activity, you'll need

- ★ Estimate, Measure & Compare the Mass Instructions
- ★ Estimate, Measure & Compare the Mass Record Sheet
- ★ a balance scale
- ★ gram masses or 2-inch paperclips
- ★ a set of geoblocks

## Instructions for Estimate, Measure & Compare the Mass

- 1 Record your name and the date at the top of a record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.
- 2 Estimate the mass of the first geoblock in grams. Record your estimate.
- 3 Find the mass of the block and record the measurement. Round your measurement to the nearest gram.
- 4 Find the difference between your estimate and the actual measurement. Record the difference in the last column.

Set D1 Measurement: Weight & Mass Blackline Run a class set.			
NAME <u>Deanna</u>		DATE <u>2/26</u>	
<b>Estimate, Measure &amp; Compare the Mass Record Sheet 1</b>			
Geoblock	Your Estimate (in grams)	Actual Measurement (in grams)	The Difference (in grams)
 Geoblock OF (rectangular prism)	125 g	92 g	33 g

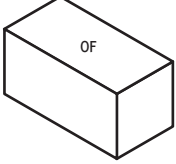
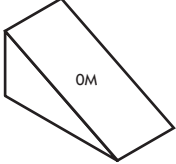
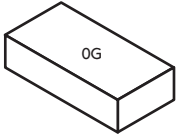
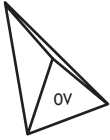
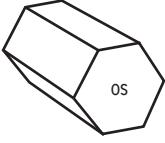
5 Continue estimating, finding the mass, and finding the difference for the other four blocks. Use what you know about the mass of the first object to estimate the others.

6 Answer the questions about mass at the bottom of the record sheet.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Estimate, Measure & Compare the Mass Record Sheet 1

Geoblock	Your Estimate (in grams)	Actual Measurement (in grams)	The Difference (in grams)
<b>1</b> Geoblock 0F 			
<b>2</b> Geoblock 0M 			
<b>3</b> Geoblock 0G 			
<b>4</b> Geoblock 0V 			
<b>5</b> Geoblock 0S 			

**6** When people measure the mass of an object, they are finding out (circle one):  
 how long it is      how heavy it is      how much matter is in it      how wide it is

**7** To find the mass of an object, you need (circle one):

a ruler      a balance      a bathroom scale      a measuring cup



NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Estimate, Measure & Compare the Mass Record Sheet 2

**8** Estimate and then find the mass of 5 other geoblocks; you choose which ones. Can you find ways to make more and more accurate estimates?

<b>Geoblock</b>	<b>Your Estimate</b> (in grams)	<b>Actual Measurement</b> (in grams)	<b>The Difference</b> (in grams)



# Set D1 ★ Activity 3



## ACTIVITY

### No Screamin' over Ice Cream

#### Overview

Students will estimate and find the mass of various portions of “ice cream.” This activity is designed for use by pairs of students during Work Places or other work periods.

#### Skills & Concepts

- ★ estimate and determine mass using metric units

#### Recommended Timing

Anytime after Set D1 Activity 1

#### You'll need

- ★ No Screamin' over Ice Cream Record Sheets (pages D1.12 and D1.13, run a class set)
- ★ a balance scale
- ★ gram masses or five boxes of 100 2" paperclips (See Advance Preparation)
- ★ a pound of modeling clay (see Advance Preparation)
- ★ a table knife and a cutting board covered with plastic or oilcloth

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**Advance Preparation** If you don't have gram masses, use jumbo paperclips, which each have a mass of about 1 gram. Bundle the clips in the box of 100 into groups of 10, using a small rubber band or a piece of tape to secure each bundle so that students can count them more efficiently. Use a pound of modeling clay to make a single “brick” of ice cream. Set up a work station somewhere in the room where a pairs of students can take turns work independently over the next few weeks as time allows. Place a balance scale, the gram masses or paperclips, the knife, cutting board, the clay, and copies of the No Screamin' over Ice Cream Record Sheet at this station.

.....

#### Instructions for No Screamin' over Ice Cream

1. Explain that you've set up another work station to give students more practice estimating and measuring mass. Show students the balance, the clay, knife, and cutting board. Then give each pair of students a copy of the No Screamin' over Ice Cream Record Sheets.
2. Read the sheets with the class and provide any clarification necessary. Take the opportunity to distinguish between mass and weight (see Set D1 Activity 1 for more information about this). Remind students that each paperclip weighs about 1 gram. Groups of 10 paperclips have been bundled together so they won't need to count them 1 at a time. The boxes hold 100 paperclips or about 100 grams.
3. Let students know that they'll be doing this activity in pairs sometime in the next few weeks. Let them know where the work station will be located. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# No Screamin' Over Ice Cream Record Sheet

 page 1 of 2

- Record your name and the date at the top of this record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.
- Your aunt has agreed to hire you to help out at her ice cream stand. In order to keep the job, you must prove that you can measure mass in metric units, because all the ice cream portions and toppings are measured in grams. Estimate the mass of the whole brick of ice cream in grams. Record your estimate.
- Find the actual mass of the ice cream and record the measurement. Round your measurement to the nearest gram.
- Find the difference between your estimate and the actual measurement. Record the difference in the last column.

Amount of Ice Cream	Your Estimate (in grams)	Actual Mass (in grams)	The Difference (in grams)
Whole brick of ice cream			

- To give you some more practice, your aunt asks you to divide the brick of ice cream into 6 equal portions. Your "customers" (otherwise known as your cousins) will be very upset if someone gets more than the others. Estimate how many grams each of the 6 cousins will get. Then cut the brick into 6 equal parts and find the mass of one of the parts. (Be sure the parts are equal!)

Amount of Ice Cream	Your Estimate (in grams)	Actual Mass (in grams)	The Difference (in grams)
$\frac{1}{6}$ of the ice cream brick			

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# No Screamin' Over Ice Cream Record Sheet

 page 2 of 2

**6** What if you had to divide the brick of ice cream among 7 cousins? Estimate how many grams of ice cream each cousin would get. Then divide the brick into 7 parts and find the mass of one of the parts. (Be sure the parts are equal!)

<b>Amount of Ice Cream</b>	<b>Your Estimate</b> (in grams)	<b>Actual Mass</b> (in grams)	<b>The Difference</b> (in grams)
$\frac{1}{7}$ of the ice cream brick			

**7** Mold the clay back into 1 large piece again so the next pair of students can start with a fresh brick of “ice cream.”



# Set D1 ★ Activity 4



## ACTIVITY

### The Sack of Groceries

#### Overview

Students estimate the weight of a sack of groceries, weigh it to find the actual weight, and then add the weights of the individual items to see if the total matches the scale reading.

#### Skills & Concepts

- ★ estimate and determine weight using U.S. customary units
- ★ explore the difference between weight and mass
- ★ carry out a simple conversion within a system of measurement such as ounces to pounds

#### Recommended Timing

Anytime after Set D1 Activity 1

#### You'll need

- ★ 20–24 cans and/or packages of food (see Advance Preparation)
- ★ 2 grocery sacks with handles
- ★ bathroom scale
- ★ Student Math Journals
- ★ calculators (half-class set)

.....

**Advance Preparation** Look through your kitchen cupboards to find a variety of canned goods and packaged dry foods (i.e., beans, macaroni, and so on) that vary in weight from just a few ounces to about a pound. Make sure that each is clearly marked with its weight in U.S. customary units. Place one grocery sack inside the other and “double-bag” the items. Weigh the sack to be sure the combination of cans and packages totals about 12 pounds.

.....

#### Instructions for The Sack of Groceries

1. Place your sack of groceries where students can see it clearly. Ask them to share some of their experiences with grocery shopping. Have they ever had to help load the sacks of groceries into the car at the store? Have they ever had to help carry the sacks into their house or apartment? How much do they think an average bag of groceries weighs?
2. Invite a volunteer to pick up the sack. How heavy does it feel? Record his or her estimate on the board. Repeat this with a second volunteer. Do their estimates match? Then explain that sometime during the day, you'd like each student to pick up the bag, estimate its weight, and add his or her estimate to the board.
3. Perhaps students have noticed that you're asking them to estimate the *weight* of the sack rather than its mass. What's the difference between weight and mass? Ask students to share anything they already know. If they don't have much to share, have several volunteers do a little research. Encourage them to read any math dictionaries you might have in class or in the school library and/or go online. (one way to narrow the search is to Google such phrases as “difference between weight and mass.”) Ask them to be prepared to report their findings the following day.
4. The next day, ask your volunteers to share what they learned. Record their discoveries on a T-chart at the board or the overhead as students do so in their math journals.

**Activity 4** The Sack of Groceries (cont.)

How much does this sack of groceries weigh?

Our estimates:

10 pounds	16 pounds	5 pounds
25 pounds	11 pounds	7 pounds
15 pounds	30 pounds	9 pounds
12 pounds	24 pounds	14 pounds

What's the difference between weight and mass?

Weight

- How heavy something is
- Usually measured on a scale
- Measures how hard gravity is pulling on something. Can change if you go to a smaller planet where gravity doesn't pull as hard.
- Weight equals the mass of an object times the force of gravity. Something with a mass of 1,000 kilograms will weigh 0 kilograms in outer space because there's no gravity.

Mass

- How much matter there is in something
- Usually measured on a balance
- Never changes. It doesn't matter where you go. Even on a different planet, an object's mass doesn't change.

You can use customary units (like ounces and pounds) or metric units (like grams or kilograms) to measure both weight and mass.

5. Then show students the bathroom scale. Explain that you want them to each come up and weigh the sack of groceries sometime before the end of the day. When they find out what the actual weight is, they'll need to keep it a secret until everyone in class has had a turn.

6. Toward the end of the day, record the actual weight of the sack of groceries on the board. How does this compare with students' estimates? How does it compare with some of the sacks of groceries they've helped carry in from the car?

7. Now take several of the lighter items out of the sack and show students how to read the labels to find out how much they weigh. How do the weights of these items compare to a pound? Remind students that there are 16 ounces in a pound.

**Teacher** *This can of cat food weighs 5 and a half ounces. This box of macaroni and cheese weighs 7 ounces. The mushroom soup weighs about 11 ounces. Do any of these weigh a pound?*

**Students** *No! They're really light.*

*The macaroni and cheese weighs about half a pound.*



**Activity 4** The Sack of Groceries (cont.)

**Students** *If you put them together, they're not even 2 pounds, because that would be 32 ounces. You must have some stuff in there that's a lot heavier, or the bag wouldn't weigh 12 pounds. There are lots of things in there, though. I looked.*

8. Record the weights of the items you've selected on the board and work with input from the class to find the total. If it's more than 16 ounces, have the students help you convert it to pounds and ounces.

		16 ounces in a pound
cat food	5.5 ounces	23.5 ounces
mac & cheese	7.0 ounces	- 16.0 ounces
soup	+ 11.0 ounces	-----
	23.5 ounces	7.5 ounces
These 3 items add up to 1 pound 7.5 ounces		

9. Take all the cans and boxes out of the bag. Give each group of four students 2–4 of the items. Ask them to find the weight on the label of each and add the weights to find out how much their little set of items totals. (Be sure they read the weight in customary rather than metric units if some of the items are labeled both ways.) Record each group's total on the board and then work with the class to add all the weights. Does the grand total match what the scale said? If not, how would students explain the difference?

**Extension**

- Go online with your class to further explore the difference between weight and mass. If you enter “difference between weight and mass” into a search engine such as Google, it will bring up a number of different web sites, some of which will calculate your weight (or the weight of a common animal or favorite dinosaur) on a variety of different planets. Many of these sites also feature explanations that are appropriate for elementary students about the differences between weight and mass.



# Set D1 ★ Activity 5



## ACTIVITY

### Kitten & Cat Weights

#### Overview

Students place food items in a grocery sack to approximate average kitten and cat weights, weigh the sack, make needed adjustments, and record their results. This activity is designed for use by student pairs during Work Places or other work periods.

#### Skills & Concepts

- ★ estimate and determine weight using U.S. customary units
- ★ carry out a simple conversion within a system of measurement such as ounces to pounds

#### Recommended Use

Anytime after Set D1 Activity 4

#### You'll need

- ★ Kitten & Cat Weights (page D1.20, class set)
- ★ 20–24 cans and/or packages of food (see Set D1 Activity 4 Advance Preparation notes)
- ★ grocery bag with handles
- ★ bathroom scale
- ★ 2 calculators

.....  
**Advance Preparation** Set up the materials listed above in a location somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.  
 .....

#### Instructions for Kitten & Cat Weights

1. Talk with students about kittens and cats. Do any of them own a kitten or a cat? Do they know how much it weighs? Do they have any idea how much a newborn kitten or a full-grown cat weighs? Then explain that you've set up some materials to help them find out, and to give them more experience estimating and measuring weight.
2. Show students a copy of the Kitten & Cat Weights sheet. Review the instructions on the sheet with the class and model the procedures described as needed.
3. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

## Kitten & Cat Weights

A newborn kitten weighs about 4 ounces. By the time a kitten is 5 weeks, he or she should weigh about 16 ounces or 1 pound. The chart below lists average weights for kittens at 7 weeks and 10 weeks, and also for full-grown cats. For each entry on the chart:

- convert the weight to pounds and ounces. (There are 16 ounces in a pound.)
- load groceries into the sack until you think it's about the same as the kitten or cat weight.
- put your sack on the scale and see how much it actually weighs.
- take some things out or add some until the sack weighs as close as you can get to the kitten or cat weight.
- record the items that are in the sack.

Age of Kitten or Cat	Average Weight in Ounces	Weight in Pounds and Ounces	Items in My Sack
7-week old kitten	24 ounces		
10-week old kitten	32 ounces		
Full-grown female cat	128 ounces		
Full-grown male cat	160 ounces		

# Set D1 ★ Activity 6



## ACTIVITY

### Line Them up by Weight

#### Overview

Students estimate the weights of 6 different items, ordering them from lightest to heaviest. Then they determine the actual weights to check their estimates. This activity is designed for use by student pairs during Work Places or other work periods.

#### Skills & Concepts

- ★ estimate and determine weight using U.S. customary units

#### Recommended Use

Anytime after Set D1 Activity 4

#### You'll need

- ★ Line Them up by Weight Instructions (page D1.22, run 1 copy)
- ★ Line Them up by Weight Record Sheet (page D1.23, run a class set)
- ★ scale that weighs in ounces (borrow one from a grade five Bridges teacher)
- ★ 6 resealable sandwich bags
- ★ items to fill the bags (see Advance Preparation)

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**Advance Preparation** Label each of the 6 bags with a letter from the alphabet from A to F. Fill each with 1 cup of something easily measured. Suggestions include paperclips, macaroni, rice, beans, unpopped popcorn, and so on. Place the activity instructions, record sheets, scale, and filled bags somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.

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#### Instructions for Line Them up by Weight

1. Explain that you've set up some materials to give students more practice estimating and finding the weight of things in ounces. Show them the bags and the scale. Remind them that there are 16 ounces in a pound, so 1 ounce doesn't weigh very much. For that reason, scales that weigh things in ounces are very sensitive and can be delicate. Talk with the class about caring for the scale, especially if you've brought it from your own kitchen or borrowed it from another classroom.
2. Show students a copy of the Line them up by Weight instructions and record sheet. Review the instructions with the class, and model the procedure of estimating and measuring as needed. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

# Line Them up by Weight Instructions

## This activity will need

- ★ Line Them up by Weight Instructions (page D1.22, 1 copy)
- ★ Line Them up by Weight Record Sheet (page D1.23, class set)
- ★ scale that weighs in ounces
- ★ 6 bags filled with different things

## Instructions for Line Them up by Weight

**1** Record your name and the date at the top of a record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.

**2** Lift the different bags so you can feel how heavy each one is. Put them in the order you think they belong, from lightest to heaviest. Record your predictions.

**3** Estimate the weight of Bag A in ounces. Record your estimate.

**4** Weigh the bag on the scale to find out how many ounces it really weighs. Record the actual weight.

**5** Find the difference between your estimate and the actual weight. Record the difference in the last column.

**6** Continue estimating, weighing, and finding the difference for the other 5 bags. Use what you know about the weight of the first bag to help make your estimates.

**7** When you've found out how much each bag actually weighs, put them in order from lightest to heaviest, and record their actual ranking.

**8** At the bottom of the record sheet, write a sentence or two about what you noticed.

**9** Clean up. Shuffle the bags so the next students who do this activity will have the fun of making their own discoveries.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Line Them up by Weight Record Sheet

Put the bags in the order you think they belong, from lightest to heaviest. Record your predictions. Then do the second part of the sheet. After you find out how many ounces each bag weighs, fill in the second row on this chart to show their actual order.

	1st lightest	2nd	3rd	4th	5th	6th heaviest
<b>Estimate</b>						
<b>Actual Rank</b>						

Container	Your estimate (in ounces)	Actual Measurement (in ounces)	The Difference (in ounces)
<b>A</b>			
<b>B</b>			
<b>C</b>			
<b>D</b>			
<b>E</b>			
<b>F</b>			

I noticed that







# GRADE 4 SUPPLEMENT

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## Set D3 Measurement: Capacity in Metric Units

### Includes

Activity 1: Estimate, Order & Measure: Milliliters & Liters	D3.1
Activity 2: Which Container is Best?	D3.5
Independent Worksheet 1: Capacity in Daily Life	D3.9

### Skills & Concepts

- ★ estimate and measure capacity in metric units
- ★ carry out simple conversions within a system of measurement, such as milliliters to liters

**Bridges in Mathematics Grade 4 Supplement**

**Set D3** Measurement: Capacity In Metric Units

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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# Set D3 ★ Activity 1



## ACTIVITY

### Estimate, Order & Measure Milliliters & Liters

#### Overview

Students estimate the capacity of 6 different containers, ordering them from least to most capacity. Then they determine the actual capacities to check their estimates. This activity is designed for use by student pairs during Work Places or other work periods.

#### Skills & Concepts

- ★ estimate and measure capacity in metric units
- ★ carry out simple conversations within a system of measurement, such as milliliters to liters

#### You'll need

- ★ Estimate, Order & Measure Instructions (page D3.3, run 1 copy)
- ★ Estimate, Order & Measure Record Sheet (page D3.4, run a class set)
- ★ 6 plastic containers (see Advance Preparation)
- ★ 1-cup liquid measuring cup (see Advance Preparation)
- ★ pitcher to hold about 2 liters of water
- ★ cafeteria tray
- ★ towel

.....

**Advance Preparation** Gather 6 plastic containers of varying capacity (e.g., margarine, yogurt, peanut butter, cream cheese containers, kids' cups from restaurants, and so on). If any of these are already marked with their capacity, black it out with a permanent marker. Label each container with an alphabet letter, A–F. Find the 1-cup measure that came with your Number Corner materials. If you haven't done so already, use the Calibration Strip on Number Corner Black-line 7.5 to calibrate the cup in increments of 10 milliliters. Place the containers, measuring cup, and pitcher of water on a cafeteria tray. Set up the tray, towel, activity instructions, and record sheets in a location somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.

.....

#### Instructions for Estimate, Order & Measure: Milliliters & Liters

1. Explain that you've set up some materials to give students practice estimating and measuring capacity in metric units. Review the terms *capacity*, *milliliter*, and *liter* with the class.

**Activity 1** Estimate, Order & Measure (cont.)

.....

**Note** *If you've done the March Calendar Collector with your class, students will already be familiar with milliliters. If not, pass the measuring cup to a volunteer and ask her to find the mark on the cup that shows 200 milliliters. How does this mark compare with the mark on the other side that shows 1 cup? If students are unfamiliar with metric units of capacity, it may help them to see that 200 milliliters is a little less than 1 cup, while the 250 milliliter mark near the very top of the measuring cup is just a little over 1 cup. Review the fact that there are 4 cups in a quart and 1000 milliliters in a liter. Because 250 milliliters is just a little more than a cup, a liter is a little more than a quart.*

.....

2. Show students a copy of the Estimate, Order & Measure instructions and record sheet. Review the instructions with the class, and model the procedure of estimating and measuring as needed. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

## Estimate, Order & Measure Instructions

### To do this activity, you'll need

- ★ Activity Instructions
- ★ Estimate, Order & Measure Milliliters & Liters Record Sheet
- ★ 6 plastic containers labeled with letters A–F
- ★ pitcher
- ★ 1-cup measuring cup
- ★ towel

### Instructions for Estimate, Order & Measure: Milliliters & Liters

- 1** Record your name and the date at the top of a record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.
- 2** Look at the 6 containers. Put them in the order you think they belong, from smallest to largest. Record your predictions.
- 3** Go to the sink with your partner and carefully measure 1–2 liters of water into the pitcher.
- 4** Estimate the capacity of Container A in milliliters or liters. (Remember that there are 1,000 milliliters in a liter, and the measuring cup holds 250 milliliters.) Record your estimate.
- 5** Use the water and the measuring cup to find out how much water Container A actually holds (to the nearest 10 milliliters). Record the actual capacity.
- 6** Find the difference between your estimate and the actual capacity. Record the difference in the last column.
- 7** Continue estimating, finding the capacity, and finding the difference for the other 5 containers. Use what you know about the capacity of the first container to help make your estimates.
- 8** When you've found out how much each container actually holds, put them in order from smallest to largest, and record their actual ranking.
- 9** Clean up. After you finish the activity, return all the water to the pitcher and empty the pitcher in the sink. Wipe down the table surface and clear any spills on the floor. Mix up the 6 containers so they're out of order and ready for the next pair of students.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Estimate, Order & Measure Record Sheet

Put the containers in the order you think they belong, from smallest to largest. Record your predictions. Then do the second part of the sheet. After you find out how much water each container holds, fill in the second row on this chart to show their actual order.

	1st smallest	2nd	3rd	4th	5th	6th largest
<b>Estimate</b>						
<b>Actual Rank</b>						

Container	Your estimate (to the nearest 10mL)	Actual Measurement (to the nearest 10mL)	The Difference (to the nearest 10mL)
<b>A</b>			
<b>B</b>			
<b>C</b>			
<b>D</b>			
<b>E</b>			
<b>F</b>			

## Set D3 ★ Activity 2



### ACTIVITY

## Which Container is Best?

### Overview

Students estimate which beverage containers are most likely to hold certain amounts of water. Then they test their ideas to find the best containers for several different situations. This activity is designed for use by student pairs during Work Places or other work periods.

### Skills & Concepts

- ★ estimate and measure capacity in metric units
- ★ carry out simple conversations within a system of measurement, such as milliliters to liters

### You'll need

- ★ Which Container is Best? Record Sheets (pages D3.7 and D3.8, run a class set)
- ★ an assortment of 8 or more beverage containers (see Advance Preparation)
- ★ 1-cup liquid measuring cup (see Advance Preparation)
- ★ pitcher to hold about 2 liters of water
- ★ cafeteria tray
- ★ towel

.....

**Advance Preparation** Gather 8 or more beverage containers of varying capacity (e.g., pop can, water bottles of various sizes, small children's cup, drink containers from restaurants including an extra large or "super" size, and so on). Label each container with an alphabet letter. Find the 1-cup measure that came with your Number Corner materials. If you haven't done so already, use the Calibration Strip on Number Corner Blackline 7.5 to calibrate the cup in increments of 10 milliliters. Place the containers, measuring cup, and pitcher of water on a cafeteria tray. Set up the tray, towel, and Record Sheets in a location somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.

.....

### Instructions for Which Container is Best?

1. Explain that you've set up some materials to give students more practice estimating and measuring capacity in metric units. Show them a copy of the Which Container is Best? Record Sheets. Review the instructions on the sheet with the class, and model the procedure of estimating and measuring as needed.
2. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

**Activity 2** Which Container is Best? (cont.)



**INDEPENDENT WORKSHEET**

See Set D3 Independent Worksheet 1 for more practice estimating and measuring capacity in metric units.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Which Container Is Best? Record Sheet page 1 of 2

## Directions

- a** Record your name and the date at the top of the record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.
- b** For each problem below:
- estimate and record which containers you think will hold the amount of water needed. (It's okay if you choose more than one container that might work.)
  - test your estimates using the liquid measuring cup.
  - decide which beverage container actually works best.
  - record your recommendation.
- c** Clean up. After you finish the activity, return all the water to the pitcher. Wipe down the table surface and clean up any spills on the floor.

## Problems

Sarah needs to bring some water for several different activities this week. Help her choose the best container for each activity.

**1** For a car trip to her grandma's on Monday, Sarah needs to bring about 500 milliliters of water to drink.

**a** Estimate: Which of the containers look like they would hold about 500 milliliters?

**b** Use the liquid measuring cup to help you find the drink container that would work best for the car trip.

**c** Container \_\_\_\_\_ holds about 500 milliliters.

**2** For ballet class on Wednesday, Sarah needs to bring about 800 milliliters of water to drink.

**a** Estimate: Which of the containers look like they would hold about 800 milliliters? Are there any two containers that look like they would hold 800 milliliters combined?

**b** Use the liquid measuring cup to help you find the drink container (or pair of containers) that would work best for ballet class.

**c** Container(s) \_\_\_\_\_ hold(s) about 800 milliliters.

## Which Container Is Best? Record Sheet page 2 of 2

**3** For her track meet on Saturday, Sarah needs to bring about a liter of water to drink.

**a** Estimate: Which of the containers look like they would hold about 1 liter? Are there any combinations of 2 or more containers that might hold 1 liter?

**b** Use the liquid measuring cup to help you find the drink container (or combination of containers) that would work best for the track meet.

**c** Container(s) \_\_\_\_\_ hold(s) about 1 liter.



### CHALLENGE

**4** On the way home from track meets, Sarah always buys a 2-liter bottle of juice. How many total milliliters of juice is she drinking if there are 6 track meets this season?

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set D3 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### Capacity in Daily Life

**1** Javier brought a thermos of tomato soup for lunch. He estimates that he brought about  $\frac{3}{4}$  of a liter. His friend insists he brought about  $\frac{3}{4}$  of a milliliter. Who is correct? Why? You may use measuring tools from your classroom to help you, if needed. Explain your answer using numbers, pictures, and/or words.

**2** Julene is making fruit punch for her scout troupe. There are 10 girls in the troupe and each one will have at least 1 glass of punch. Should she use 2 milliliters, 2 liters, 20 liters, or 200 liters of water? Why? You may use measuring tools from your classroom to help you, if needed. Explain your answer using numbers, pictures, and/or words.





# GRADE 4 SUPPLEMENT

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## Set D6 Measurement: Area & Perimeter

### Includes

Activity 1: Measuring Area	D6.1
Activity 2: Measuring Perimeter	D6.9
Activity 3: The Ladybugs' Garden	D6.15
Activity 4: Hexarights	D6.21
Independent Worksheet 1: Area & Perimeter Review	D6.29
Independent Worksheet 2: Measuring Rectangles	D6.33

### Skills & Concepts

- ★ determine the perimeters and areas of squares and other rectangles using formulas and explain why the formulas work
- ★ determine the areas of nonrectangular figures that can be composed or decomposed into rectangles
- ★ demonstrate that rectangles with the same area can have different perimeters, and that rectangles with the same perimeter can have different areas
- ★ solve single- and multi-step contextual problems involving perimeters and areas, and justify the solutions

**Bridges in Mathematics Grade 4 Supplement**

**Set D6** Measurement: Area & Perimeter

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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# Set D6 ★ Activity 1



## ACTIVITY

### Measuring Area

#### Overview

Students review the term area and work together to generate a formula for determining the area of rectangles and squares. In the process, they have an opportunity to see and handle a square inch and a square foot. Then they apply the information as they work in pairs to find the area of various items around the classroom.

#### Skills & Concepts

- ★ determine the perimeters and areas of squares and other rectangles using formulas and explain why the formulas work

#### You'll need

- ★ Measuring Area (page D6.4, run a class set)
- ★ one 12" × 12" piece of red construction paper
- ★ 10" × 18" blue construction paper (1 piece for every 4 students)
- ★ rulers (class set)
- ★ yardsticks and measuring tapes
- ★ masking tape
- ★ calculators (optional, class set)
- ★ Student Math Journals or 1 piece of lined or grid paper per student
- ★ Word Resource Cards *Area, Dimension* (pages D6.5 and D6.6 & D6.7 and D6.8, run 1 copy back to back on cardstock, cut out each card)

#### Instructions for Measuring Area

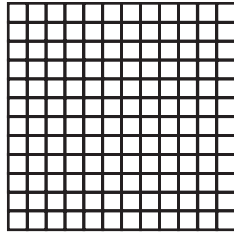
1. Post the Word Resource Card for *area* on the board. Ask students to pair-share what they know about this term. After a minute or two, invite volunteers to share their ideas with the class. As the discussion unfolds, review the following concepts:

- area is a measure of how much surface something takes up.
- area is measured in square units such as square inches, square feet, or square miles.



2. Hold up a single tile and ask students to report its area in square inches. If necessary, have a volunteer measure the dimensions of the tile and work with the class to establish the fact that it's exactly 1 square inch. Use a loop of masking tape to fasten the tile to the board. Work with class input to label its dimensions and area.

3. Distribute sets of tile. Ask students to work in groups of four to build a square with an area of exactly 144 square inches. After they've had a few minutes to work, have them share and compare their results.

**Activity 1** Measuring Area (cont.)

**Students** *We thought it was going to be really big, but it's not so big after all.*

*We knew it was going to be a 12" × 12" square because 12 × 12 is 144.*

*We each made 3 rows of 12 and put them together. It went pretty fast for us.*

4. Ask each group to measure the dimensions of the square they've just built with the inch side of their ruler. What can they tell you about the square now? As volunteers share with the class, press them to explain their thinking.

**Alex** *It's 12 inches on both sides.*

**Teacher** *What is the area of your square, and how do you know?*

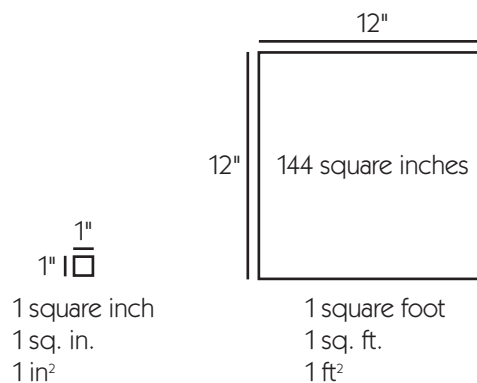
**Students** *It's 144 square inches because that's what you told us to do.*

*It's 144 square inches because we used 144 tiles, and each tile is 1 square inch.*

*You can see a 10 × 10 square inside the 12 × 12. Then just add 12 on the top and bottom, and 10 on both sides. It makes 144 in all.*

*It's 12 rows of 12. If you just multiply 12 × 12, you get 144.*

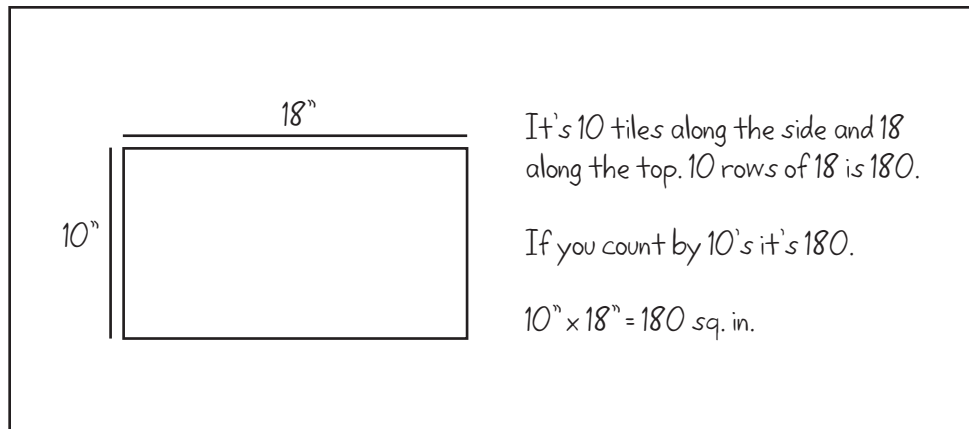
5. Show students the 12" × 12" square of red construction paper you've prepared. Ask a volunteer to compare the paper to the tile square at his or her table. After confirming that the two are the same size, fasten the paper square to the board. Work with class input to label its dimensions and area. Explain that because it is 12" or 1 foot on each side, it's called a square foot, and record this information on the board.



6. Give each group a 10" × 18" piece of blue construction paper. Ask them to find the area of this rectangle, using their rulers and/or the tile to help. Challenge them to find a more efficient method than covering the entire rectangle with tile. Have them each record the answer, along with any computations they made, in their journals.

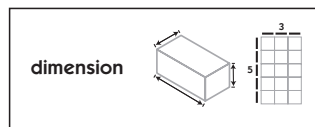
7. When they've had a few minutes to work, ask students to share their answers and explain how they found the area of the rectangle. Record their strategies at the board.



**Activity 1** Measuring Area (cont.)

8. Chances are, some students will have compared the paper rectangle to the tile square at their table to find the side lengths, and then used some kind of counting strategy to find the area. Others may have done the same but multiplied the dimensions to find the area. Still others may have measured the dimensions with their rulers and multiplied. If the third strategy doesn't come from the students, tape one of the 10" × 18" pieces of paper to the board and model it yourself.

9. Post the Word Resource Card for *dimension* on the board. Explain that to find the area of a square or a rectangle, we measure its dimensions and multiply the 2 numbers. Press students to explain how and why this works, and then work with input from the class to write the general formula for the area of a rectangle: area = length × width or  $A = lw$ .



10. Explain that in a minute, students will be working in pairs to find the area of some things around the classroom. Ask them to look around. Can they spot anything they'd measure in square inches? What about the calendar grid pocket chart or the whiteboard? Would they find the area of these in square inches or square feet?

**Students** *I'd use square inches to find out the area of small stuff like my math journal or probably my desk.*

*I'd maybe use square feet instead of square inches to get the area of the calendar chart.*

*I'd definitely use square feet to measure the area of the rug or the whole room.*


11. Give students each a copy of the Measuring Area worksheet. Examine the chart together and explain the tasks as needed. Make sure they know where to find the yardsticks and measuring tapes as they need them. Then ask them to work in pairs to complete the sheet.

**Note** *Advise students to work to the nearest inch in measuring the dimensions of the items listed on the worksheet. You might also allow them to use calculators to help with the computation, especially if some of your students aren't yet completely fluent with 2-digit by 2-digit multiplication.*

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Measuring Area

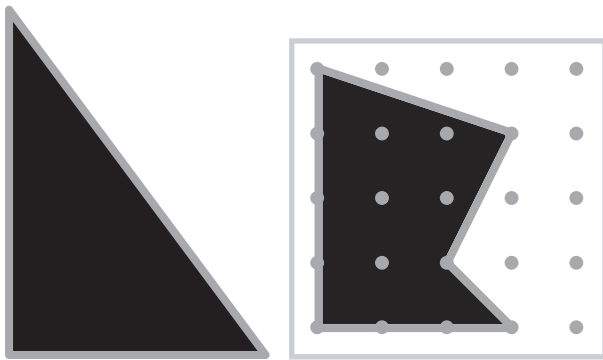
Find the area of each item listed below.	Dimensions (Measure to the nearest inch and show your units: inches or feet)	Area (Show your work and label the answer with the correct units.)
<b>example</b> A piece of blue construction paper	Length = 18" Width = 10"	$18'' \times 10'' = 180 \text{ sq. in.}$
<b>1</b> Your math journal		
<b>2</b> Your desk or table		
<b>3</b> A geoboard		
<b>4</b> Calendar Grid pocket chart		
<b>5</b> The top of a bookshelf		
<b>6</b> The front of a chapter book		
<b>7</b> A Calendar Grid marker		
<b>8</b> A work table larger than the one where you sit		
<b>9</b> The whiteboard		
 <b>10</b> The classroom		

# area

Bridges in Mathematics

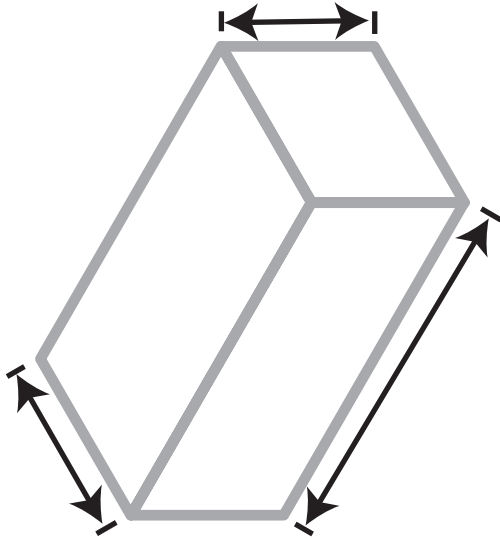
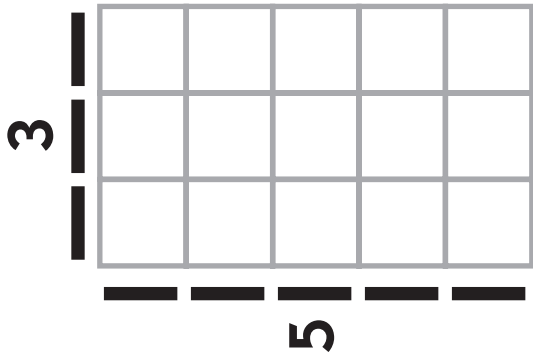


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Working Definition

**area: the total number of square units  
needed to cover a 2-dimensional surface**



**dimension**

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Bridges in Mathematics

Working Definition

**dimension: length, width, or depth**

# Set D6 ★ Activity 2



## ACTIVITY

### Measuring Perimeter

#### Overview

Students review the terms area and perimeter, and find the perimeter of a rectangular and a square piece of construction paper. Together, they generate formulas for determining the perimeter of rectangles and squares. Then they apply the information as they work in pairs to find the perimeter of various items around the classroom.

#### Skills & Concepts

- ★ determine the perimeters and areas of squares and other rectangles using formulas and explain why the formulas work

#### Recommended Timing

Anytime after Set D6 Activity 1

#### You'll need

- ★ Measuring Perimeter (page D6.12, class set)
- ★ 9" × 12" green construction paper (half class set)
- ★ one 12" × 12" piece of red construction paper
- ★ base 10 mats available
- ★ geoboards available
- ★ rulers (class set)
- ★ yardsticks and measuring tapes
- ★ Student Math Journals or 1 piece of lined or grid paper per student
- ★ Word Resource Cards *Area, Perimeter* (pages D6.5 and D6.6 & D6.13 and D6.14, run 1 copy back to back on cardstock, cut out each card)

#### Instructions for Measuring Perimeter

1. Post the Word Resource Cards for *area* and *perimeter* on the board. Ask student pairs to compare and contrast the two terms. How are they alike? How are they different? After a minute or two, invite volunteers to share their ideas with the class. As the discussion unfolds, review the following concepts:

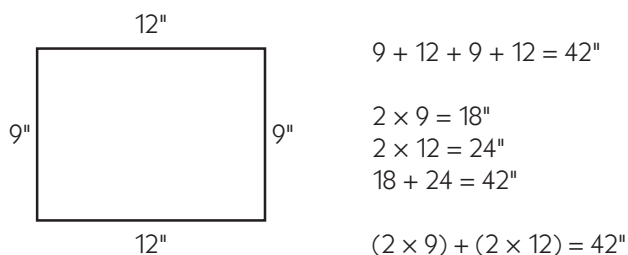
- area and perimeter are both measurements.
- area is a measure of how much surface something takes up.
- area is measured in square units such as square inches, square feet, or square miles.
- perimeter is a measure of the total distance around something.
- perimeter is measured in linear units such as inches, feet, yards, or miles.



2. Explain that you'll be working with perimeter today. Have students pair up or assign partners, and ask them to get out their rulers and math journals. Give each pair a 9" × 12" sheet of construction paper without mentioning the dimensions. Ask them to use the inch side of their ruler to find the perimeter, or the total distance around the paper. Have them each record the answer, along with any computations they made, in their journals.

**Activity 2** Measuring Perimeter (cont.)

3. When they've had a couple of minutes to work, ask students to share their answers and explain how they found the perimeter of the paper. Use numbers and labeled sketches to record the strategies they share.



4. Chances are, some students will have added all 4 side lengths, while others may have multiplied each of the lengths by 2 and then added. If the second strategy doesn't come from the students, model it yourself. Then work with input from the class to write a general formula for finding the perimeter of a rectangle: perimeter =  $2 \times$  the width +  $2 \times$  the length, or  $P = 2w + 2l$ .

5. Hold up the 12" square of construction paper. Ask students to estimate the perimeter of this square based on the measurements they just made. It's fine if they want to set one of the 9"  $\times$  12" sheets directly on top of the square to help make a more accurate estimate. Record their estimates on the board. Then have a volunteer measure one of the sides of the square and share the measurement with the class. Ask students how they can use that information to find the perimeter. Is it possible to do so without measuring the other 3 side lengths?

**Students** *Sure! It's a square, so all the sides are the same.*

*Just add 12 four times.*

*Or you could multiply  $12 \times 4$  to get the answer. It's 48 inches.*

6. Work with input from the class to write a general formula for finding the perimeter of a square: perimeter =  $4 \times$  the length of one side, or  $P = 4s$ .

7. Ask students to consider the following question: If there are 12" in a foot, what is the perimeter of the paper square in feet? Have them give the thumbs-up sign when they have the answer and then invite a couple of volunteers to share their thinking.

**Students** *Each side is a foot, so it's 4 feet all the way around.*

*Also, it's 48 inches and  $48 \div 12 = 4$ , so that's 4 feet.*

*Wow! That's pretty big around. My little sister isn't much taller than about 4 feet.*

8. Explain that in a minute, students will be working in pairs to measure the perimeter of some things around the classroom. Ask them to look around. Can they spot anything they'd measure in inches? What about the calendar grid pocket chart or the whiteboard? Would they find the perimeter of these in inches or feet? Hold up a yardstick and ask them if there's anything in the room with a perimeter it would make most sense to measure in yards.

**Students** *I'd use inches to find out the perimeter of small stuff like a book or probably my desk.*

*I'd definitely use feet instead of inches to get the perimeter of the whiteboard.*

*I'd use yards to measure the perimeter of the rug or the whole room.*



**Activity 2** Measuring Perimeter (cont.)

9. Give students each a copy of the Measuring Perimeter worksheet. Examine the chart together and explain the tasks as needed. Ask students if they need to measure the length of every side in order to find the perimeter of their math journal or their desk. Why not?

Make sure they know where to find the yardsticks and measuring tapes as they need them. Then ask them to work in pairs to complete the sheet.

.....  
*Note* Advise students to work to the nearest inch in measuring the side lengths of the items listed on the worksheet.  
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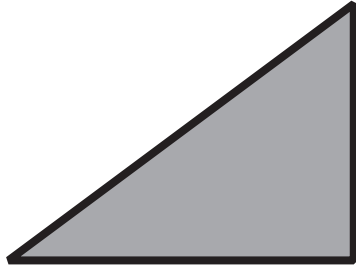
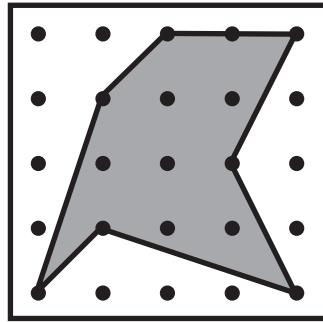
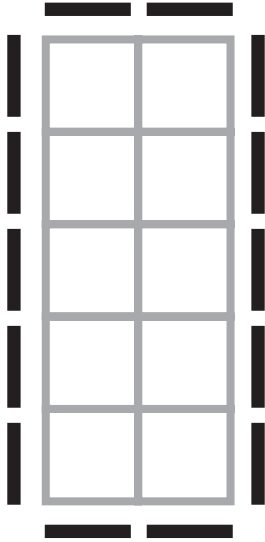
NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Measuring Perimeter

Find the perimeter of each item listed below.	Side Lengths (Include units: inches, feet, or yards)	Circle the formula you need to find the perimeter.	Perimeter (Show your work and label the answer with the correct units.)
<b>example</b> A piece of green construction paper	9" and 12"	$P = 2w + 2l$ $P = 4s$	$(2 \times 9) + (2 \times 12) = 42"$
<b>1</b> Your math journal		$P = 2w + 2l$ $P = 4s$	
<b>2</b> Your desk or table		$P = 2w + 2l$ $P = 4s$	
<b>3</b> A geoboard		$P = 2w + 2l$ $P = 4s$	
<b>4</b> Calendar Grid pocket chart		$P = 2w + 2l$ $P = 4s$	
<b>5</b> The top of a bookshelf		$P = 2w + 2l$ $P = 4s$	
<b>6</b> A base 10 mat		$P = 2w + 2l$ $P = 4s$	
<b>7</b> The whiteboard		$P = 2w + 2l$ $P = 4s$	
<b>8</b> The classroom		$P = 2w + 2l$ $P = 4s$	

# perimeter



Bridges in Mathematics

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Working Definition

**perimeter: the distance in linear units  
around a figure**

# Set D6 ★ Activity 3



## ACTIVITY

### The Ladybugs' Garden

#### Overview

The Ladybugs are planning their spring garden. They have exactly 24 centimeters of fencing, and they want to make a rectangular garden. Students investigate relationships between area and perimeter as they develop the best plan for the Ladybugs' garden.

#### Skills & Concepts

- ★ determine the perimeters and areas of squares and other rectangles using formulas and explain why the formulas work
- ★ demonstrate that rectangles with the same area can have different perimeters, and that rectangles with the same perimeter can have different areas
- ★ solve single- and multi-step contextual problems involving perimeters and areas, and justify the solutions

#### Recommended Timing

Anytime after Set D6 Activity 2

#### You'll need

- ★ The Ladybugs' Garden (page D6.18, 1 copy on a transparency)
- ★ Centimeter Grid Paper (page D6.19, class set)
- ★ overhead pens
- ★ a piece of paper to mask parts of the overhead
- ★ rulers (class set)

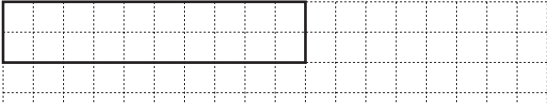
#### Instructions for The Ladybugs' Garden

1. Give students each a sheet of Centimeter Grid Paper and ask them to get out their pencils and rulers. Show the prompt at the top of the Ladybugs' Garden overhead. Read it with the class and clarify as needed. Give them a few minutes to draw a rectangle on their grid paper that has a perimeter of exactly 24 centimeters.
2. Then invite a volunteer up to the overhead to share his or her work with the class.

Set D6 Measurement: Area & Perimeter Blackline Run 1 copy on a transparency.

### The Ladybugs' Garden

1 The Ladybugs are planning to plant a garden this spring. They want it to be rectangular. They have exactly 24 centimeters of fencing put around the perimeter of their garden. Sketch a plan for them on your grid paper.



**Beckett** *I started by drawing a line that was 10 centimeters along the top. That just seemed like a good length. Then I drew 2 centimeters down. That added up to 12, and I realized that it would take 12 more to make the rest of the rectangle. It turned out kind of skinny, but it worked.*

### Activity 3 The Ladybugs' Garden (cont.)

3. Have your volunteer label each side of his or her rectangle with its length and sit down again. Then ask the rest of the class to write 2 equations on the back of their grid paper, one for the perimeter and one to determine the area of the rectangle. Remind them to label their answers with the correct units. Have them pair-share their work as they finish. Work with input from the class to label the rectangle with its area and write the two needed equations at the overhead. Take the opportunity to review the formulas for finding the perimeter and area of a rectangle, and ask students to correct their work if necessary.

Set D6 Measurement: Area & Perimeter Blackline Run 1 copy on a transparency.

#### The Ladybugs' Garden

1 The Ladybugs are planning to plant a garden this spring. They want it to be rectangular. They have exactly 24 centimeters of fencing put around the perimeter of their garden. Sketch a plan for them on your grid paper.

A grid showing a rectangle with a length of 10 cm and a width of 2 cm. The perimeter is labeled as 24 cm and the area as 20 sq cm. To the right of the grid, the following equations are written:

$$P: (2 \times 2) + (2 \times 10) = 24 \text{ cm}$$

$$A: 2 \times 10 = 20 \text{ sq cm}$$

4. Have a student who responded differently to the original prompt draw and label his or her rectangle at the overhead. (If no one had a different response, volunteer one of your own.)

Set D6 Measurement: Area & Perimeter Blackline Run 1 copy on a transparency.

#### The Ladybugs' Garden

1 The Ladybugs are planning to plant a garden this spring. They want it to be rectangular. They have exactly 24 centimeters of fencing put around the perimeter of their garden. Sketch a plan for them on your grid paper.

A grid showing two rectangles. The first rectangle has a length of 10 cm and a width of 2 cm, with a perimeter of 24 cm and an area of 20 sq cm. The second rectangle has a length of 8 cm and a width of 4 cm, also with a perimeter of 24 cm and an area of 20 sq cm. To the right of the grid, the following equations are written:

$$P: (2 \times 2) + (2 \times 10) = 24 \text{ cm}$$

$$A: 2 \times 10 = 20 \text{ sq cm}$$

**Delia** I started with 8 centimeters along the top and then drew 4 down. I saw that was 12, so I just did the same thing for the bottom and the other side. It's 24 in all.

5. Confirm with the class that both rectangles have a perimeter of 24 centimeters. Even before they calculate the area of the second rectangle, would they say the areas are the same or different?

**Students** The second one looks bigger.

I'm pretty sure there's more space in the second one.

That's weird because they both have the same amount of fence around the outside.

**Activity 3** The Ladybugs' Garden (cont.)

6. Ask students to write 2 equations for the second rectangle on the back of their grid paper, one for the perimeter and one for the area. Then work with their input to label the second rectangle with its area and write both equations at the overhead. Is the area of the second rectangle the same as the first or different? Ask students to pair share ideas about why the areas are different even though the perimeters are the same. Then invite volunteers to share their thinking with the class.

**Students** *The one that's long and skinny doesn't have as much area.  
It's like when you make the sides shorter, you get more room in the middle.  
The first rectangle I drew has even more space in the middle.*

7. Then reveal the rest of the overhead. Read it with the class and clarify as needed. Let them know that they need to find at least 4 different rectangles, and it's fine if one is a square because squares are also rectangles. Make sure students understand that a  $2 \times 10$  and a  $10 \times 2$  don't count as 2 different rectangles. Ask them to respond to questions 3 and 4 on the back of their grid paper.

- 2** Now sketch as many different rectangles as you can find that have a perimeter of 24 centimeters. Label each one with its perimeter and area, along with equations to show how you got the answers. Note: The sides of your rectangle must lie on the grid lines.
- 3** All of your rectangles have a perimeter of 24 centimeters. Do they all have the same area? Why or why not?
- 4** Which rectangle would work best for the Ladybugs' garden? Explain your answer.

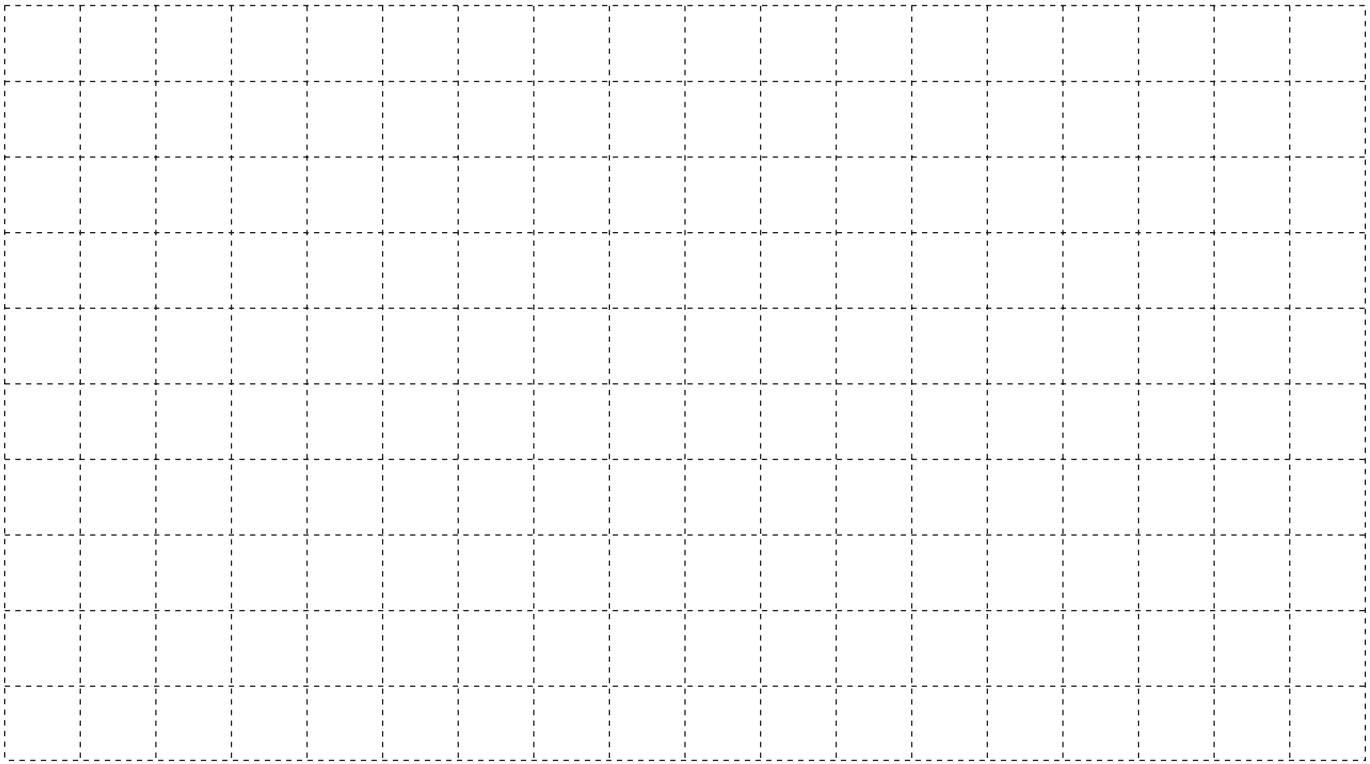
8. When most students have finished, reconvene the class to share and compare their results. They'll find that there are 6 different rectangles with a perimeter of 24 cm:  $1 \times 11$ ,  $2 \times 10$ ,  $9 \times 3$ ,  $8 \times 4$ ,  $7 \times 5$ , and  $6 \times 6$ . Each has a different area (11 sq cm, 20 sq cm, 27 sq cm, 32 sq cm, 35 sq cm, and 36 sq cm respectively), the square having the most. Encourage students to continue to explain why the areas vary from one rectangle to the next. (The closer rectangles with the same perimeter get to being square, the larger their area. Some students may be interested to know that a circle is the shape that has the maximum area for any given perimeter.) Also encourage students to discuss and debate the best rectangle for the Ladybugs' garden. Some may feel that the  $6 \times 6$  is best because it offers the most space. Others may believe that the  $3 \times 9$  or  $4 \times 8$  is better because it's easier to water all the plants, including ones in the middle.

**INDEPENDENT WORKSHEET**

See Set D6 Independent Worksheets 1 and 2 for more practice selecting and using appropriate units and formulas to determine area and perimeter.

# The Ladybugs' Garden

**1** The Ladybugs are planning to plant a garden this spring. They want it to be rectangular. They have exactly 24 centimeters of fencing put around the perimeter of their garden. Sketch a plan for them on your grid paper.



**2** Now sketch as many different rectangles as you can find that have a perimeter of 24 centimeters. Label each one with its perimeter and area, along with equations to show how you got the answers. Note: The sides of your rectangle must lie on the grid lines.

**3** All of your rectangles have a perimeter of 24 centimeters. Do they all have the same area? Why or why not?

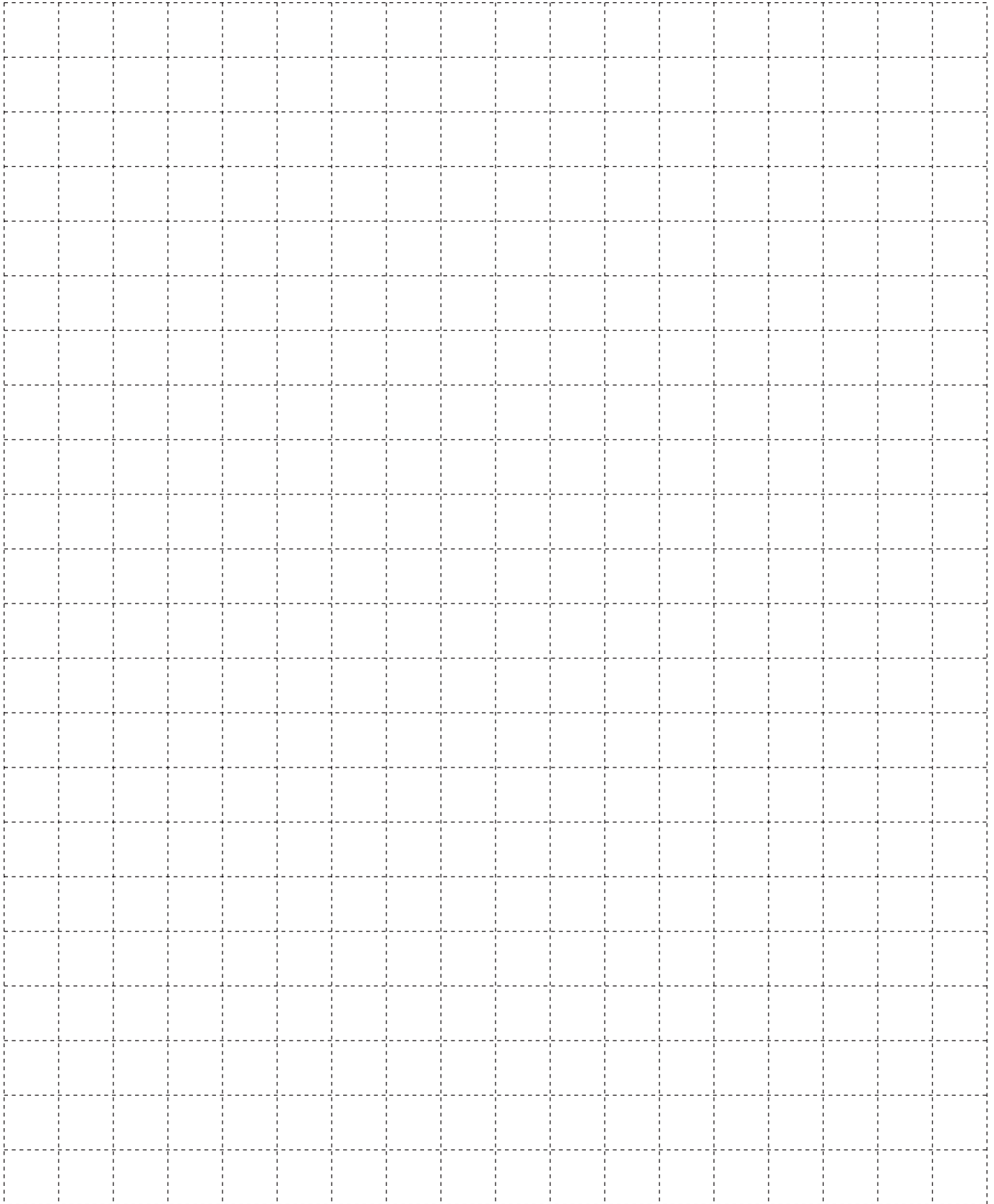
**4** Which rectangle would work best for the Ladybugs' garden? Explain your answer.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Centimeter Grid Paper





# Set D6 ★ Activity 4



## ACTIVITY

### Hexarights

#### Overview

Students continue to investigate relationships between area and perimeter as they measure and construct polygons called “hexarights” (hexagons with pairs of adjacent sides that meet at right angles).

#### Skills & Concepts

- ★ determine the perimeters and areas of squares and other rectangles using formulas and explain why the formulas work
- ★ determine the areas of nonrectangular figures that can be composed or decomposed into rectangles
- ★ demonstrate that rectangles with the same area can have different perimeters, and that rectangles with the same perimeter can have different areas
- ★ solve single- and multi-step contextual problems involving perimeters and areas, and justify the solutions

#### Recommended Timing

Anytime after Set D6 Activity 2

#### You'll need

- ★ Introducing Hexarights (page D6.24, 1 copy on a transparency)
- ★ Measuring Hexarights (page D6.25, half-class set, cut in half)
- ★ Hexarights, Perimeter = 24 cm (page D6.26, class set)
- ★ Centimeter Grid Paper (page D6.27, class set, plus a few extra)
- ★ piece of paper to mask parts of the overhead
- ★ 2 or 3 transparencies and overhead pens
- ★ rulers marked with both centimeters and inches (class set)

#### Instructions for Hexarights

1. Show the top portion of Introducing Hexarights at the overhead, masking the rest with a piece of paper. Give students a minute to pair-share any observations they can make. Then invite volunteers to share their thinking with the class. Record some of their ideas in the space to the left of the shape.
2. Then reveal the definition below the shape, still keeping the rest of the overhead covered. Read and discuss it with the class. As you do so, review the meanings of the terms *hexagon*, *perpendicular*, and *right angles*.

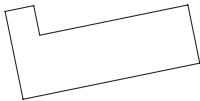
Set D6 Measurement: Area & Perimeter Blackline Run 1 copy on a transparency.

### Introducing Hexarights

**1** Describe this shape.

- has 6 sides
- has 5 maybe 6 right angles
- has parallel lines
- some of the lines are perpendicular
- kind of like 2 rectangles stuck together
- none of the lines are the same length

This shape is a hexagon because it has 6 sides, but let's call it a *hexaright*. A *hexaright* is a hexagon in which sides that touch each other is perpendicular (That is, they meet at right angles.)



## Activity 4 Hexarights (cont.)

3. Next, reveal the two counter-examples shown in the middle of the overhead. Can students explain why neither of these are hexarights? Have them share at the overhead so their classmates can see what they're talking about.

Set D6 Measurement: Area & Perimeter Blackline Run 1 copy on a transparency.


### Introducing Hexarights

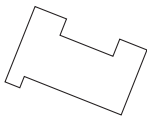
1 Describe this shape.

- has 6 sides
- has 5 maybe 6 right angles
- has parallel lines
- some of the lines are perpendicular
- kind of like 2 rectangles stuck together
- none of the lines are the same length

This shape is a hexagon because it has 6 sides, but let's call it a *hexaright*. A *hexaright* is a hexagon in which sides that touch each other is perpendicular (That is, they meet at right angles.)

2 Here are 2 examples of shapes that are *not* hexarights. Can you see why?

a 

b 

**Students** *Shape a isn't a hexaright because there are 2 angles that aren't right angles.*

*I thought they were wrong about shape b because it's all right angles, but then I realized there are 10 sides! A hexaright can only have 6 sides.*

4. Now show the 2 hexarights at the bottom of the overhead and briefly discuss strategies for finding the area and perimeter of each. Then give students each a copy of the Measuring Hexarights half-sheet. Ask them to experiment with both the inch side and the centimeter side of their rulers. Which unit of measure works best? Students will quickly discover that most of the measurements don't come out evenly unless they use centimeters.

5. Solicit agreement from the class that they'll work in centimeters and square centimeters rather than inches and square inches, and let them get started. Encourage them to share and compare their strategies and solutions as they work.

6. When most students have finished finding the perimeter and area of at least one of the hexarights, place a blank transparency on top of the overhead and invite volunteers to share their work with the class. Move or replace the transparency each time a new volunteer comes up to the overhead to accommodate several different presentations. Here is an example of the sort of work you might expect from students, although some will divide the hexarights differently.

Activity 4 Hexarights (cont.)

Set D6 Measurement: Area & Perimeter Blackline Run a half-class set and cut the sheets in half.  
 Name \_\_\_\_\_ Date \_\_\_\_\_

### Measuring Hexarights

Find the area and perimeter of the hexarights below. Show all your work.

$2 \times 3 = 6 \text{ sq cm}$   
 $3 \times 4 = 12 \text{ sq cm}$   
 $6 + 2 + 3 + 3 + 4 = 18 \text{ cm}$   
 $P = 18 \text{ cm}$      $A = 18 \text{ sq cm}$

$1 \times 7 = 7 \text{ sq cm}$   
 $1 \times 4 = 4 \text{ sq cm}$   
 $1 + 8 + 4 + 1 + 3 + 7 = 24 \text{ cm}$   
 $P = 24 \text{ cm}$      $A = 11 \text{ sq cm}$

7. As students share, discuss the methods they’re using to find the area and perimeter of these shapes. Did they use the perimeter formulas they developed during Set D6 Activity 2? Why not? (Because these are irregular polygons. All you can do is simply add all the different side lengths.) Did they use the area formula they developed during Measurement—Area Perimeter Activity 1? How? (To find the area without covering the shape with centimeter square units or drawing them in, you need to divide each hexaright into 2 rectangles. Then you can use  $A = lw$  to find the area of each rectangle and add these areas to get the area of the hexaright.)

8. After 2 or 3 strategies have been shared for each hexaright, explain that there is more than one hexaright with a perimeter of 24 centimeters. Give students each a copy of Hexarights, Perimeter = 24 cm. Review the instructions together and clarify as needed. Place a small stack of the Centimeter Grid Paper on each table and give students the remainder of the math period to work. Encourage them to share and compare their strategies for finding other hexarights with perimeters equal to 24 centimeters. What are some of the areas that result? Are they all equal?

Set D6 Measurement: Area & Perimeter Blackline Run a class set.  
 NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Hexarights, Perimeter = 24 cm

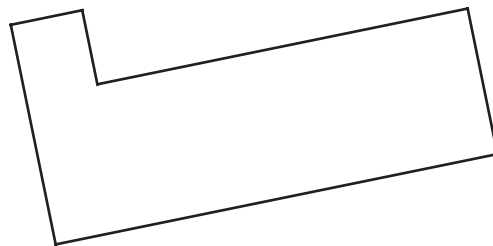
- 1 Draw 2 *different* hexarights with a perimeter of 24 cm, and find the area of each. Then draw a third hexaright with a perimeter of 24 cm. This time, make the area as large as you can.
- 2 You can use the space below and the back of this sheet. Or, you can draw your hexarights on centimeter grid paper, cut them out, and glue them to this sheet. Use your ruler to help make the lines straight and accurate.
- 3 Label your hexarights with their dimensions, perimeter, and area. Use numbers, sketches, and/or words to show how you found the perimeter and area of each hexaright.
- 4 On the back of the sheet, write at least 2 sentences to describe what you found out about the areas of hexarights with a perimeter of 24 cm.

Reconvene the class to share strategies and solutions either at the end of the period or at another time.

**Note** “Hexaright” is not some long-forgotten concept from your high school geometry days. It is a made-up term borrowed from Measuring Up: Prototypes for Mathematics Assessment (Mathematical Sciences Education Board National Research Council, 1993. Washington, DC: National Academy Press). You may want to let students know this so that they won’t expect to see, or use it on standardized texts.

# Introducing Hexarights

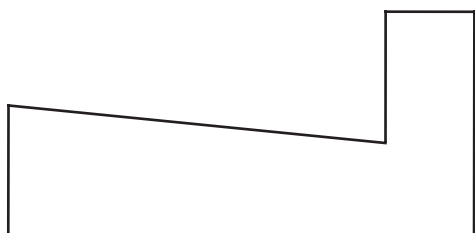
**1** Describe this shape.



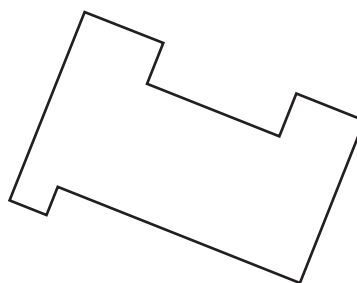
This shape is a hexagon because it has 6 sides, but let's call it a *hexaright*. A *hexaright* is a hexagon in which sides that touch each other are perpendicular. (That is, they meet at right angles.)

**2** Here are 2 examples of shapes that are *not* hexarights. Can you see why?

**a**

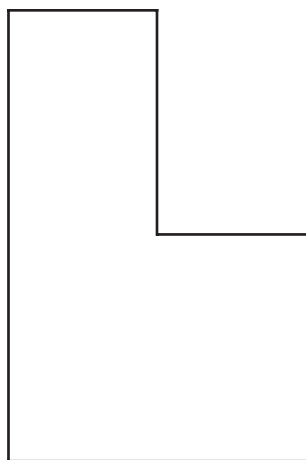


**b**

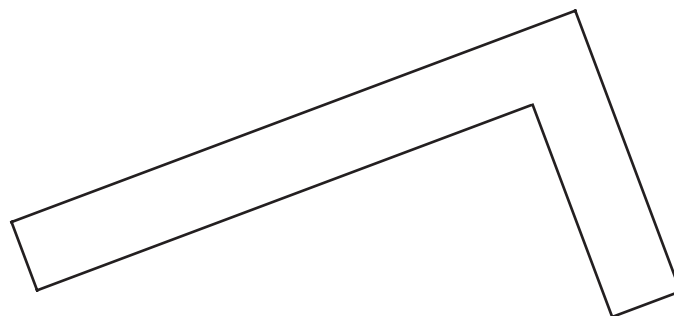


**3** Find the area and perimeter of the hexarights below.

**a**



**b**

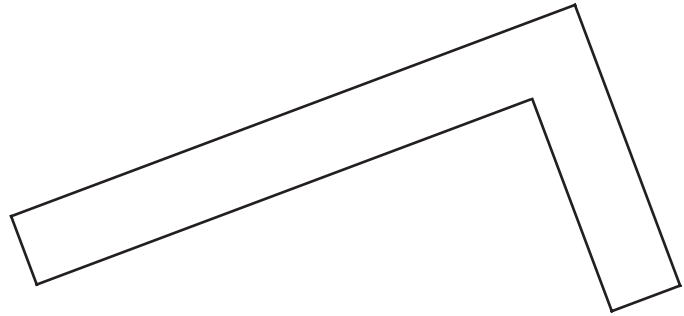
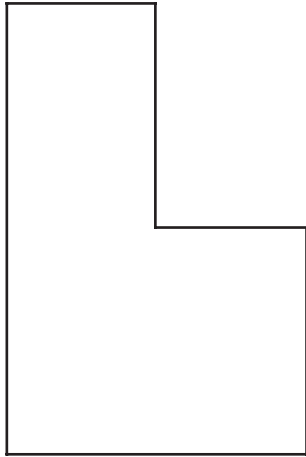


NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Measuring Hexarights

Find the area and perimeter of the hexarights below. Show all your work.



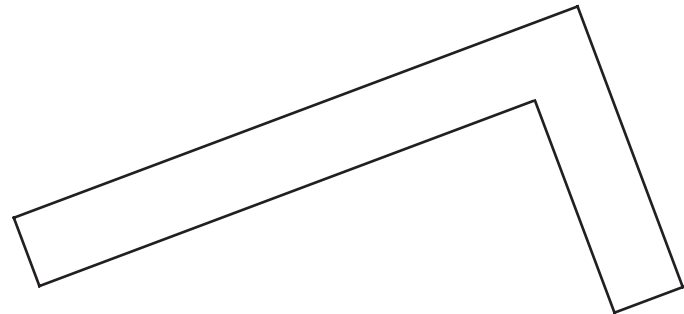
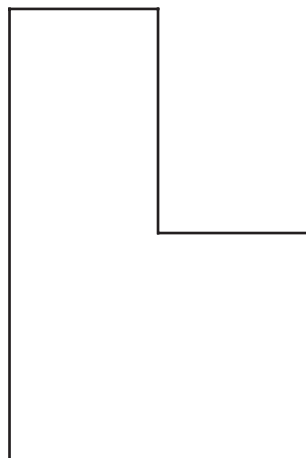
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NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Measuring Hexarights

Find the area and perimeter of the hexarights below. Show all your work.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Hexarights, Perimeter = 24 cm

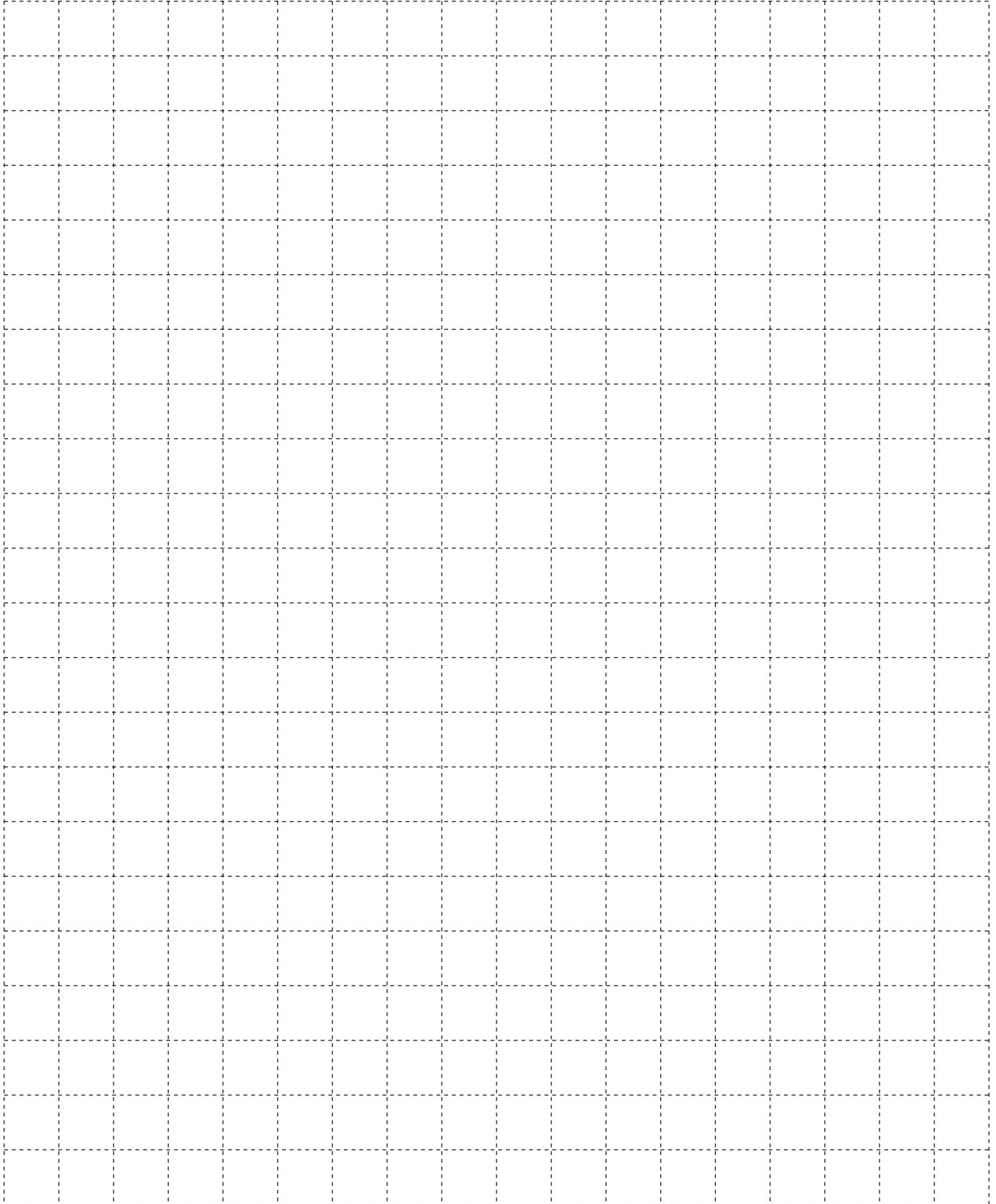
- 1** Draw 2 *different* hexarights with a perimeter of 24 cm, and find the area of each. Then draw a third hexaright with a perimeter of 24 cm. This time, make the area as large as you can.
- 2** You can use the space below and the back of this sheet. Or, you can draw your hexarights on centimeter grid paper, cut them out, and glue them to this sheet. Use your ruler to help make the lines straight and accurate.
- 3** Label your hexarights with their dimensions, perimeter, and area. Use numbers, sketches, and/or words to show how you found the perimeter and area of each hexaright.
- 4** On the back of the sheet, write at least 2 sentences to describe what you found out about the areas of hexarights with a perimeter of 24 cm.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Centimeter Grid Paper





NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set D6 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### Area & Perimeter Review

*Perimeter* is the distance all the way around a figure. Perimeter is measured in linear units like centimeters, meters, inches, feet, and yards.

*Area* is the amount of surface a figure covers. Area is measured in square units like square centimeters, square meters, square inches, square feet, and square yards.



Area

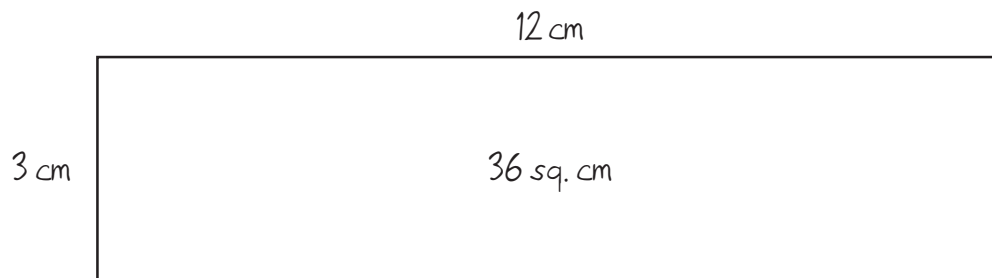


Perimeter

**1** Use the centimeter side of your ruler to measure the dimensions (the length and width) of each rectangle on the next page. Then find its area and perimeter using the formulas below. Show your work.

- Perimeter =  $(2 \times \text{the width}) + (2 \times \text{the length})$  or  $P = (2 \times w) + (2 \times l)$
- Area = length  $\times$  width or  $A = l \times w$

### example

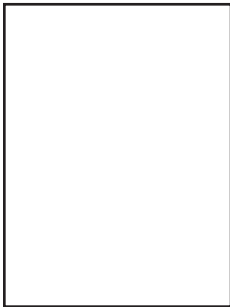
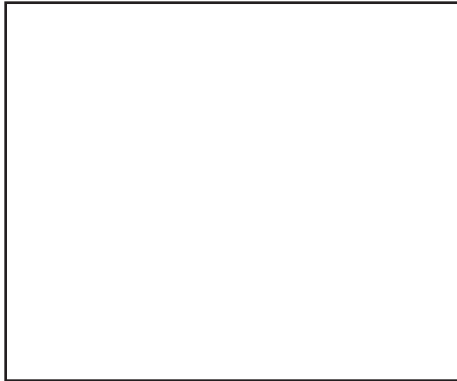




Perimeter:  $(2 \times 3) + (2 \times 12) = 30 \text{ cm}$

Area:  $12 \times 3 = 36 \text{ sq. cm}$

(Continued on back.)

**Independent Worksheet 1** Area & Perimeter Review (cont.)

<p><b>a</b></p>  <p>Perimeter: Area:</p>	<p><b>b</b></p>  <p>Perimeter: Area:</p>
<p><b>c</b></p>  <p>Perimeter: Area:</p>	<p><b>d</b></p>  <p>Perimeter: Area:</p>

**2** Jamie says you only need to measure one side of a square to find its perimeter. Do you agree with her? Why or why not? Use numbers, labeled sketches, and words to explain your answer.

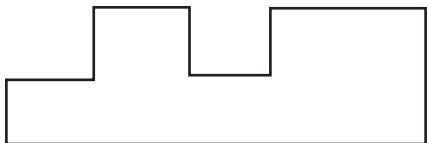
(Continued on next page.)

NAME \_\_\_\_\_

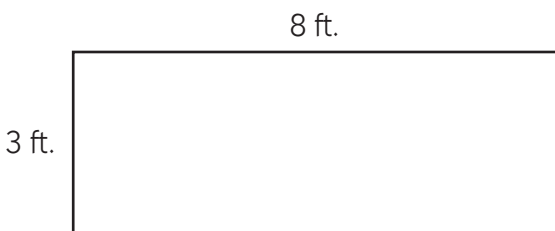
DATE \_\_\_\_\_

**Independent Worksheet 1** Area & Perimeter Review (cont.)

**3** Hector says you have to measure the length of every side of this figure to find its perimeter. Do you agree with him? Why or why not? Use numbers, labeled sketches, and words to explain your answer.



**4** Which equation shows how to find the perimeter of this rectangle?



- $3 \times 8 = 24$  ft.
- $(2 \times 3) + 8 = 14$  ft.
- $(2 \times 3) + (2 \times 8) = 22$  ft.
- $4 + 8 = 12$  ft.

**5** Mr. Hunter is trying to find the distance from one end of his whiteboard to the other. Mr. Hunt is measuring:



- the board's area
- the board's length
- the board's perimeter

**6** Which of these situations is about perimeter?

- determining the number of tiles needed to cover a floor
- determining how many feet of fencing is needed to surround a rectangular yard
- determining the width of a table

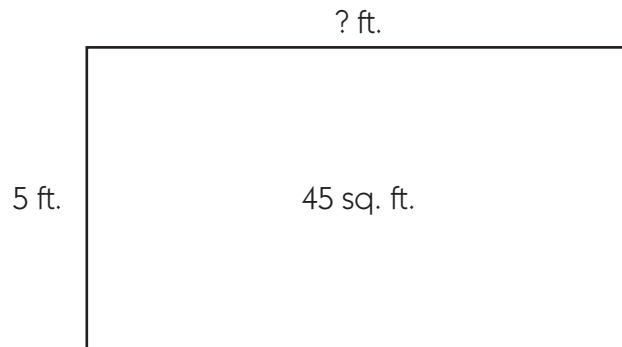
**7** Beckett and his mom are going to paint the living room. They need to measure the room so they know how much paint to buy. They should measure the wall in:

- square centimeters
- square feet
- square inches
- square miles

(Continued on back.)

**Independent Worksheet 1** Area & Perimeter Review (cont.)

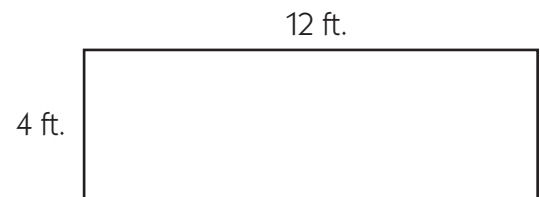
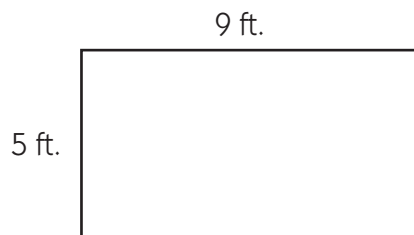
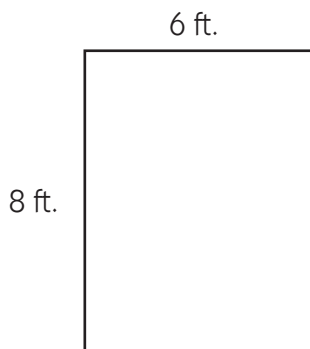
**8** This rectangle has an area of 45 square feet. What is the missing measure? Show your work.



**9** Tom wants to find the area of his school's basketball court. Which formula should he use? (circle one)

$A = l + w$      
  $A = l \times w$      
  $A = l - w$      
  $A = (2 \times w) + (2 \times l)$

**10** Alexandra and her dad build a deck in their backyard. It had an area of 48 square feet and a perimeter of 28 feet. Circle the drawing that shows the deck they built. Use numbers, labeled sketches, and words to explain your answer.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

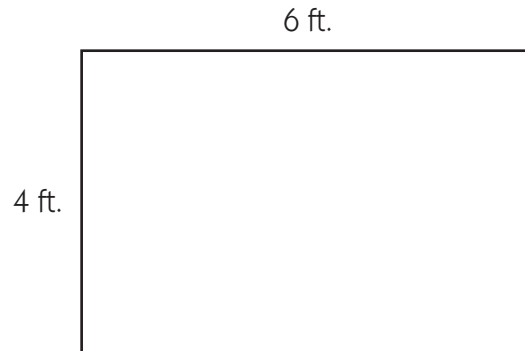
# Set D6 ★ Independent Worksheet 2



## INDEPENDENT WORKSHEET

### Measuring Rectangles

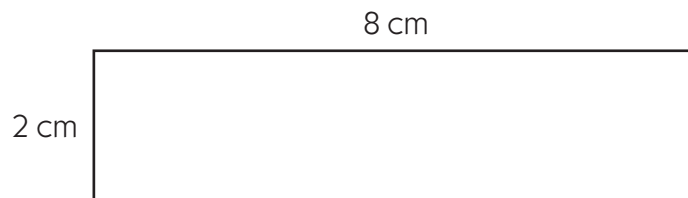
**1a** Which formula shows how to find the area of this rectangle?



- Area =  $(2 \times \text{width}) + (2 \times \text{length})$   
 $A = 2w + 2l$
- Area =  $\text{length} + \text{width}$   
 $A = l + w$
- Area =  $\text{length} \times \text{width}$   
 $A = l \times w$

**b** Use the formula you selected to find the area of the rectangle. Show your work.

**2a** Which formula shows how to find the perimeter of this rectangle?



- Perimeter =  $(3 \times \text{width}) + (3 \times \text{length})$   
 $P = w + 3l$
- Perimeter =  $\text{length} + \text{width}$   
 $P = l + w$
- Perimeter =  $\text{length} \times \text{width}$   
 $P = l \times w$
- Perimeter =  $(2 \times \text{width}) + (2 \times \text{length})$   
 $P = 2w + 2l$

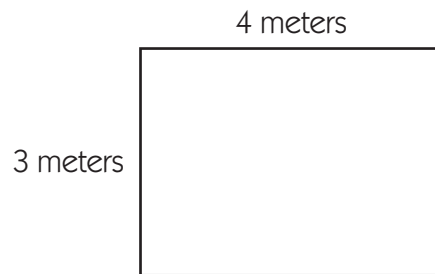
(Continued on back.)

**Independent Worksheet 2** Measuring Rectangles (cont.)

**2b** Use the formula you selected to find the perimeter of the rectangle. Show your work.



**3a** Which formula shows how to find the area of this rectangle?



Area =  
length  $\div$  width  
 $A = l \div w$

Area =  
length  $\times$  width  
 $A = l \times w$

Area =  
length  $-$  width  
 $A = l - w$

Area =  
length  $+$  width  
 $A = l + w$

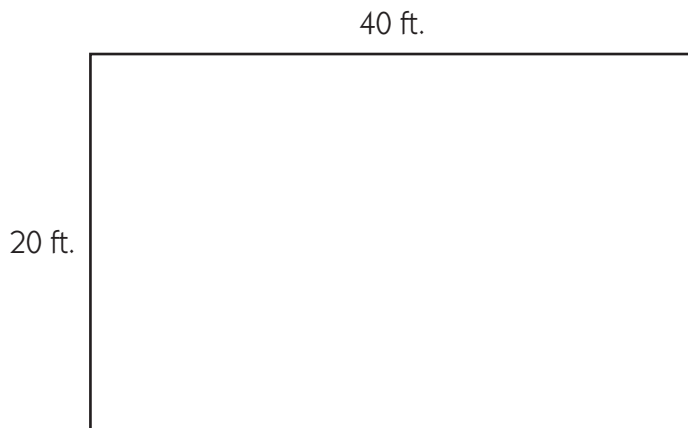
**b** Use the formula you selected to find the area of the rectangle. Show your work.

(Continued on next page.)



NAME \_\_\_\_\_

DATE \_\_\_\_\_

**Independent Worksheet 2** Measuring Rectangles (cont.)**4a** Which formula shows how to find the perimeter of this rectangle?

Perimeter =  
 $(2 \times \text{width}) + (2 \times \text{length})$   
 $P = 2w + 2l$

Perimeter =  
 $\text{length} \times \text{width} \times \text{height}$   
 $P = l \times w \times h$

Perimeter =  
 $\text{length} \times \text{width}$   
 $P = l \times w$

Perimeter =  
 $(2 \times \text{width}) - \text{length}$   
 $P = 2w - l$

**b** Use the formula you selected to find the perimeter of the rectangle. Show your work.





# GRADE 4 SUPPLEMENT

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## Set D9 Measurement: Area of Polygons

### Includes

Activity 1: Area of Parallelograms, Part 1	D9.1
Activity 2: Area of Parallelograms, Part 2	D9.9
Activity 3: Area of Right Triangles	D9.19
Activity 4: Polygons to Order	D9.25
Independent Worksheet 1: Geoboard Polygons	D9.31
Independent Worksheet 2: Finding Perimeter & Area of Quadrilaterals	D9.33
Independent Worksheet 3: Finding the Area of Right Triangles	D9.35
Independent Worksheet 4: Rectangles, Parallelograms & Right Triangles	D9.37

### Skills & Concepts

- ★ develop and use the area formula for a right triangle by comparing with the formula for a rectangle (e.g., two of the same right triangles make a rectangle)
- ★ develop, use, and justify the relationships among area formulas of triangles and parallelograms by decomposing and comparing with areas of right triangles and rectangles
- ★ determine the area of a trapezoid by the composition and decomposition of rectangles, triangles, and parallelograms
- ★ compare areas of polygons using different units of measure within the same measurement system (e.g., square feet, square yards)
- ★ measure and draw line segments to the nearest eighth-inch and millimeter
- ★ identify, draw, and construct models of regular and irregular polygons including triangles, quadrilaterals, pentagons, hexagons, and octagons to solve problems
- ★ solve single- and multi-step word problems about the perimeters and areas of quadrilaterals and triangles, and verify the solutions

**Bridges in Mathematics Grade 4 Supplement**

**Set D9** Measurement: Area of Polygons

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*Bridges in Mathematics* is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at [www.mathlearningcenter.org](http://www.mathlearningcenter.org).

# Set D9 ★ Activity 1



## ACTIVITY

### Area of Parallelograms, Part 1

#### Overview

Students work on geoboards to find the area of several rectangular and non-rectangular parallelograms. Today's activities help students move from what they know about finding the area of a rectangle toward a more general formula for all parallelograms. If time allows at the end of the session, students build a variety of polygons on the geoboard and find the area of each in square units.

#### Skills & Concepts

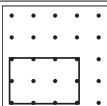
- ★ describe, classify, construct, and draw rectangles and parallelograms
- ★ recognize that a square that is 1 unit on a side is the standard unit for measuring area
- ★ find the area of parallelograms and rectangles

#### You'll need

- ★ Area Problems (page D9.5, run a display copy)
- ★ Geoboard Paper (page D9.6, run a display copy and a class set)
- ★ Finding the Area of More Polygons (page D9.7, run a class set)
- ★ overhead geoboard and rubber bands
- ★ class set of geoboards and rubber bands
- ★ class set of rulers
- ★ a piece of paper to mask parts of the overhead

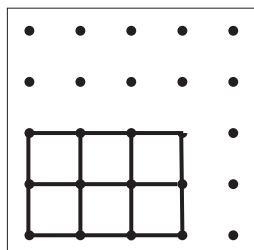
#### Instructions for Area of Parallelograms, Part 1

1. To start the activity, review the concept of area. Discuss some of the following questions:
  - What does the word area mean?
  - What is the difference between area and perimeter? (Have a volunteer show the area and the perimeter of a piece of paper or a wall chart.)
  - How do people measure perimeter? How do they measure area? What units do they use for each type of measurement? (Review the fact that perimeter is measured in linear units such as centimeters, meters, inches, feet, yards, and so on, while area is measured in square units such as square centimeters, square meters, square inches, square feet, and so on.)
  - What are some of the reasons people might want to measure area?
2. Explain that over the next few days, students will learn how to find the area of polygons other than rectangles and squares. Today, they will build some different shapes on geoboards and find the area of each. Have helpers distribute geoboards and rubber bands to each student as you place the top section of the Area Problems sheet on display. Keep the rest of the sheet covered for now.

<small>Set D9 Measurement: Area of Polygons Blackline Run a display copy.</small> NAME _____ DATE _____	
<b>Area Problems</b>	
<b>1</b> Build this rectangle on your geoboard. Find the area of the rectangle in square units.	
	Area = _____ How did you figure it out?

**Activity 1** Area of Parallelograms, Part 1 (cont.)

3. Read the first problem with the class. Clarify that the smallest square on the geoboard has an area of 1 square unit. Have students build the rectangle shown in the first problem on their geoboards and determine its area in square units. Ask the children to pair-share solutions and strategies. Then call on a volunteer to bring her geoboard up to the document camera or overhead and explain how she found the area of the rectangle.

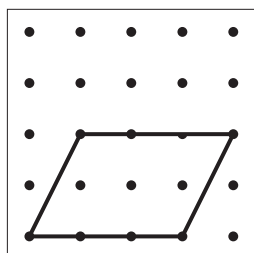


**Kate** *It's 6 because you can just count the squares. See where I put the rubber bands to show?*

**Teacher** *6 whats?*

**Students** *The area is 6 square units. You can see that it's 2 rows of 3 squares, so that makes 6. It's  $2 \times 3$ . That's 6 square units.*

4. Ask your volunteer if you can borrow her geoboard for a moment. Then, as the class watches, shift the rubber band over a peg to the right, as shown below. Ask students to identify the new shape you have created. You may have to review the fact that a parallelogram is a quadrilateral with two pairs of parallel sides. Squares and rectangles are examples of parallelograms, but there are non-rectangular parallelograms as well.



**Students** *I think it's a diamond now.*

*There's no such thing as diamond in math, remember? Maybe it's a rhombus.*

*But all the sides have to be equal on a rhombus. Those sides don't look equal.*

*Well, it's definitely not a square or a rectangle.*

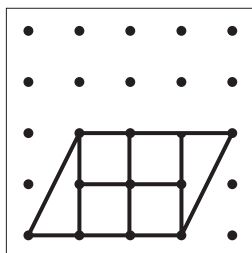
*I know! It's a quadrilateral because it has 4 sides.*

**Teacher** *You're right that this shape is a quadrilateral, but it's a special kind of quadrilateral. So far, no one has mentioned parallelogram. Does anyone remember the definition of a parallelogram? No? Who'd like to look it up for us?*

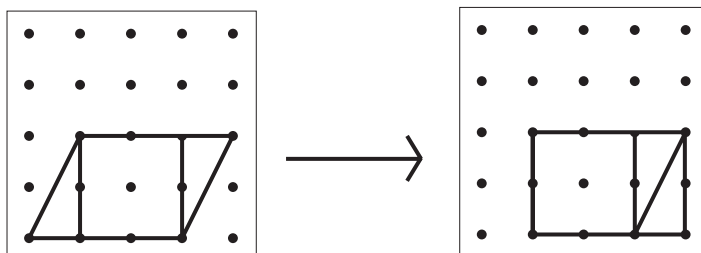
5. Once the shape has been identified by name, ask students to build it on their own geoboards by shifting the rubber band over 1 peg to the right, just as you did. Then ask them to find the area of the parallelogram. Give them a minute to wrestle with the problem. Then call 2 or 3 volunteers up to the document camera or overhead to show and explain their solutions and strategies.

**Activity 1** Area of Parallelograms, Part 1 (cont.)

**Whitney** First I saw that there were 4 squares in the middle. I can show them with rubber bands. Then I could see that the triangles on both sides fit together, so that's 2 more squares. I think the area of this parallelogram is 6 squares.



**Pedro** My idea is kind of like Whitney's, but I moved over the triangle from one side to the other, and it turned back into a rectangle, like this, see? The area is definitely 6 square units.



**Kyra** I thought the same thing as Whitney and Pedro. Then I realized that the area had to stay the same from the rectangle to the parallelogram because we just moved the rubber band over. We didn't change anything else, so the area has to be the same.

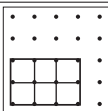
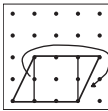
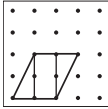
**DeAndre** At first I thought that the area changed because of the diagonal lines, but with Pedro's way, you can see that the two triangles fit back together, so it's still 6.

6. Place the Area Problems sheet on display again. Work with students' input to summarize their thinking on the first two problems. Then reveal the third problem. Read it with the students and have them build the parallelogram on their geoboards. After they have had a minute to find the area, call on volunteers to share their thinking as you record on the display master.

Set D9 Measurement: Area of Polygons Blackline Run a display copy.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Area Problems**

<p><b>1</b> Build this rectangle on your geoboard. Find the area of the rectangle in square units.</p> 	<p>Area = <u>6 square units</u></p> <p>How did you figure it out?</p> <p>Put rubber bands on and count the squares See 2 rows of 3 squares <math>2 \times 3 = 6</math></p>
<p><b>2</b> Change the rectangle into a parallelogram. Find the area of the parallelogram in square units.</p> 	<p>Area = <u>6 square units</u></p> <p>How did you figure it out?</p> <p>4 squares in the middle, and fit the 2 triangles together to make 2 more squares. We just moved the rubber band. It didn't change the area.</p>
<p><b>3</b> Build this parallelogram on your geoboard. Find the area of the parallelogram in square units.</p> 	<p>Area = <u>4 square units</u></p> <p>How did you figure it out?</p> <p>2 squares in the middle, and then the 2 triangles fit together to make 2 more squares. Move the rubber band to make it back into a square. The square is 4 square units.</p>

**Activity 1** Area of Parallelograms, Part 1 (cont.)

7. Give students each a piece of geoboard paper as you reveal the last two problems. Read the text with the students and clarify as needed. If necessary, work problem 4 together. Give students a minute to see if they can make a non-rectangular parallelogram with an area of 3 square units on their geoboard. Then work with their input to make a labeled sketch on your display copy of the geoboard paper.

**Students** *I see how to do it! You can do one with 2 squares in the middle, and then a little triangle on both sides.*

*Hey, this is cool! Just make a rectangle that's 3 squares big and move the rubber bands to make a parallelogram.*

Set D9 Measurement: Area of Polygons Blackline Run a display copy and a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Geoboard Paper**

The 2 triangles are each  $\frac{1}{2}$  a square.  
They fit together, so it's 3 sq. units.

8. When students understand what to do, have them work individually or in pairs to build and record the area of the 4 parallelograms in problems 4 and 5. As they finish, ask students to check their solutions and strategies with at least one other classmate, and then start work on Finding the Area of More Polygons. (Students who are unable to finish or even start this sheet can be assigned to complete it for homework or during a designated seat work period the following day.)

9. Reconvene the class 5–10 minutes before the end of the period. Ask volunteers to show and explain some of the parallelograms they built with areas of 3, 2, 9, and/or 12 square units.

**INDEPENDENT WORKSHEET**

Use Set D9 Independent Worksheet 1 to provide students with more practice determining the area of irregular and regular polygons.

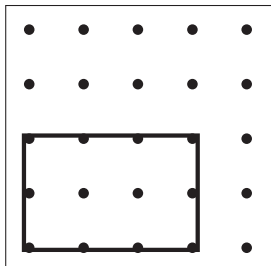


NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Area Problems

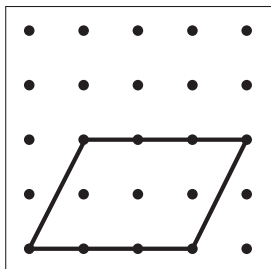
**1** Build this rectangle on your geoboard. Find the area of the rectangle in square units.



Area = \_\_\_\_\_

How did you figure it out?

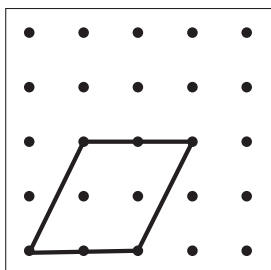
**2** Change the rectangle into a parallelogram. Find the area of the parallelogram in square units.



Area = \_\_\_\_\_

How did you figure it out?

**3** Build this parallelogram on your geoboard. Find the area of the parallelogram in square units.



Area = \_\_\_\_\_

How did you figure it out?

**4** Build a parallelogram on your geoboard that has an area of 3 square units. Record the parallelogram you built on geoboard paper. Use labeled sketches, numbers, and/or words to prove that the area is 3 square units.

**5** Build and record parallelograms with the following areas:

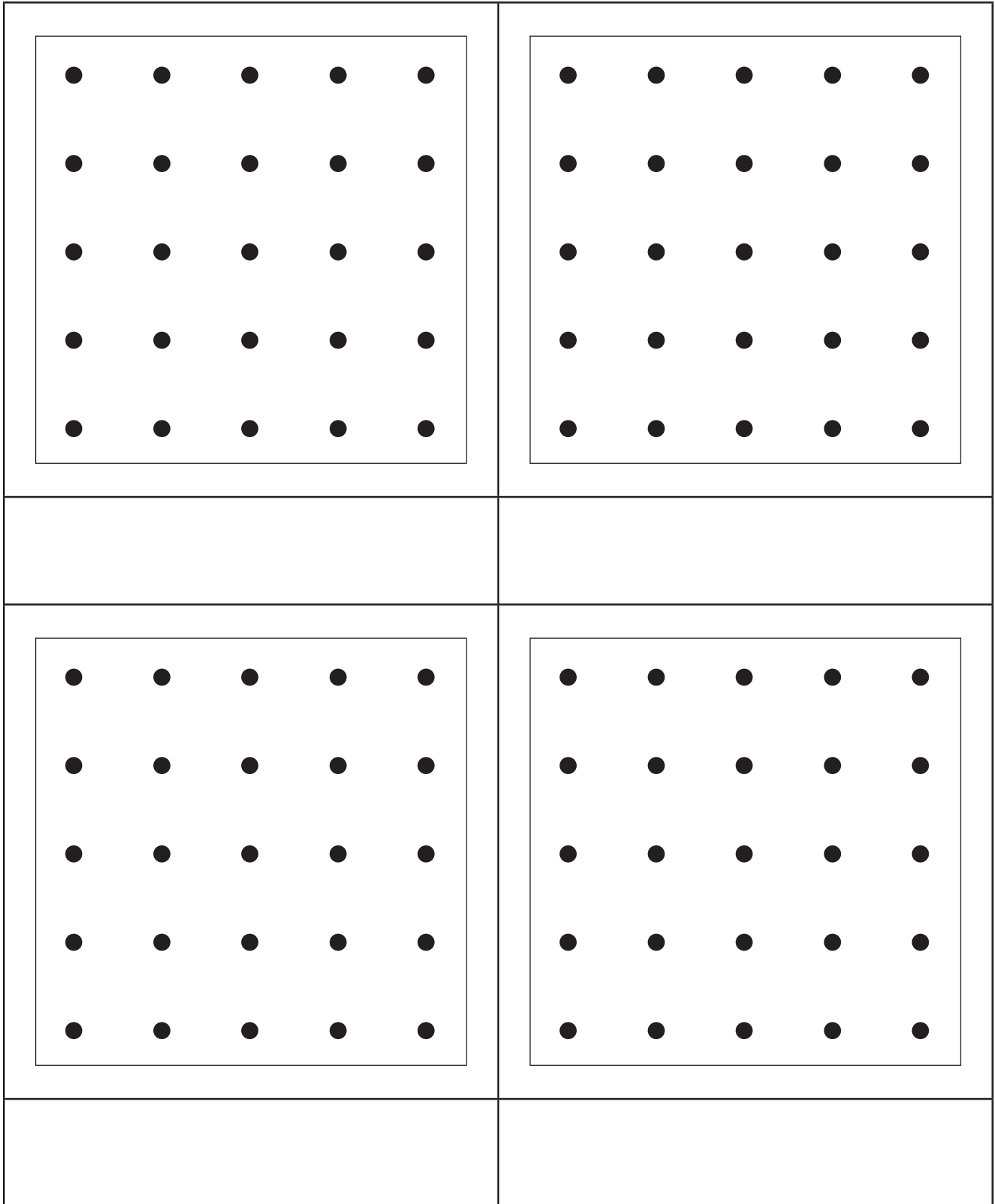
- 2 square units
- 9 square units
- 12 square units

Use labeled sketches, numbers, and/or words to prove each area.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Geoboard Paper

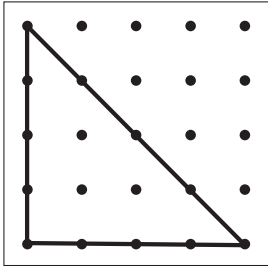
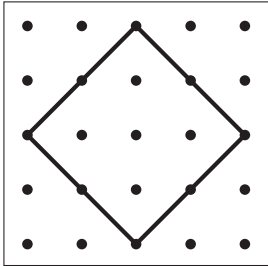
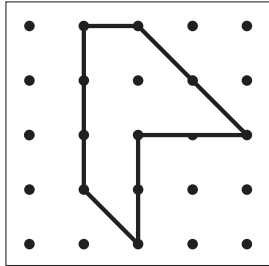
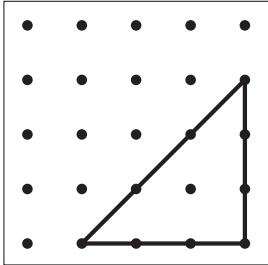
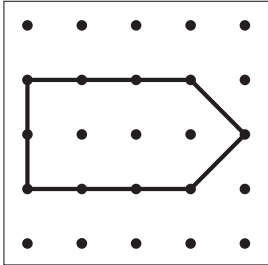
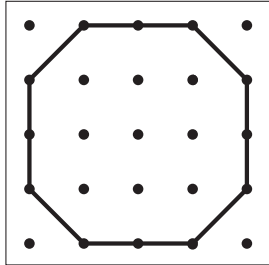


NAME \_\_\_\_\_

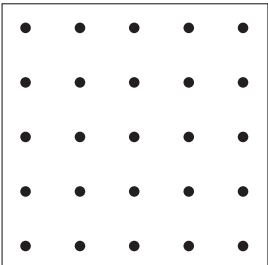
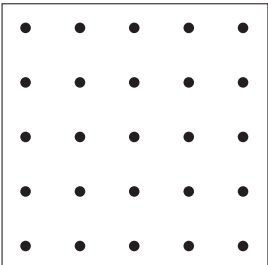
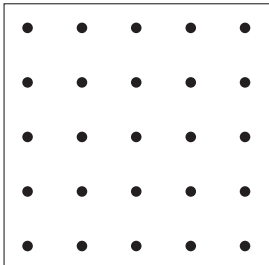
DATE \_\_\_\_\_

# Finding the Area of More Polygons

**1** Find the area of each of the polygons below in square units. Use labeled sketches, numbers, and/or words to prove each of your answers.

**2** Build and record 3 different polygons (not rectangles) that each have an area of 6 square units. Use labeled sketches, numbers, and/or words to prove that the area of each polygon is really 6 square units.

		
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# Set D9 ★ Activity 2



## ACTIVITY

### Area of Parallelograms, Part 2

#### Overview

Students work in pairs to find the area of several non-rectangular parallelograms. After they share their solutions and strategies for doing so, the teacher introduces a general area formula for parallelograms: base  $\times$  height, or  $bh$ . Students then complete two worksheets in which they apply the formula.

#### Skills & Concepts

- ★ identify, draw, and construct models of parallelograms, including rectangles and squares
- ★ develop, use, and explain the area formula for parallelograms

#### You'll need

- ★ Parallelogram A (page D9.14, quarter class set)
- ★ Centimeter Grid Paper (page D9.15, half-class set plus a few extra)
- ★ More Parallelograms to Measure (page D9.16, half-class set)
- ★ Finding the Area of Parallelograms (pages D9.17 & D9.18, class set)
- ★ access to base ten pieces
- ★ class sets of scissors and rulers

#### Instructions for Area of Parallelograms, Part 2

1. Open today's session by asking students to summarize what they learned in the previous activity about finding the area of non-rectangular parallelograms. Give them a minute to pair-share, and then call on a few volunteers to share their ideas with the class.

***Students** It's easy to find the area of shapes on a geoboard. You can just count the squares. We thought it would be hard to do the area of a parallelogram, but then we found out the two triangles on the ends fit together. We found out we could turn a slanty parallelogram back into a rectangle on the geoboard, and then it's easy to find the area.*


2. Explain that the class is going to do some more work with parallelograms today. Have students pair up, or assign partners in preparation for the next activity. Then give each pair a copy of Parallelogram A, and place a few sheets of centimeter grid paper on each table. Explain that their task is to find the area of this parallelogram in square centimeters.

Set D9 Measurement: Area of Polygons Blackline Run a quarter of a class set. Cut sheets in half.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Parallelogram A**

Find the area of this parallelogram in square centimeters.



**Activity 2** Area of Parallelograms, Part 2 (cont.)

3. Spend a minute or two discussing some possible ways to approach the problem before student pairs go to work. It may be helpful to review the size of a square centimeter, and have students estimate the area of the parallelogram as well.

**Teacher** *You are going to work with your partner to find the area of this parallelogram in square centimeters. How big is a square centimeter, anyway?*

**Students** *Really little!*

*One of those little base ten units is a square centimeter.*

*It's one of the little squares on the grid paper.*

**Teacher** *What would you estimate the area of parallelogram A to be in square centimeters? Talk with your partner for a few moments, and then let's see what people think.*

**Students** *I don't see how you can do the triangle parts on the ends.*

*Can we cut out the parallelogram? Then we could put it on the grid paper and count the squares.*

*I think it's about 6 centimeters up and 10 over, so maybe the area is 60 square centimeters.*

*Can we cut it apart into pieces? I think I see how to turn it into a rectangle.*

**Teacher** *It sounds like people have some ideas about how they're going to find the area of this parallelogram. What are some tools that might be helpful for this job?*

**Students** *Scissors and grid paper!*

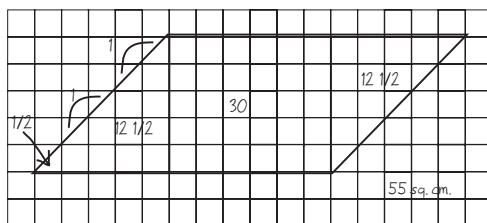
*A ruler to make a straight line so you can cut off the triangle at one end and move it.*

*We're going to cut out the parallelogram and trace it onto the grid paper.*

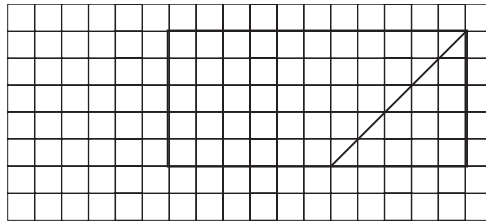
4. When students have some ideas about how to proceed, have them go to work. As they finish, have them share and compare their solutions and strategies with at least one other pair. If some pairs complete the task before others, give them a copy of the More Parallelograms to Measure, and challenge them to find the areas of parallelograms B, C, and D as well.

5. When most pairs have finished, reconvene the class and ask several volunteers to share and explain their results, at the document camera if possible.

**Jenna** *First we cut out the parallelogram. Then we traced around it on the grid paper and counted the squares. We got 30 in the middle. Then each triangle is 12 and a half, so that's 25. It's 55 square centimeters in all.*

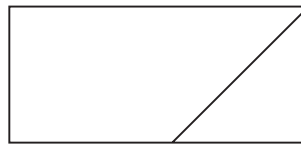


**Brandon** *We cut out the parallelogram and put it on the grid paper. We were going to trace around it and count the squares, but then we saw that we could cut off the triangle on one side and move it over, like this.*

**Activity 2** Area of Parallelograms, Part 2 (cont.)

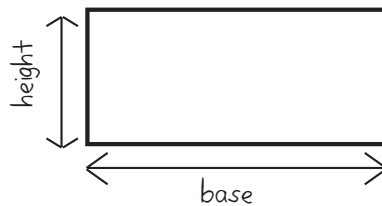
**Pedro** Then we could see that it's 5 squares along the side and 11 over. That's 55 square centimeters.

**Sara** We did kind of the same thing, but after we cut out the parallelogram, we just cut off the triangle on the left side and moved it over to make a rectangle. We measured and multiplied. It was  $5 \times 11$ , so it's 55.



6. Now distribute copies of More Parallelograms to Measure to all the student pairs. Give them a few minutes to find the area of at least one of the parallelograms on the sheet; more than one if they have time. Ask the children to use one of the strategies just shared, or devise another, preferably more efficient than tracing and counting the squares. Circulate as students work to provide support as needed. Encourage pairs to work on different parallelograms so the class can report the area of all three within a short amount of time.

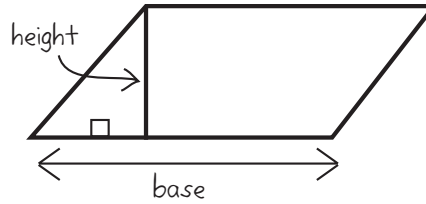
7. When all the students have had time to find the area of at least one of the parallelograms, reconvene the class to share their results. (Parallelogram B is 39 square centimeters; Parallelogram C is 60 square centimeters, Parallelogram D is 28 square centimeters.) Then sketch a rectangle on the board and label it to introduce the terms *base* and *height*. Explain that the *height* of a figure tells how far it is from the *base* or bottom of the figure to the top of the figure.



8. Next, sketch a parallelogram on the board and label the base. Ask students to pair-share where they think the height of the parallelogram would be located. Then invite a volunteer to come up to the board and draw in the height. As he or she does so, explain that the height of a figure is always perpendicular to the base.

**Erika** I think the height is right here. It's the same as where we cut the triangle off so we could make the parallelogram into a rectangle.

**Activity 2** Area of Parallelograms, Part 2 (cont.)



9. Now write the formula for finding the area of a parallelogram:  $\text{base} \times \text{height}$ , or  $bh$ , on the board. Discuss this formula with the class, and work with input from the students to explain it.

**Teacher** Here is the formula mathematicians use for finding the area of a parallelogram: *base times height*, or  $bh$ . Talk with the person next to you about this formula. How does it work? Would it work for any parallelogram, including rectangles and squares?

**Students** It's the same as length times width.

The height is like the line that can turn a slanty parallelogram into a rectangle.

I think the base is kind of like the length, and the height is kind of like the width.

10. Give students each a copy of Finding the Area of Parallelograms. Read over both sheets with the class and clarify as necessary. One image that may be helpful to students in identifying the height of each parallelogram on the first sheet is this: if a figure were to slide into the room on its base, what would be the height of the shortest door it could get through without bending over?

Set D9 Measurement: Area of Polygons Blackline Run a display copy and a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Finding the Area of Parallelograms** page 1 of 2

The height ( $h$ ) of a parallelogram tells how far one side is from its opposite side. The height of a parallelogram must be perpendicular to the base ( $b$ ) of the parallelogram.

**1** Use the letter  $h$  to label the height of each parallelogram below. Use the letter  $b$  to label the base. If the height is not shown, use your ruler to draw it in, and then label it.

a b

c d

**2** To find the area of a parallelogram, multiply base times height. Try it for yourself. Measure the base and the height of the parallelogram below in centimeters. Multiply the two measurements. Is the answer correct? Use a labeled sketch, numbers, and words to explain.

Set D9 Measurement: Area of Polygons Blackline Run a display copy and a class set.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**Finding the Area of Parallelograms** page 2 of 2

Here is the formula for finding the area of a parallelogram.

The area of a parallelogram =  $\text{base} \times \text{height}$  or  $b \times h$  or  $bh$ . (Since a rectangle is a special kind of parallelogram, this is also the formula for the area of a rectangle.)

**3** Find the area of each figure below. Use the formulas. Show your work.

a Area = \_\_\_\_\_ sq cm

b Area = \_\_\_\_\_ sq cm

**4** For each of the parallelograms below:

- draw in the height.
- measure and label the height and the base to the nearest centimeter.
- find and record the area and show your work.

a Area = \_\_\_\_\_ sq cm

b Area = \_\_\_\_\_ sq cm



**Activity 2** Area of Parallelograms, Part 2 (cont.)

11. When students understand what to do, have them go to work on the two sheets individually or in pairs. Circulate to provide support, or meet with students who feel they need help to complete the sheets.



**INDEPENDENT WORKSHEET**

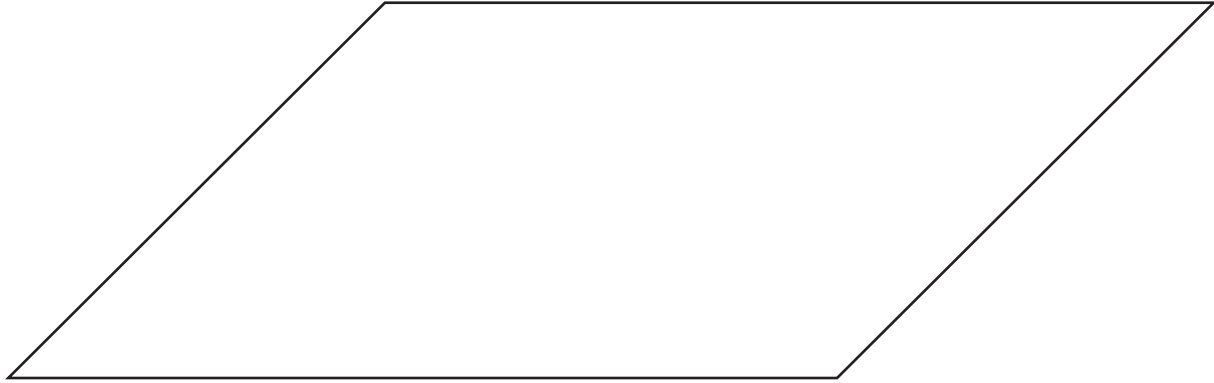
Use Set D9 Independent Worksheet 2 to provide students with more practice finding the area of parallelograms.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Parallelogram A

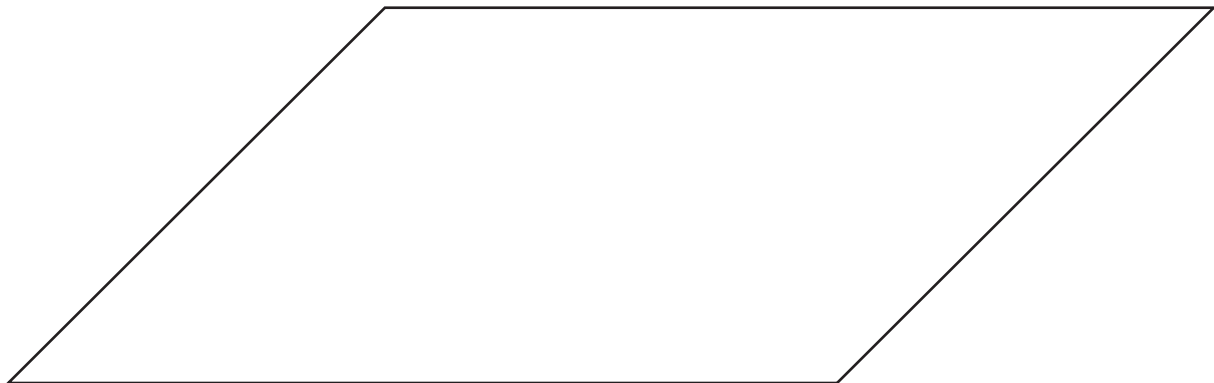
Find the area of this parallelogram in square centimeters.



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## Parallelogram A

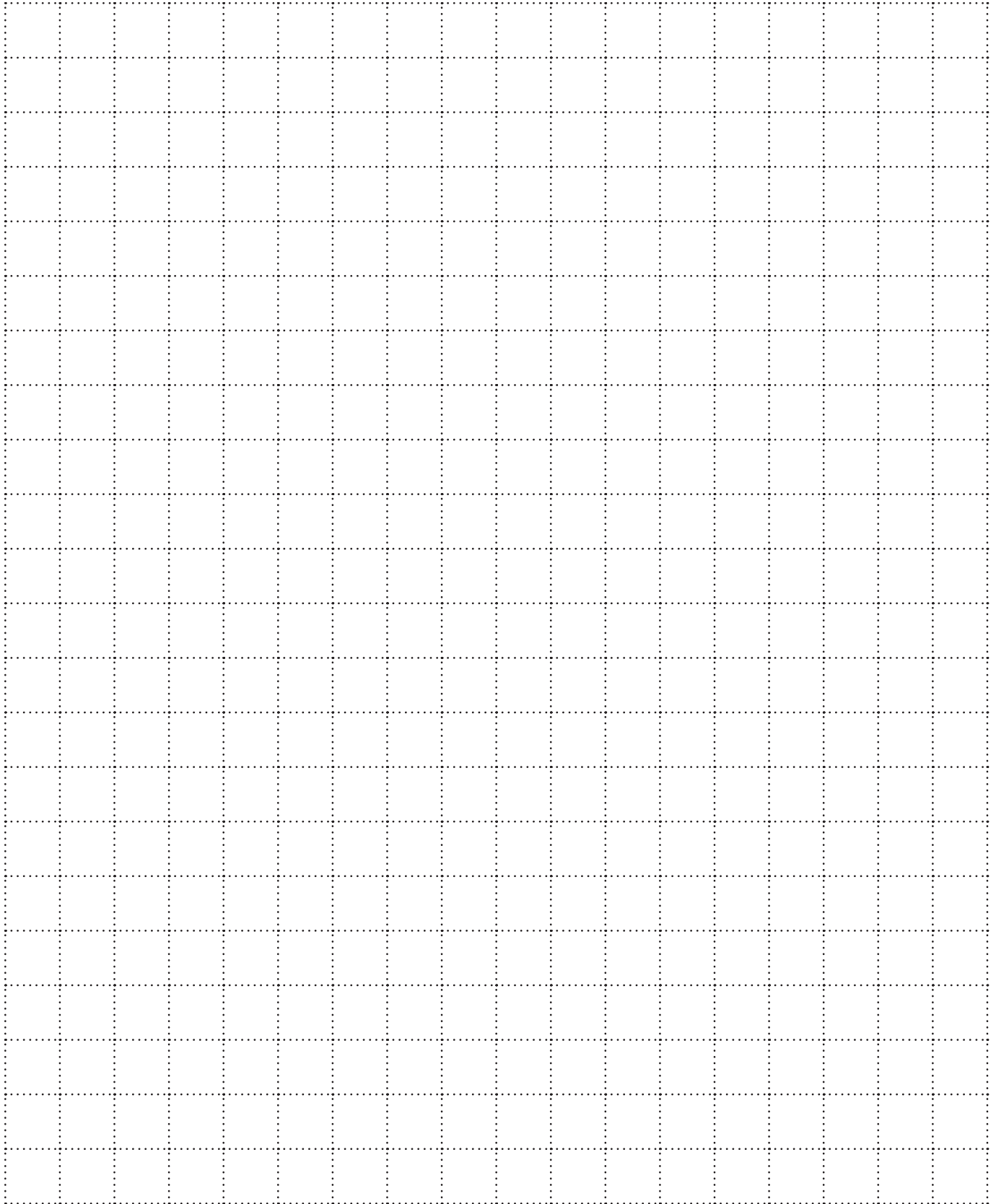
Find the area of this parallelogram in square centimeters.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Centimeter Grid Paper

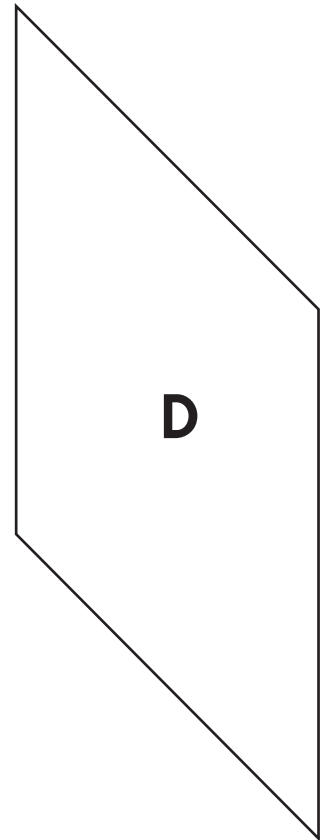
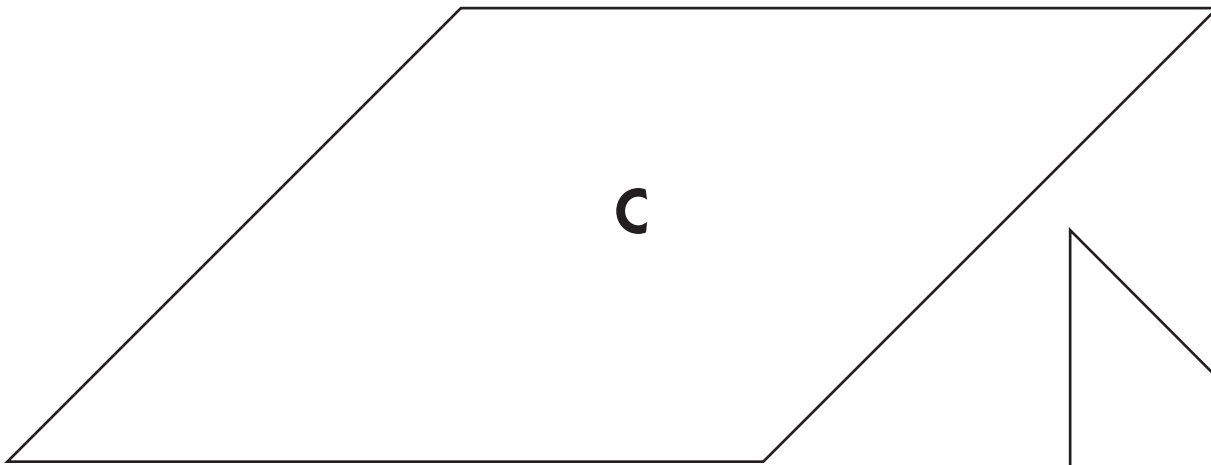
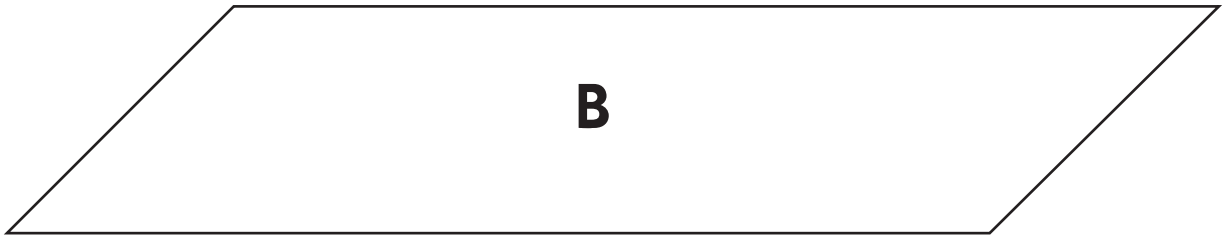


NAME \_\_\_\_\_

DATE \_\_\_\_\_

## More Parallelograms to Measure

Find the area of these parallelograms in square centimeters.

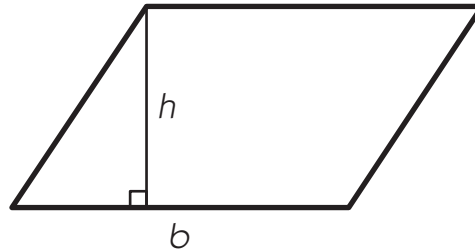


NAME \_\_\_\_\_

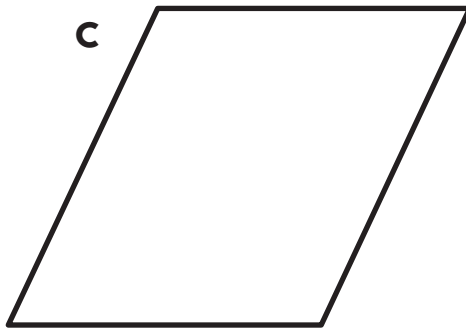
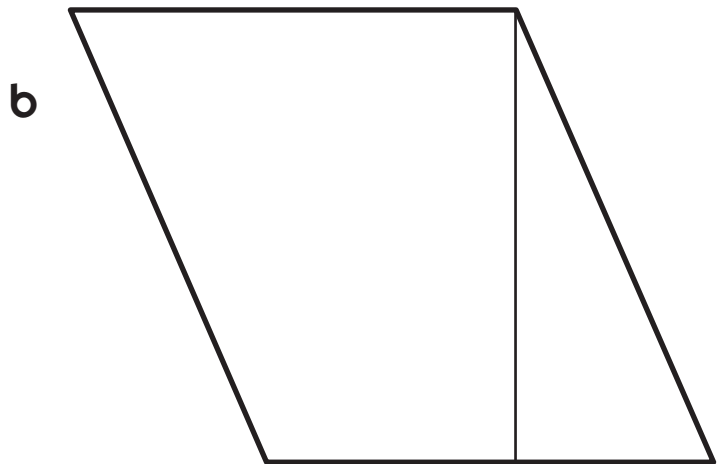
DATE \_\_\_\_\_

# Finding the Area of Parallelograms page 1 of 2

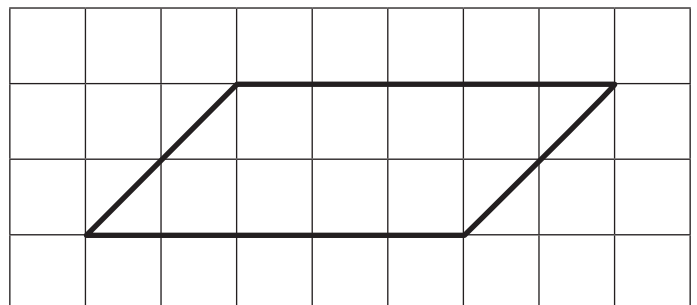
The height ( $h$ ) of a parallelogram tells how far one side is from its opposite side. The height of a parallelogram must be perpendicular to the base ( $b$ ) of the parallelogram.



**1** Use the letter  $h$  to label the height of each parallelogram below. Use the letter  $b$  to label the base. If the height is not shown, use your ruler to draw it in, and then label it.



**2** To find the area of a parallelogram, multiply base times height. Try it for yourself. Measure the base and the height of the parallelogram below in centimeters. Multiply the two measurements. Is the answer correct? Use a labeled sketch, numbers, and words to explain.



NAME \_\_\_\_\_


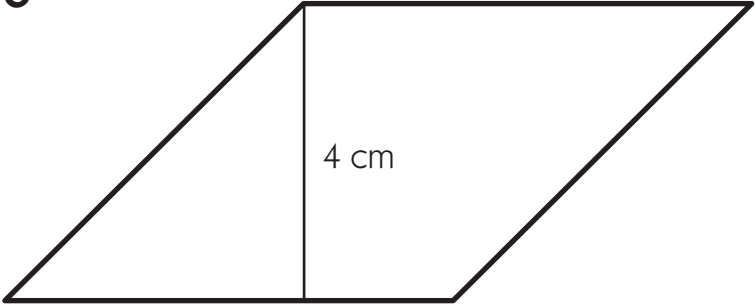
DATE \_\_\_\_\_

## Finding the Area of Parallelograms page 2 of 2

Here is the formula for finding the area of a parallelogram.


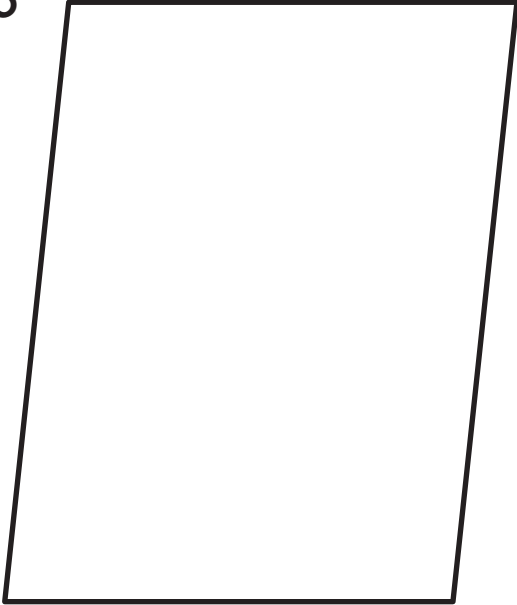
*The area of a parallelogram = base  $\times$  height or  $b \times h$  or  $bh$ . (Since a rectangle is a special kind of parallelogram, this is also the formula for the area of a rectangle.)*

**3** Find the area of each figure below. Use the formulas. Show your work.

<p><b>a</b></p>  <p style="text-align: center;">6 cm</p> <p style="text-align: left;">4 cm</p> <p>Area = _____ sq cm</p>	<p><b>b</b></p>  <p style="text-align: center;">6 cm</p> <p style="text-align: right;">4 cm</p> <p>Area = _____ sq cm</p>
---	---

**4** For each of the parallelograms below:

- draw in the height,
- measure and label the height and the base to the nearest centimeter,
- find and record the area and show your work.

<p><b>a</b></p>  <p>Area = _____ sq cm</p>	<p><b>b</b></p>  <p>Area = _____ sq cm</p>
---	--

# Set D9 ★ Activity 3



## ACTIVITY

### Area of a Right Triangle

#### Overview

Students work on geoboards to find the area of several right triangles. After they share and explain their strategies, the teacher introduces the area formula for a right triangle and the class discusses how and why it works.

#### Skills & Concepts

- ★ develop and use the area formula for a right triangle by comparing with the formula for a rectangle (e.g., two of the same right triangles make a rectangle)
- ★ identify, draw, and construct models of right triangles and rectangles to solve problems

#### You'll need

- ★ Finding the Area of a Right Triangle (page D9.23, run a display copy)
- ★ More Triangles to Measure (page D9.24, class set)
- ★ Geoboard Paper (page D9.15, a few copies)
- ★ overhead geoboard and rubber bands
- ★ class set of geoboards and rubber bands
- ★ access to scissors and rulers
- ★ a piece of paper to mask parts of the display master

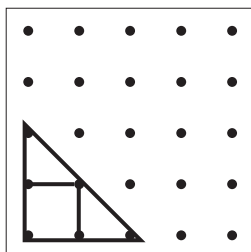
#### Instructions for Area of a Right Triangle

1. Let students know that they are going to do some more work with area today. Place the top section of Finding the Area of a Right Triangle on display as helpers distribute geoboards and rubber bands to each student.

Set D9 Measurement: Area of Polygons Blackline Run a display copy.	
NAME _____	DATE _____
<b>Finding the Area of a Right Triangle</b>	
<p><b>1</b> Build this right triangle on your geoboard. Find the area of the triangle in square units.</p>	
	Area = _____ How did you figure it out?

2. Read the first problem with the class, and take a minute to review the definition of right triangle (a triangle that has a  $90^\circ$  angle). Then ask students to copy the right triangle shown in the problem onto their geoboards and find the area in square units. After they have had a minute or two to work, ask them to pair-share their solutions and strategies. Then invite 2 or 3 volunteers to share and explain their work at the document camera or overhead.

***Maria** You can see 1 square in the middle and 2 little triangles. They're each half a square, so the whole thing is 2 square units. I put rubber bands on so you can see the square and the triangles.*



**Activity 3** Finding the Perimeter & Area of a Parallelogram (cont.)

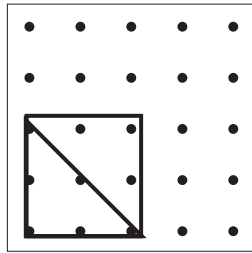
**Jeffrey** *I did it the same way, but I didn't put the rubber bands on like Maria did.*

3. Chances are, students will respond in a manner similar to the children in the dialogue above, identifying a square and mentally combining the two smaller triangles to create a second square. Press children to explain how they know that each of the smaller triangles is half a square unit. Then, unless it has already come up in discussion, ask students if the entire right triangle is half of a larger square. Give them a minute to explore and discuss the idea among themselves, and then ask a volunteer to share his thinking.

**Garrett** *Look, you can make this square around the whole triangle.*

**Paula** *You can see that the triangle is half the square; it's like cutting a sandwich in half on the diagonal, like my dad does when he makes the lunches.*

**Pedro** *If you use that way, it's easy to see that the area of the triangle is 2, because the whole square is 4, and just cut that in half.*



4. Reveal the next problem on the display sheet. Ask students to replicate the second right triangle on their geoboards and find the area. After they have had a minute or two to work, reconvene the class. Have a couple of volunteers share their strategies and solutions. Then work with input from the class to enter the information for both problems on the display sheet.

Set D9 Measurement: Area of Polygons Blackline Run a display copy.	
NAME _____	DATE _____
<b>Finding the Area of a Right Triangle</b>	
<b>1</b> Build this right triangle on your geoboard. Find the area of the triangle in square units.	
	Area = _____ How did you figure it out?
<b>2</b> Now build this right triangle on your geoboard. Find the area of the triangle in square units.	
	Area = _____ How did you figure it out?



**Activity 3** Finding the Perimeter & Area of a Parallelogram (cont.)

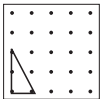
5. Now give students each a copy of More Triangles to Measure. Read the instructions on the sheet with the class, and clarify as necessary. Ask them to write a response to the last question in their math journal or on the back of the sheet.

Set D9 Measurement: Area of Polygons Blackline Run a class set.

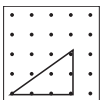
NAME \_\_\_\_\_ DATE \_\_\_\_\_

**More Triangles to Measure**

**1** Build this right triangle on your geoboard. Find the area of the triangle in square units.

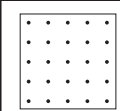
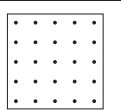
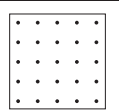
	Area = _____ How did you figure it out?
---	--

**2** Now build this right triangle on your geoboard. Find the area of the triangle in square units.

	Area = _____ How did you figure it out?
---	--

**3** Build 3 right triangles, one with an area of 6 square units, one with an area of 8 square units, and one with an area of  $4\frac{1}{2}$  square units. Record your work below. Use labeled sketches, numbers, and/or words to prove that the area of each triangle you have drawn is correct.

a. 6 square units      b. 8 square units      c.  $4\frac{1}{2}$  square units

		
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**4** The formula for the area of a right triangle is  $\frac{1}{2}$  base  $\times$  height, or  $\frac{1}{2}bh$ . Use labeled sketches, numbers, and words to explain why this works.

6. When students understand what to do, have them go to work individually or in pairs. Circulate to provide support as needed. While some students will quickly latch onto the idea of surrounding the triangle with a rectangle, others may want to cut the triangles apart and fit the pieces together. Provide these students with geoboard paper so they can experiment. As they do so, they may discover that the right triangles in problems 1 and 2 can both be pieced together to form rectangles.

7. As students finish, have them share and compare their solutions and strategies with at least one other classmate. Children who finish well ahead of their classmates can be challenged to construct other triangles, including non-right triangles, with areas of 6, 8, and  $4\frac{1}{2}$  square units on their geoboards. Give these students geoboard paper on which to record their work.

8. When there are 5–10 minutes remaining in the period, reconvene the class to read and discuss the last question on the display master.

**For discussion:**

The formula for finding the area of a right triangle is  $\frac{1}{2}$  base  $\times$  height, or  $\frac{1}{2}bh$ .

- Show how and why this formula works.
- Do you think this formula works for all types of triangles? Why or why not?

**Activity 3** Finding the Perimeter & Area of a Parallelogram (cont.)

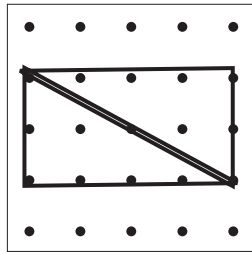
**Teacher** Talk with the person sitting next to you about the formula shown here. Does  $\frac{1}{2}$  base  $\times$  height make sense as a way to find the area of a right triangle? Why or why not? Can you find a way to show how it works on your geoboard? Take a minute to talk it over, and then let's hear some ideas.

**Students** That formula just looks weird.

But not if you remember that base times height is the way to find the area of a rectangle.

I know how to show it on a geoboard! Just make a right triangle and put a rectangle around it like this, see? Then you can see that the area of the triangle is half the area of the rectangle!

Oh yeah! So the whole rectangle takes up 8 squares. That means the triangle must be 4 square units.



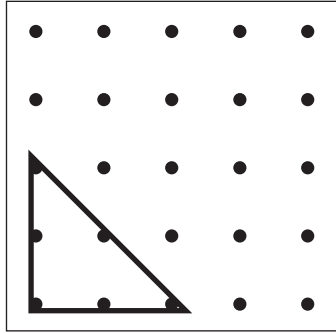
9. Conclude the session by letting students know they'll be doing some more work with area tomorrow.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Finding the Area of a Right Triangle

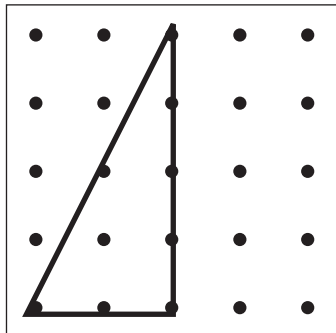
**1** Build this right triangle on your geoboard. Find the area of the triangle in square units.



Area = \_\_\_\_\_

How did you figure it out?

**2** Now build this right triangle on your geoboard. Find the area of the triangle in square units.



Area = \_\_\_\_\_

How did you figure it out?

### For discussion:

The formula for finding the area of a right triangle is  $\frac{1}{2}$  base  $\times$  height, or  $\frac{1}{2}bh$ .

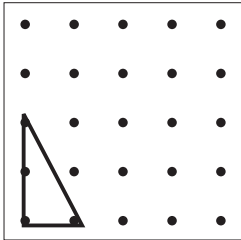
- Show how and why this formula works.
- Do you think this formula works for all types of triangles? Why or why not?

NAME \_\_\_\_\_

DATE \_\_\_\_\_

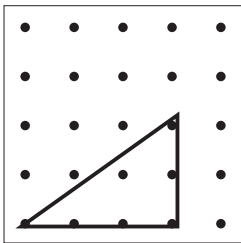
## More Triangles to Measure

**1** Build this right triangle on your geoboard. Find the area of the triangle in square units.



Area = \_\_\_\_\_  
How did you figure it out?

**2** Now build this right triangle on your geoboard. Find the area of the triangle in square units.

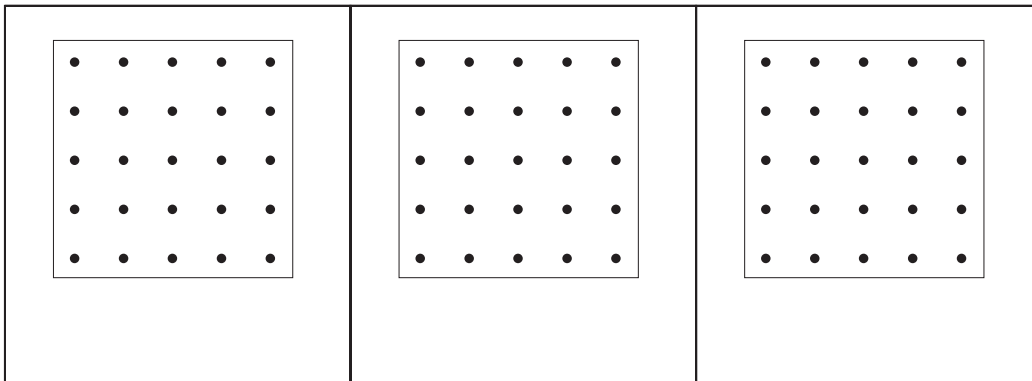


Area = \_\_\_\_\_  
How did you figure it out?

**3** Build 3 right triangles, one with an area of 6 square units, one with an area of 8 square units, and one with an area of  $4\frac{1}{2}$  square units. Record your work below. Use labeled sketches, numbers, and/or words to prove that the area of each triangle you have drawn is correct.

a. 6 square units

b. 8 square units

c.  $4\frac{1}{2}$  square units

**4** The formula for the area of a right triangle is  $\frac{1}{2}$  base  $\times$  height, or  $\frac{1}{2}bh$ . Use labeled sketches, numbers, and words to explain why this works.

# Set D9 ★ Activity 4



## ACTIVITY

### Polygons to Order

#### Overview

The teacher reviews the formulas for finding the area of rectangles, non-rectangular parallelograms, and triangles with the class. Students then work in pairs to estimate and determine the area in square centimeters of 6 different polygons.

#### Skills & Concepts

- ★ develop and use the area formula for a right triangle by comparing with the formula for a rectangle (e.g., two of the same right triangles make a rectangle)
- ★ develop, use, and justify the relationships among area formulas of triangles and parallelograms by decomposing and comparing with areas of right triangles and rectangles
- ★ measure to the nearest millimeter

#### You'll need

- ★ Area Formulas (page D9.28, run a display copy)
- ★ Polygons to Order (page D9.29, run a half-class set plus a few extra on 3 or 4 different colors of copy paper)
- ★ Polygons Record Sheet (page D9.30, class set)
- ★ access to Centimeter Grid Paper (page D9.15)
- ★ rulers, scissors, gluesticks (class set of each)
- ★ 12" x 18" newsprint (half-class set plus a few extra)
- ★ piece of paper to mask parts of the display master

#### Instructions for Polygons to Order

1. Let students know that they are going to spend some more time investigating area of various polygons today. Then place the top portion of the Area Formulas overhead on display, keeping the rest covered for now. Read the instructions with the class.

Set D9 Measurement: Area of Polygons Blackline Run a display copy.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Area Formulas

Use the formulas to find the area of each polygon below. Then use the grid to make sure the answers are accurate.

**1** The area of a rectangle is *base* × *height* or *bh*

2. Review the formula for finding the area of a rectangle ( $\text{base} \times \text{height}$ ). Have a volunteer come up to measure and label the base and height of the rectangle (6 cm and 3 cm). Work with input from the class to record the equation that will yield the area ( $6 \times 3 = 18 \text{ sq cm}$ ). Then call another volunteer to come up and confirm the answer by counting the grid squares.

## Activity 4 Polygons to Order (cont.)

**Anna** *Yep, it works. You can see that there are 3 rows of 6 in that rectangle, so the answer has to be 18 square centimeters.*

3. Reveal the second and then the third problems on the Area Formulas sheet. As you show each problem, repeat step 2, recording on the sheet as you go.

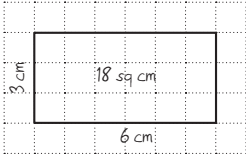
Set D9 Measurement: Area of Polygons Blackline Run a display copy.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### Area Formulas

Use the formulas to find the area of each polygon below. Then use the grid to make sure the answers are accurate.

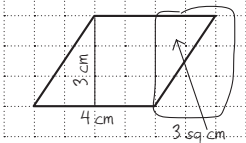
**1** The area of a rectangle is *base*  $\times$  *height* or  $bh$



$6 \times 3 = 18 \text{ sq cm}$

3 rows of 6 is 18 squares, so 18 sq cm is right.

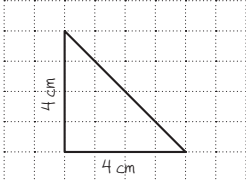
**2** The area of a parallelogram is *base*  $\times$  *height* or  $bh$



$4 \times 3 = 12 \text{ sq cm}$

6 squares in the middle. Then each triangle is 3 sq cm.  $6 + 3 + 3 = 12 \text{ sq cm}$ .

**3** The area of a triangle is *one half* *base*  $\times$  *height* or  $\frac{1}{2}bh$



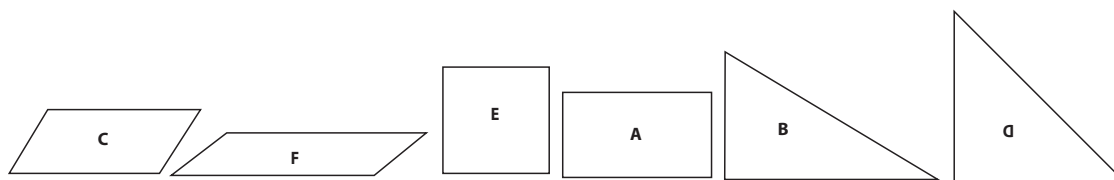
$(4 \times 4) \div 2 = 8 \text{ sq cm}$

There are 6 whole squares and 4 half squares.  $6 + 1/2 + 1/2 + 1/2 + 1/2 = 8 \text{ sq cm}$ .

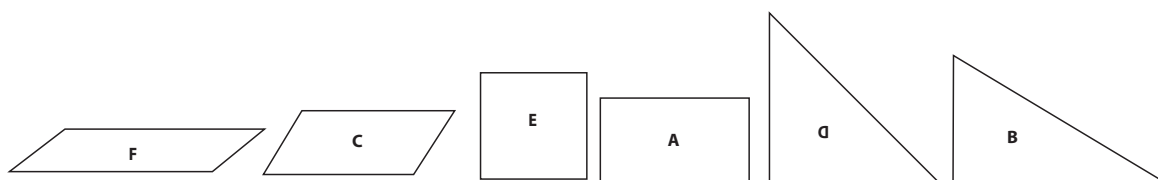
4. Now ask students to pair up, or assign partners. Give each pair a copy of the Polygons to Order blackline. ( If you give each pair at a table a different color sheet, they'll be able to keep track of their own polygons more easily.) Have them work together to carefully cut apart the 6 polygons along the heavy lines.

5. Let students know that in a minute, they'll be estimating and finding the area of each polygon in square centimeters. Before they do, ask them to use their estimation skills to place the 6 in order, from smallest to largest area. Have them discuss their thinking with their partners as they sequence the polygons, and then choose a few volunteers to share their ideas with the class.

**DJ** *It's kind of hard to tell. First we thought the rectangle was the smallest, but then we set the parallelograms on top of the rectangle, and it looked like they were smaller. Same with the square. The triangles are definitely bigger than the square and the rectangle.*

**Activity 4** Polygons to Order (cont.)

**Maria** We said *F* is the smallest because it's so skinny. We put *C* next, and then *E*. After that, we put *A*, but we think *B* might be bigger than *D*. Even though *D* is taller, *B* is longer.



6. Asks students to get out their rulers (if they haven't done so already), and give each student a copy of the Polygons Record Sheet. Review the instructions on the sheet with the class, and let them know where they can find the large paper when they are ready for it. Explain that each pair is responsible for turning in a large sheet with the polygons glued on and labeled, and each partner is responsible for completing his or her own record sheet. Let students know that while they are expected to measure each polygon carefully, and use the formula to find its area, they can also use grid paper to double-check their answers. When students understand what to do, have them go to work.

**CHALLENGE**

7. Pairs who complete the assignment well before other students may be asked to create a seventh polygon with an area of 36 square centimeters and glue it to their large sheet of paper with the other 6 shapes. Challenge them to create a polygon that is not a right triangle, rectangle, or parallelogram. Remind them to label their polygon with its dimensions and area, and show how they found the area after they have glued it to the paper.

**INDEPENDENT WORKSHEET**

Use Set D9 Independent Worksheets 3 and 4 to provide students with more practice using formulas to determine the areas of right triangles, rectangles, and parallelograms.

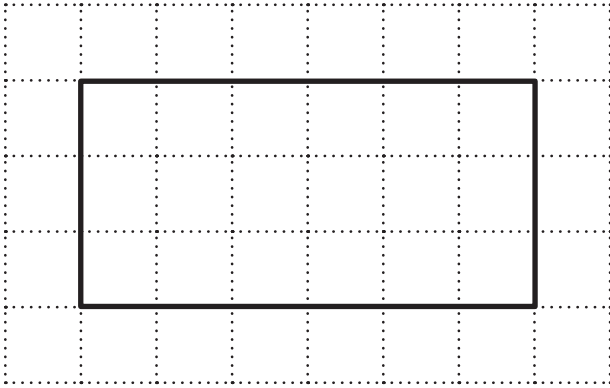
NAME \_\_\_\_\_

DATE \_\_\_\_\_

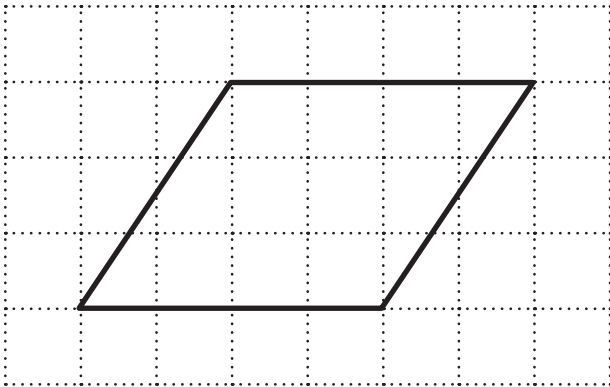
# Area Formulas

Use the formulas to find the area of each polygon below. Then use the grid to make sure the answers are accurate.

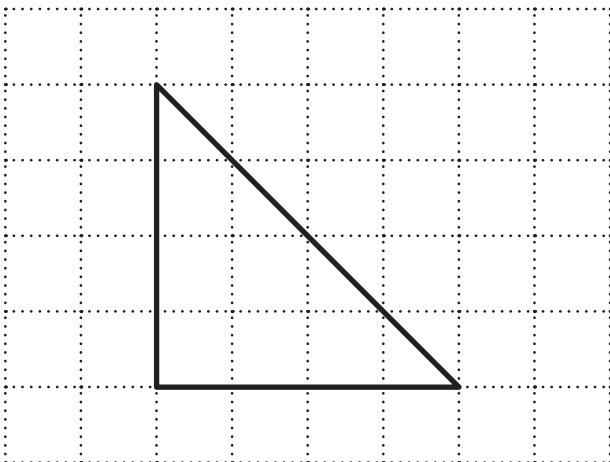
**1** The area of a rectangle is *base*  $\times$  *height* or  $bh$



**2** The area of a parallelogram is *base*  $\times$  *height* or  $bh$

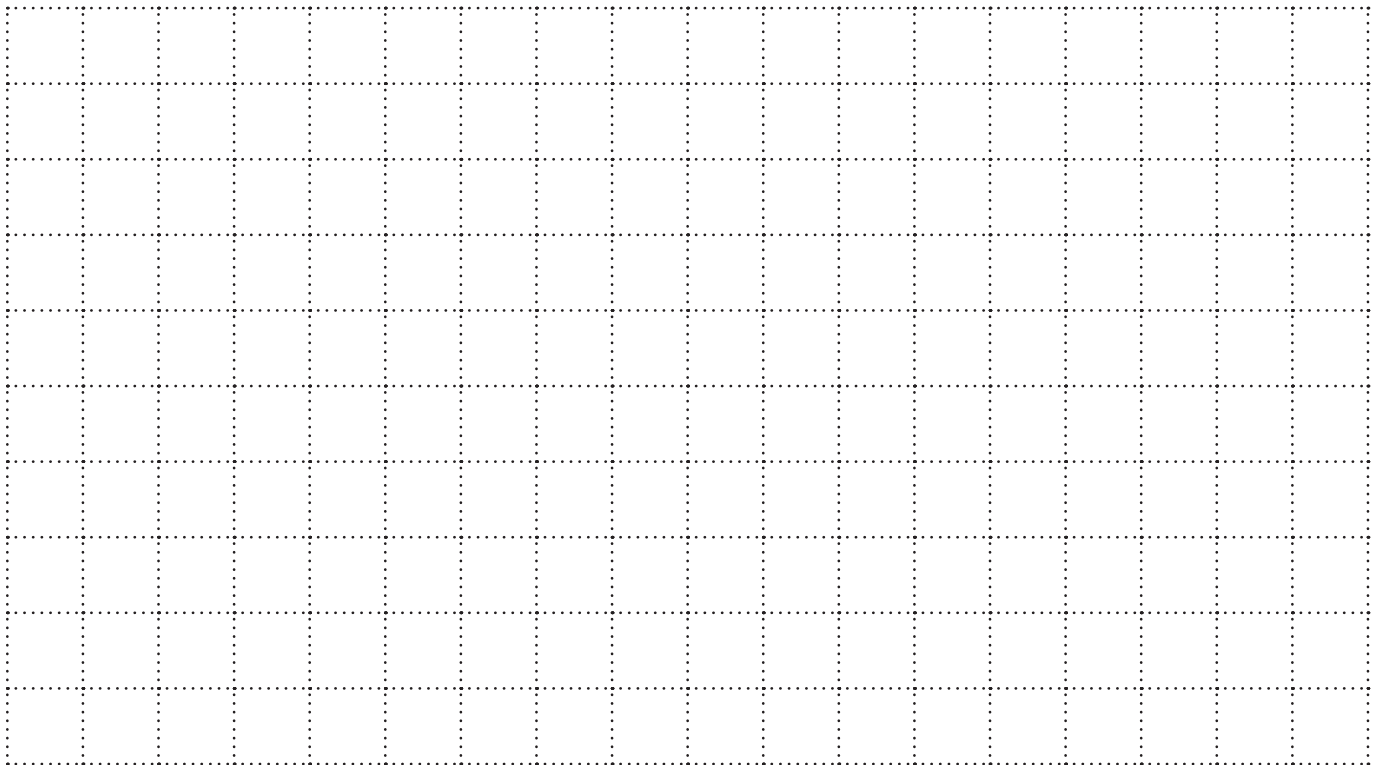
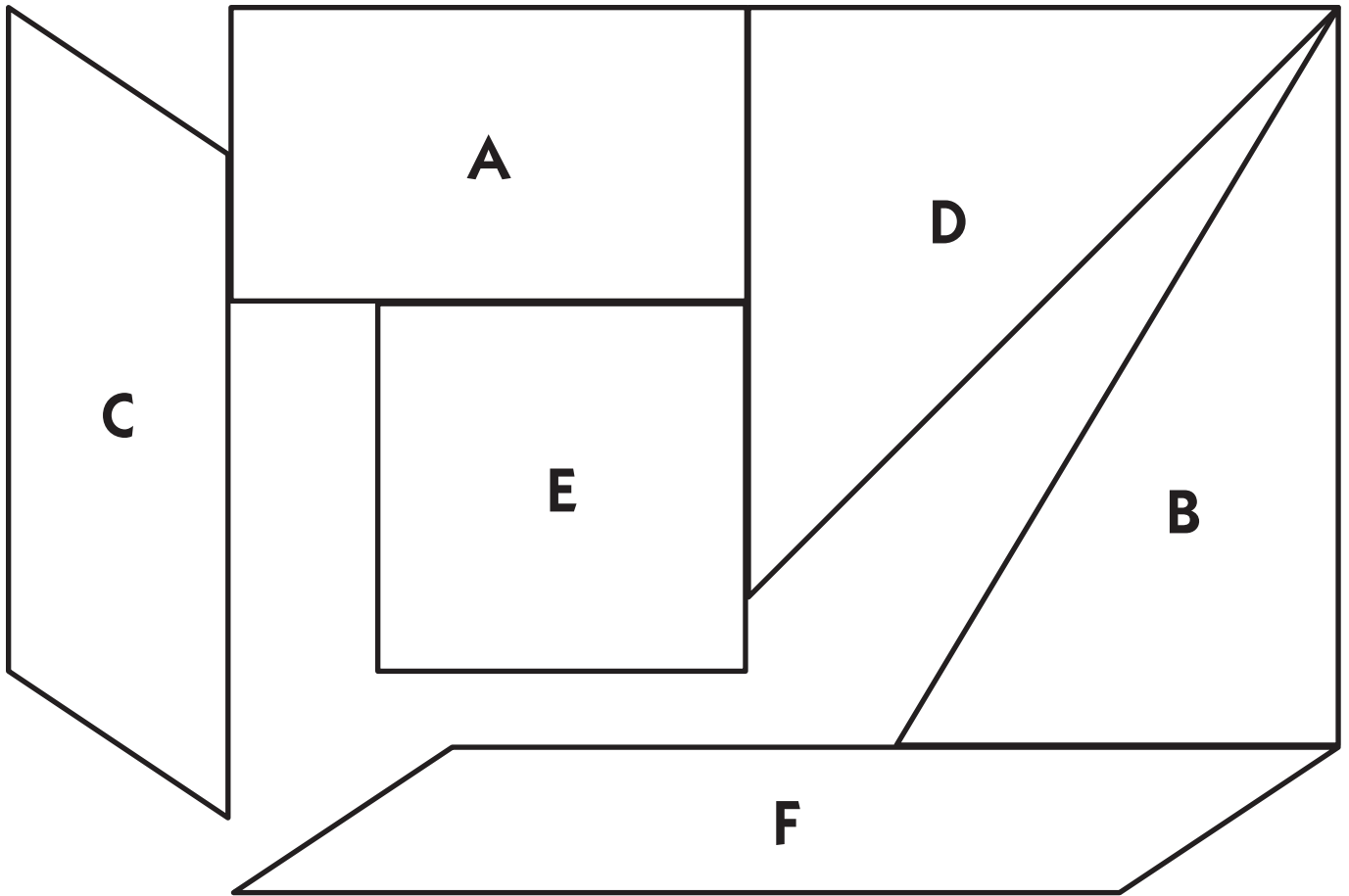


**3** The area of a triangle is *one half base*  $\times$  *height* or  $\frac{1}{2}bh$





# Polygons to Order



NAME \_\_\_\_\_

DATE \_\_\_\_\_

## Polygons Record Sheet

**1** Work with your partner to carefully cut out the 6 polygons and put them in order, from smallest to largest area.

**2** After you've agreed on the order, write the letters of the polygons where you think they belong in the boxes below.

Smallest Area				Largest Area	

**3** Estimate the area of each polygon and find its actual area in square centimeters. Remember to label your work with the correct units (square centimeters). Record your work on the chart below.

Polygon Letter	Your Estimate in square centimeters (sq. cm)	Actual Area in square centimeters (sq. cm)

**4** Glue the polygons onto a large sheet of paper in order from smallest area to largest area. Label each polygon with its base, height, and area. For each polygon, use sketches, numbers and/or words to show how you found the area.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set D9 ★ Independent Worksheet 1



## INDEPENDENT WORKSHEET

### Geoboard Polygons, page 1 of 2

**1** Build and record 3 different polygons (not rectangles) that each have an area of 2 square units. Use labeled sketches, numbers, and/or words to prove that the area of each polygon is really 2 square units.

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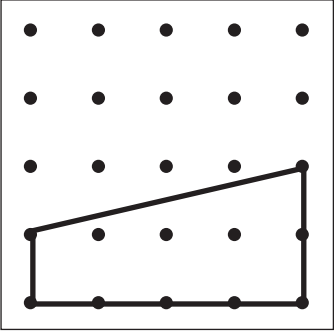
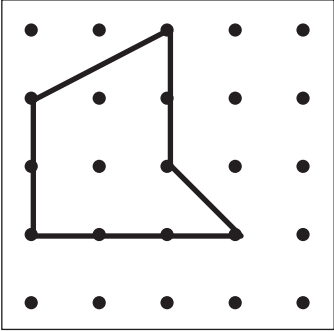
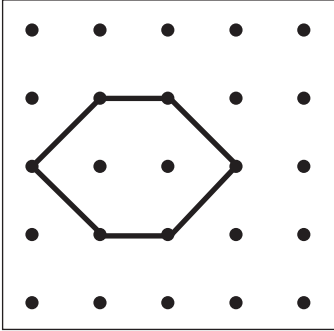
**2** Find the area of each of the polygons below in square units. Use labeled sketches, numbers, and/or words to prove each of your answers.

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(Continued on back.)

**Independent Worksheet 1** Geoboard Polygons, page 2 of 2 (cont.)

**3** Find the area of each of the polygons below in square units. Use labeled sketches, numbers, and/or words to prove each of your answers.

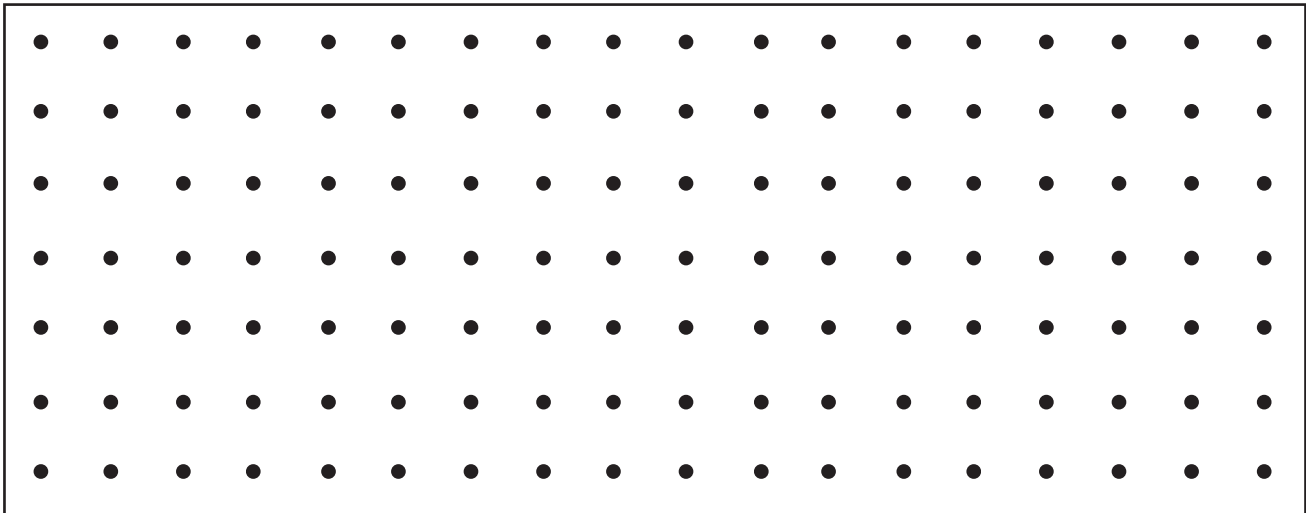
		
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**CHALLENGE**

**4a** Here is a giant geoboard. On this geoboard, draw a right triangle, a rectangle, and a square that follow the rules below.

- The rectangle's area must be 3 times as big as the area of the right triangle.
- The square's perimeter must be 2 times as big as the perimeter of the rectangle.



**4b** Label each of the polygons you drew with its base, height, area, and perimeter.

NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set D9 ★ Independent Worksheet 2



## INDEPENDENT WORKSHEET

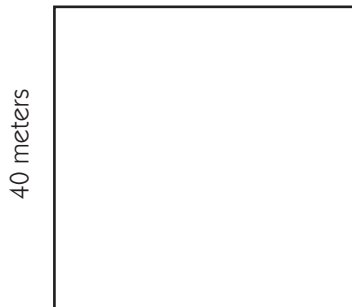
### Finding Perimeter & Area of Quadrilaterals, page 1 of 2

To find the perimeter of any quadrilateral, add the side lengths. For rectangles, you can use the formula 2 times length plus 2 times width, or  $2l + 2w$ .

The formula for finding the area of all parallelograms, including rectangles is base  $\times$  height, or  $bh$ .

**1** Use the formulas above to find the perimeter and area of each figure on this page. Show your work.

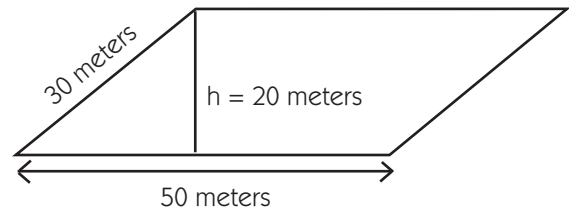
**a** Square



Perimeter = \_\_\_\_\_ meters

Area = \_\_\_\_\_ square meters

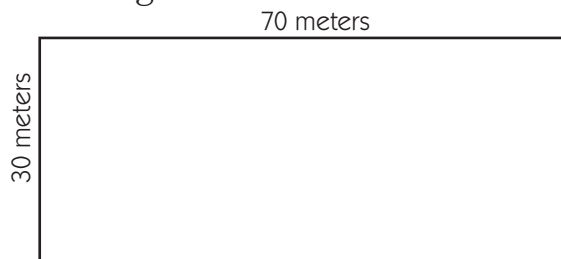
**b** Parallelogram



Perimeter = \_\_\_\_\_ meters

Area = \_\_\_\_\_ square meters

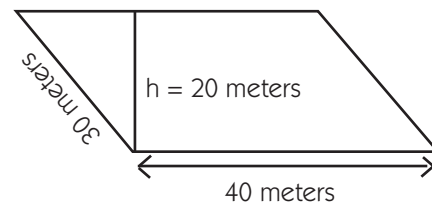
**c** Rectangle



Perimeter = \_\_\_\_\_ meters

Area = \_\_\_\_\_ square meters

**d** Parallelogram



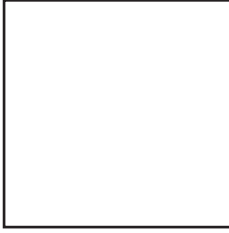
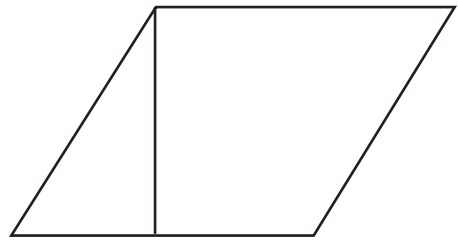
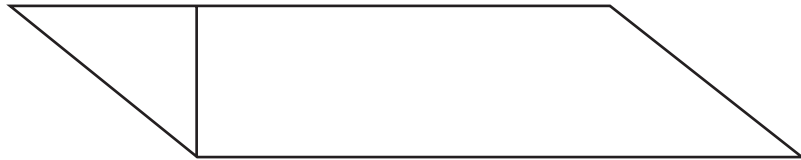

Perimeter = \_\_\_\_\_ meters

Area = \_\_\_\_\_ square meters

**Independent Worksheet 2** Finding Perimeter & Area of Quadrilaterals, page 2 of 2 (cont.)

**3** For each quadrilateral below:

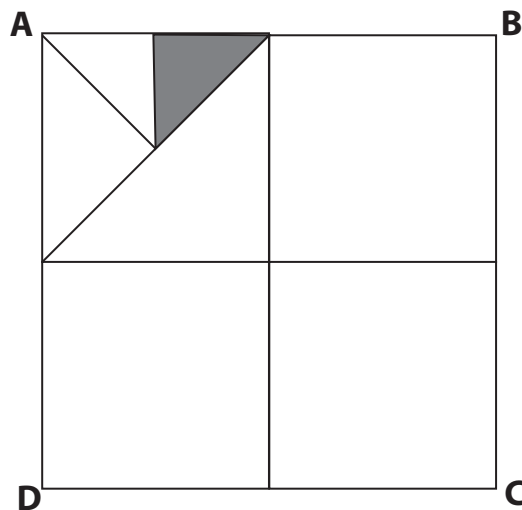
- Measure and label the base and height in centimeters.
- Use the information to find the area of the quadrilateral. Show your work.

<p><b>a</b></p>  <p style="text-align: center;">Area = _____ sq. cm</p>	<p><b>b</b></p>  <p style="text-align: center;">Area = _____ sq. cm</p>
<p><b>c</b></p>  <p style="text-align: center;">Area = _____ sq. cm</p>	<p><b>d</b></p>  <p style="text-align: center;">Area = _____ sq. cm</p>



**CHALLENGE**

**4** The area of square ABCD is 64 square feet. What is the area of the gray triangle? Use sketches, numbers and/or words to solve the problem. Show all of your work.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

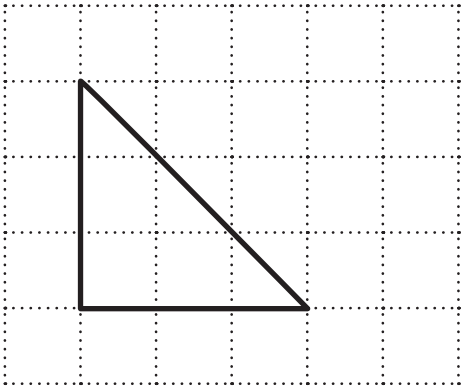
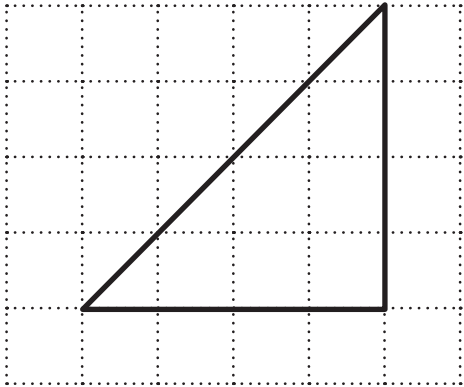
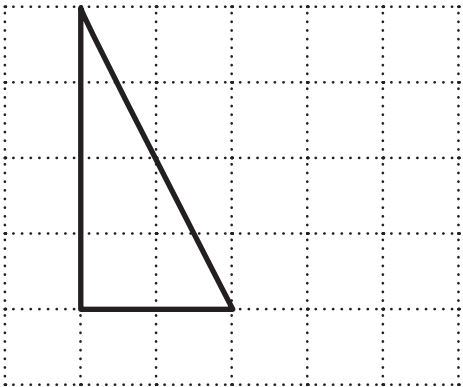
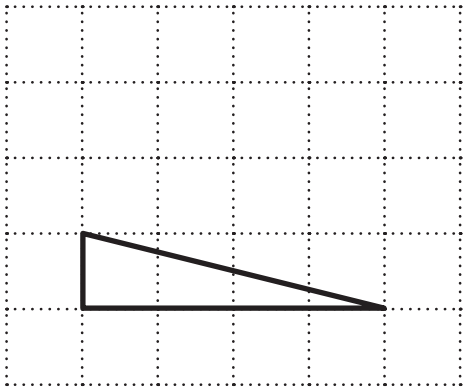
# Set D9 ★ Independent Worksheet 3



## INDEPENDENT WORKSHEET

### Finding the Area of Right Triangles, page 1 of 2

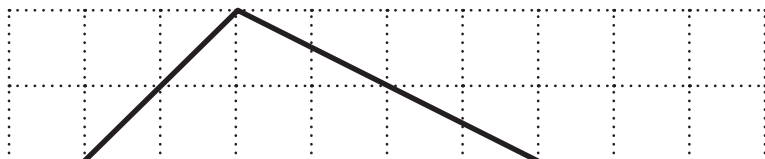
**1** The formula for the area of a right triangle is  $\frac{1}{2}$  base  $\times$  height, or  $\frac{1}{2}bh$ . Use the formula to find the area of each right triangle below. Show your work. Use the grids to check your answers.

<p><b>a</b></p>  <p>Area = _____ sq. cm</p>	<p><b>b</b></p>  <p>Area = _____ sq. cm</p>
<p><b>c</b></p>  <p>Area = _____ sq. cm</p>	<p><b>d</b></p>  <p>Area = _____ sq. cm</p>



### CHALLENGE

**e** Hint: Divide the triangle into 2 right triangles. Find the area of each and add them.

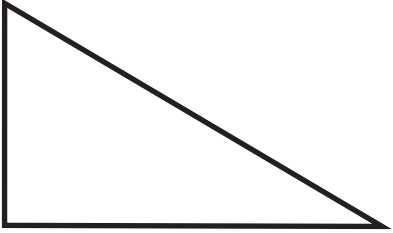
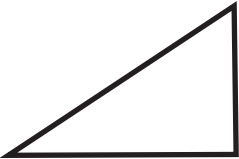

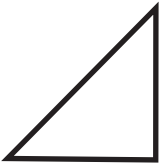


(Continued on back.)

**Independent Worksheet 3** Finding the Area of Right Triangles, page 2 of 2 (cont.)

**3** For each right triangle below:

- Measure and label the base and height in centimeters.
- Use the information to find the area of the right triangle. Show your work.

<p><b>a</b></p>  <p>Area = _____</p>	<p><b>b</b></p>  <p>Area = _____</p>
<p><b>c</b></p>  <p>Area = _____</p>	<p><b>d</b></p>  <p>Area = _____</p>

**4** The drill team wants to make new black and white flags, using the plan below.



**a** How many square feet of white fabric will it take to make 1 flag? How many square feet of black fabric will it take to make 1 flag? Show your work.

**b** The team needs to make 20 flags. The black fabric costs 50¢ a square foot. The white fabric is on sale for 45¢ a square foot. How much will they have to pay for all the fabric to make 20 flags? Show your work.



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Set D9 ★ Independent Worksheet 4



## INDEPENDENT WORKSHEET

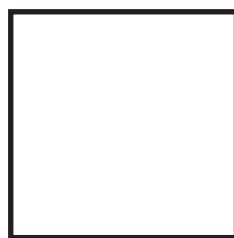
### Rectangles, Parallelograms & Right Triangles, page 1 of 2

The formula for finding the area of all parallelograms, including rectangles, is base  $\times$  height, or  $bh$ .

The formula for finding the area of all triangles is  $\frac{1}{2}$  base  $\times$  height, or  $\frac{1}{2}bh$ .

**1** Use the formulas above to find the area of each figure on this page. Show your work. Label your answers with the correct units.

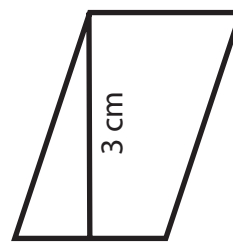
**a** Square



3 cm

Area = \_\_\_\_\_

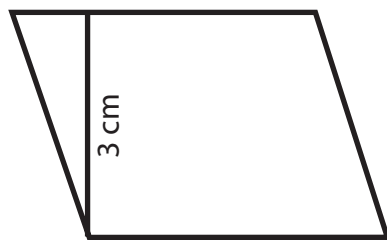
**b** Parallelogram



2 cm

Area = \_\_\_\_\_

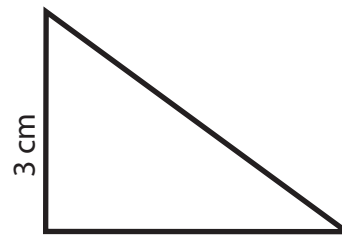
**c** Parallelogram



4 cm

Area = \_\_\_\_\_

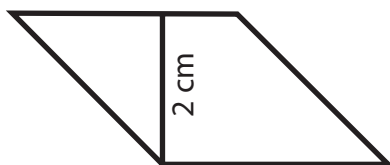
**d** Right Triangle



4 cm

Area = \_\_\_\_\_

**e** Parallelogram



3 cm

Area = \_\_\_\_\_

**f** Rectangle



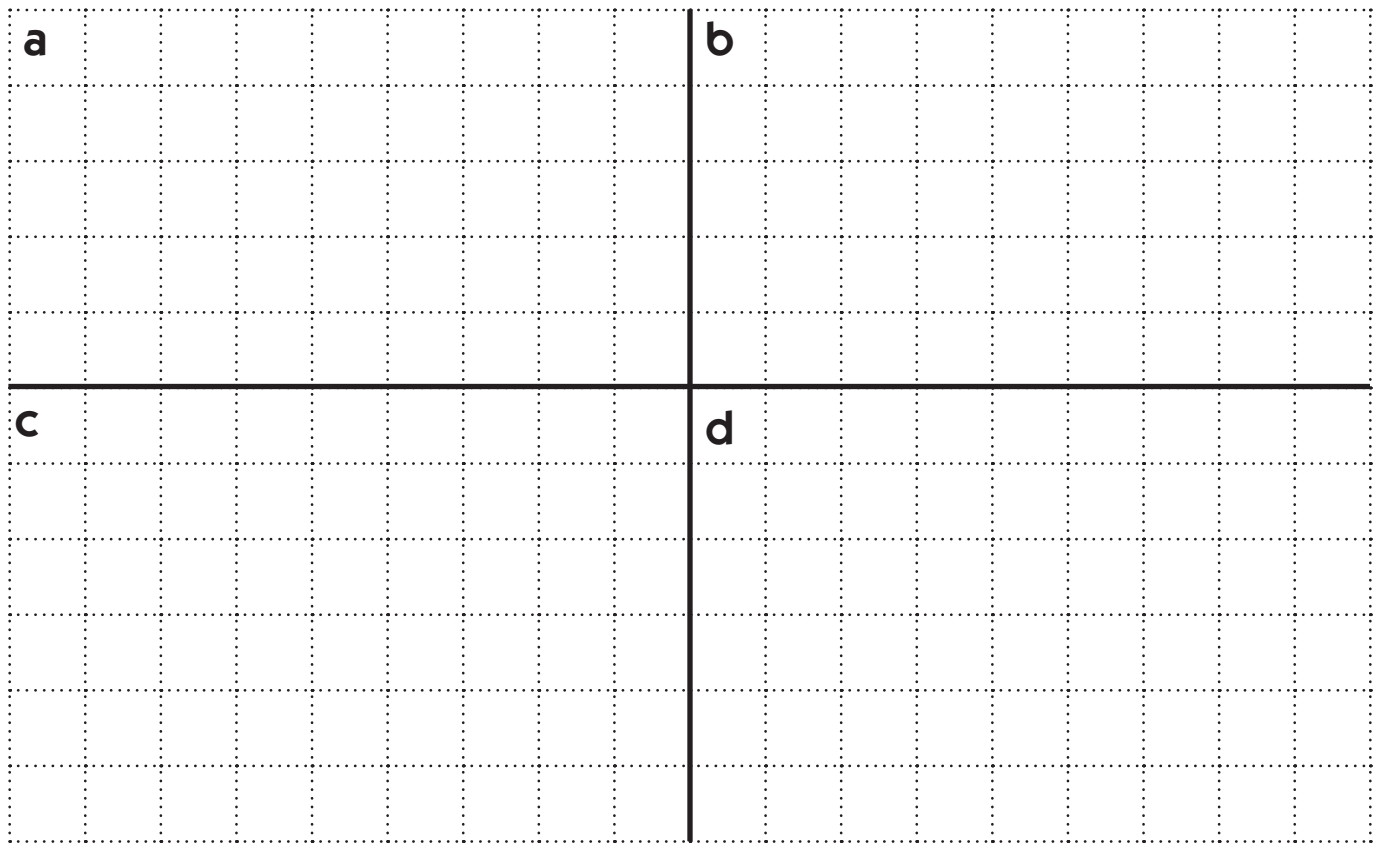
6 cm

Area = \_\_\_\_\_

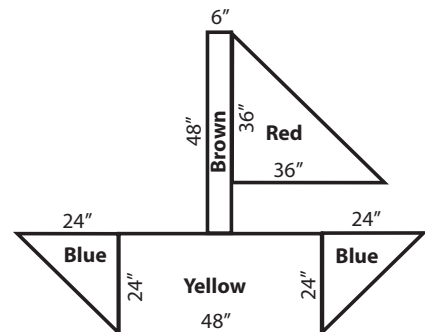
**Independent Worksheet 4** Rectangles, Parallelograms & Right Triangles, page 2 of 2 (cont.)

**2** On the centimeter grid below, draw the following shapes. Label each shape with its base, height, and area.

- a** A rectangle with an area of 15 square centimeters.
- b** A right triangle with an area of 8 square centimeters.
- c** A parallelogram that is not a rectangle with an area of 10 square centimeters.
- d** A right triangle with an area of 12 square centimeters.



**3** Miss Smith wants to make a paper sailboat to put up on the wall in her kindergarten classroom. How many square inches of butcher paper will she need in each color? Show all of your work. If you need more space, use another piece of paper and attach it to this sheet.





## BRIDGES GRADE 4

PUBLISHER'S CORRELATIONS TO  
COMMON CORE STATE STANDARDS  
FOR MATHEMATICS, GRADE 4



# Bridges Grade 4 Correlations to Common Core State Standards

## Common Core State Standards for Mathematics, Grade 4

In Grade 4, instructional time should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.

(1) Students generalize their understanding of place value to 1,000,000, understanding the relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, area models), place value, and properties of operations, in particular the distributive property, as they develop, discuss, and use efficient, accurate, and generalizable methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop fluency with efficient procedures for multiplying whole numbers; understand and explain why the procedures work based on place value and properties of operations; and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use efficient, accurate, and generalizable procedures to find quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.

(2) Students develop understanding of fraction equivalence and operations with fractions. They recognize that two different fractions can be equal (e.g.,  $\frac{1}{2} = \frac{2}{4}$ ), and they develop methods for generating and recognizing equivalent fractions. Students extend previous understandings about how fractions are built from unit fractions, composing fractions from unit fractions, decomposing fractions into unit fractions, and using the meaning of fractions and the meaning of multiplication to multiply a fraction by a whole number.

(3) Students describe, analyze, compare, and classify two-dimensional shapes. Through building, drawing, and analyzing two-dimensional shapes, students deepen their understanding of properties of two-dimensional objects and the use of them to solve problems involving symmetry.

## Grade 4 Overview

### Operations & Algebraic Thinking

- Use the four operations with whole numbers to solve problems.
- Gain familiarity with factors and multiples.
- Generate and analyze patterns.

### Number & Operations in Base Ten

- Generalize place value understanding for multidigit whole numbers.
- Use place value understanding and properties of operations to perform multi-digit arithmetic.

### Number & Operations—Fractions

- Extend understanding of fraction equivalence and ordering.
- Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.
- Understand decimal notation for fractions, and compare decimal fractions.

### Measurement & Data

- Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.
- Represent and interpret data.
- Geometric measurement: understand concepts of angle and measure angles.

### Geometry

- Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

### Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Taken from the *Common Core State Standards for Mathematics 2010*, pages 27 & 28.

# Bridges Grade 4 Correlations to Common Core State Standards

## OPERATIONS AND ALGEBRAIC THINKING 4.OA

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Use the four operations with whole numbers to solve problems.</b>				
1. Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.	Not Yet Addressed			
2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.	Not Yet Addressed			
3a. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted.	Unit 1, Session 10 Unit 2, Sessions 6–9, 12, 14, 19 Unit 3, Sessions 12, 13, 17, 18	October Problem Solving November Problem Solving November Number Line December Problem Solving January Problem Solving February Problem Solving March Problem Solving May Calendar Collector May Problem Solving	Set A5 Number & Operations: Multi-Digit Multiplication, Activities 2, 4, 6, 8, 9, 13 and Ind: Worksheets 1, 5, 9 Set B1 Algebra: Equations & Expressions, Activities 1–4 and Independent Worksheets 1–3 Bridges Practice Book, pp 2, 4, 8, 12, 14, 16, 18, 24, 36, 40, 54, 56, 58, 60, 62, 69, 70, 72, 74, 76, 80, 94, 96, 98, 99, 100, 124, 128	<b>Formal</b> Bridges, Vol: 1, pp 179–181, 255–262 (Unit 2 Pre- and Post-Assessment) Bridges, Vol: 3, pp 653–657, 759–764 (Unit 6 Pre- and Post-Assessment) Set A5 Number & Operations: Multi-Digit Multiplication, Activity 14 Number Corner Teacher's Guide, Vol: 2, pp 289–292 (Checkup 3)
3b. Represent these multistep word problems posed with whole numbers using equations with a letter standing for the unknown quantity.			Set B1 Algebra: Equations & Expressions, Activities 1–4 and Independent Worksheets 1–3 Bridges Practice Book, pp 124, 128	
3c. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	Unit 2, Sessions 7, 9–11, 20 Unit 3, Session 18	November Number Line December Problem Solving December Number Line January Number Line May Calendar Collector	Set A4 Number & Operations: Estimating to Multiply & Divide, Independent: Worksheets 1–3 Set A5 Number & Operations: Multi-Digit Multiplication, Activities 2, 4, 9, 13 Bridges Practice Book, pp 73, 75, 94, 96, 98, 100	<b>Formal</b> Set A5 Number & Operations: Multi-Digit Multiplication, Activities 1, 14 Number Corner Teacher's Guide, Vol: 2, pp 211–214 (Checkup 2)

# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

OPERATIONS AND ALGEBRAIC THINKING 4.OA				
Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Gain familiarity with factors and multiples.</b>				
4a. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors.	Unit 1, Sessions 11, 12 Unit 1, p 92 (HC 6) Unit 3, p 354 (HC 25)	March Number Line	Set A6 Number & Operations: Fractions, Mixed Numbers & Decimals, Activity 2 Bridges Practice Book, pp 17, 42, 105, 107, 109, 126, 129	<b>Informal</b> Bridges Practice Book, pp 105, 107, 109 <b>Formal</b> Bridges, Vol. 1, pp 49–53, 125–134 (Unit 1 Pre- and Post-Assessment) Number Corner Teacher’s Guide, Vol. 2, pp 365–369 (Checkup 4)
4b. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number.		September Number Line October Number Line November Number Line January Number Line February Number Line	Bridges Practice Book, pp 15, 126, 129	<b>Formal</b> Number Corner Teacher’s Guide, Vol. 2, pp 365–369 (Checkup 4)
4c. Determine whether a given whole number in the range 1–100 is prime or composite.	Unit 1, Session 12 Unit 1, pp 72, 92 (HC’s 5, 6) Unit 3, p 354 (HC 25)	March Number Line	Bridges Practice Book, pp 17, 42, 105, 107, 109, 126, 129	<b>Informal</b> Bridges Practice Book, pp 105, 107, 109 <b>Formal</b> Bridges, Vol. 1, pp 24–27, 49–53, 125–134 (Unit 1 Pre- and Post-Assessment) Number Corner Teacher’s Guide, pp 365–369 (Checkup 4)
<b>Generate and analyze patterns.</b>				
5a. Generate a number or shape pattern that follows a given rule.	Unit 2, Sessions 1, 2, 4 Unit 3, p 285 (HC 19) Unit 7, Sessions 1–3, 5–9, 13 Unit 7, pp 793, 853 (Home Connections 50, 54) Unit 7, pp 833–835 (WP 7B)	September Calendar Grid September Number Line October Calendar Grid October Number Line November Number Line January Calendar Grid February Calendar Grid February Number Line	Bridges Practice Book, pp 122, 125, 126, 129, 138	<b>Informal</b> Unit 7, Session 13 (Work Sample) <b>Formal</b> Bridges, Vol. 4, pp 801–806, 854–861 (Unit 7 Pre- and Post-Assessment)
5b. Identify apparent features of the pattern that were not explicit in the rule. For example, given the rule “Add 3” and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.	Unit 2, Sessions 1, 2, 4 Unit 3, p 285 (HC 19) Unit 7, Sessions 1–3, 5–9, 13 Unit 7, pp 793, 853 (Home Connections 50, 54) Unit 7, pp 833–835 (WP 7B)	September Calendar Grid September Number Line October Calendar Grid October Number Line November Number Line January Calendar Grid February Calendar Grid February Number Line	Bridges Practice Book, pp 122, 126, 129, 138	<b>Informal</b> Unit 7, Session 13 (Work Sample) <b>Formal</b> Bridges, Vol. 4, pp 801–806, 854–861 (Unit 7 Pre- and Post-Assessment)

# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

## NUMBER AND OPERATIONS IN BASE TEN 4.NBT

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Generalize place value understanding for multi-digit whole numbers.</b>				
1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that $700 \div 70 = 10$ by applying concepts of place value and division.	Unit 2, Sessions 1, 2, 4 Unit 4, p 186 (HC 13)	September Calendar Grid September Problem Solving October Calendar Grid	Set A3 Number & Operations: Place Value to Millions, Activities 1–3 and Independent Worksheets 1–3 Set A5 Number & Operations: Multi-Digit Multiplication, Activities 2, 3, 7, 10 and Ind. Worksheets 1 & 2 Bridges Practice Book, pp 25, 37, 61, 75	<b>Formal</b> Bridges, Vol. 1, pp 54–57 (Individual Interview) Set A5 Number & Operations: Multi-Digit Multiplication, Activities 1, 14
2a. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form.	Unit 2, Session 4	September Calendar Grid September Problem Solving November Number Line December Number Line January Number Line March Number Line	Set A3 Number & Operations: Place Value to Millions, Activities 1–3 and Independent Worksheets 1–3 Bridges Practice Book, pp 21, 25, 29, 111	<b>Formal</b> Bridges, Vol. 1, pp 54–57 (Individual Interview) Number Corner Teacher’s Guide, Vol. 1, pp 97–101 (Checkup 1) Number Corner, Vol. 2, pp 365–369 (Checkup 4)
2b. Compare two multi-digit numbers based on meanings of the digits in each place, using $>$ , $=$ , and $<$ symbols to record the results of comparisons.		September Number Line November Number Line December Number Line January Number Line	Set A3 Number & Operations: Place Value to Millions, Activity 3 and Independent Worksheet 1 Bridges Practice Book, pp 132, 134	<b>Formal</b> Number Corner Teacher’s Guide, Vol. 1, pp 59–63 (Baseline Assessment) Number Corner Teacher’s Guide, Vol. 2, pp 365–369 (Checkup 4)
3. Use place value understanding to round multi-digit whole numbers to any place.		November Number Line December Number Line January Number Line	Set A4 Number & Operations: Estimating to Multiply & Divide, Independent Worksheets 1–3 Bridges Practice Book, p 9	<b>Formal</b> Number Corner Teacher’s Guide, Vol. 2, pp 211–214 (Checkup 2)
<b>Use place value understanding and properties of operations to perform multi-digit arithmetic.</b>				
4. Fluently add and subtract multi-digit whole numbers using the standard algorithm.		October Problem Solving January Number Line May Calendar Collector	Bridges Practice Book, pp 1–5, 7, 8, 9, 12, 17, 37	<b>Formal</b> Number Corner Teacher’s Guide, Vol. 1, pp 59–63, 97–101 (Baseline, Checkup 1) Number Corner, Vol. 2, pp 211–214, 365–369 (Checkups 2, 4)



# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

NUMBER AND OPERATIONS IN BASE TEN 4.NBT			
Standard	Bridges	Number Corner	Bridges Supplement
<b>Use place value understanding and properties of operations to perform multi-digit arithmetic.</b>			
5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Unit 1, Sessions 8, 10, 13–17 Unit 2, Sessions 6–16, 19, 20 Unit 2, pp 186, 197, 215–216, 248 (HC's 13, 14, 15, 18)	November Problem Solving Dec. Computational Fluency April Problem Solving	Set A4 Number & Operations: Estimating to Multiply & Divide, Independent Worksheets 1–3 Set A5 Number & Operations: Multi-Digit Multiplication, Activities 2–13 and Ind. Worksheets 1–9 Bridges Practice Book, pp 23, 33, 34, 35, 39, 53, 61, 66, 68, 69, 71, 73, 75, 77, 78, 79, 87, 95, 136, 139
6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Unit 1, Sessions 9, 10 Unit 3, Session 12–19 Unit 3, p 367 (HC 26) Unit 8, Sessions 14, 17, 18	November Problem Solving January Problem Solving Jan. Computational Fluency February Problem Solving Feb. Computational Fluency March Problem Solving March Computational Fluency April Problem Solving April Computational Fluency	Set A4 Number & Operations: Estimating to Multiply & Divide, Independent Worksheets 1–3 Bridges Practice Book, pp 81, 82, 85, 87, 93, 136  <b>Informal</b> Unit 3, Sessions 13 & 17 (Work Samples)  <b>Formal</b> Unit 1, pp 54–57 (Ind. Interview) Bridges, Vol. 2, pp 286–292, 386–394 (Unit 3 Pre- and Post-Assessments) Number Corner Teacher's Guide, Vol. 1, pp 59–63 (Baseline) Number Corner Teacher's Guide, Vol. 2, p 211–214, 289–292, 365–369 (Checkups 2–4)

NUMBER AND OPERATIONS—FRACTIONS 4.NF			
Standard	Bridges	Number Corner	Bridges Supplement
<b>Extend understanding of fraction equivalence and ordering. (Note: Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12 &amp; 100.)</b>			
1. Explain why a fraction $a/b$ is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.	Unit 3, Sessions 3, 5–9, 11 Unit 3, pp 310, 318 (HC's 21, 22) Unit 6, Sessions 2, 3, 13	Oct Calendar Collector Dec Calendar Collector March Calendar Grid April Calendar Collector	Set A6 Number & Operations: Fractions & Mixed Numbers, Activities 1 & 2 Bridges Practice Book, pp 41, 42, 45, 47, 59, 101, 105, 107, 109, 111, 113, 115, 117, 119, 137  <b>Formal</b> Bridges, Vol. 2, pp 286–292, 386–394 (Unit 3 Pre- and Post-Assessments) Number Corner Teacher's Guide, Vol. 1 pp 60–63 (Baseline) Number Corner Teacher's Guide, Vol. 2, pp 289–292 (Checkup 3)

# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

## NUMBER AND OPERATIONS—FRACTIONS 4.NF

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Extend understanding of fraction equivalence and ordering.</b> (Note: Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12 & 100.)				
2. Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as $\frac{1}{2}$ . Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols $>$ , $=$ , or $<$ , and justify the conclusions, e.g., by using a visual fraction model.	Unit 3, Session 3 Unit 3, pp 310, 318 (HCs 21, 22) Unit 6, Sessions 2, 3, 10, 11 Unit 6, p 673 (HC 43)	March Calendar Grid March Calendar Collector April Calendar Collector May Number Line	Set A6 Number & Operations: Fractions & Mixed Numbers, Activity 2 Bridges Practice Book, pp 42–44, 46, 47, 57, 67, 102, 103, 109, 117	<b>Formal</b> Bridges, Vol. 2, pp 286–292, 386–394 (Unit 3 Pre- and Post-Assessments) Bridges, Vol. 3, pp 759–764 (Unit 6 Post Assessment) Number Corner Teacher’s Guide, Vol. 2, pp 365–369 (Checkup 4)
<b>Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.</b>				
3. Understand a fraction $\frac{a}{b}$ with $a > 1$ as a sum of fractions $\frac{1}{b}$ .				
a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.	Unit 1, Session 4 Unit 3, Sessions 3, 8 Unit 6, Sessions 2, 3, 13	Sept. Calendar Collector Oct. Calendar Collector Nov. Calendar Collector Dec. Calendar Collector April Calendar Collector	Set A6 Number & Operations: Fractions & Mixed Numbers, Activities 1 & 2 Set A9 Number & Operations: Adding & Subtracting Fractions, Ind. Worksheets 1 & 2	
b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. Examples: $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$ ; $\frac{3}{8} = \frac{1}{8} + \frac{2}{8}$ ; $2\frac{1}{8} = 1 + 1 + \frac{1}{8} = \frac{9}{8} + \frac{1}{8} + \frac{1}{8}$ .	Not Yet Addressed			
c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.	Unit 3, Session 3	March Problem Solving April Calendar Collector	Set A9 Number & Operations: Adding & Subtracting Fractions, Ind. Worksheets 1–3	



# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

## NUMBER AND OPERATIONS—FRACTIONS 4.NF

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Understand decimal notation for fractions, and compare decimal fractions.</b>				
5. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. For example, express $\frac{3}{10}$ as $\frac{30}{100}$ , and add $\frac{3}{10} + \frac{4}{100} = \frac{34}{100}$ .	Unit 6, Sessions 9, 10, 12, 13, 16, 17, 20 Unit 6, pp 755–756 (WP 6D) Unit 6, p 715 (HC 46) Unit 8, Session 13	March Number Line April Number Line May Number Line		<b>Formal</b> Bridges, Vol. 3, pp 653–657, 759–764 (Unit 6 Pre- and Post-Assessment) Number Corner Teacher’s Guide, Vol. 1, pp 60–63 (Baseline Checkup) Number Corner Teacher’s Guide, Vol. 2, 211–214 (Checkup 2)
6. Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as $\frac{62}{100}$ ; describe a length as 0.62 meters; locate 0.62 on a number line diagram.	Unit 6, Sessions 9, 10, 12–14, 18, 19 Unit 6, pp 722–723, 749–751 (WP’s 6B, 6C) Unit 6, p 715 (HC 46)	Dec. Calendar Collector April Number Line	Bridges Practice Book, pp 111, 115, 119, 137	<b>Formal</b> Bridges, Vol. 3, pp 653–657, 759–764 (Unit 6 Pre- and Post-Assessment) Number Corner Teacher’s Guide, pp 365–369 (Checkup 4)
7a. Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole.	Unit 6, Sessions 10, 11, 18, 20 Unit 6, pp 720–721, 755–756 (WP’s 6A, 6D) Unit 6, pp 724, 740 (Home Connections 47, 48)	Dec. Calendar Collector March Number Line April Number Line	Bridges Practice Book, pp 111, 115, 119, 137	<b>Informal</b> Unit 6, Session 10 (Work Sample) <b>Formal</b> Bridges, Vol. 3, pp 653–657, 759–764 (Unit 6 Pre- and Post-Assessment) Number Corner Teacher’s Guide, pp 365–369 (Checkup 4)
7b. Record the results of comparisons with the symbols $>$ , $=$ , or $<$ , and justify the conclusions, e.g., by using a visual model.	Unit 6, Session 10		Bridges Practice Book, pp 111, 113, 119, 137	

## MEASUREMENT AND DATA 4.MD

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.</b>				
1a. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.	Unit 2, Sessions 3–5	Sept. Calendar Collector	Bridges Practice Book, pp 10, 28, 48,	Number Corner Teacher’s Guide, Vol. 1, pp 97–101 (Checkup 1)
i. metric length (km, m, cm)	Unit 2, Sessions 3–5	Sept. Calendar Collector	Bridges Practice Book, pp 10, 28, 48,	Number Corner Teacher’s Guide, Vol. 1, pp 97–101 (Checkup 1)
ii. standard length (yd, ft, in)	Unit 3, Session 3 Unit 3, pp 334–335 (WP 3B) Unit 3, pp 298, 354 (HC’s 20,25)	Nov. Calendar Collector	Bridges Practice Book, p 110	Number Corner Teacher’s Guide, Vol. 2, pp 211–214 (Checkup 2)

# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

MEASUREMENT AND DATA 4.MD			
Standard	Bridges	Number Corner	Bridges Supplement
<b>Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.</b>			
1a. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.			
iii. metric mass (kg, g)	Not Yet Addressed		
iv. standard weight (lb, oz)			Set D1 Measurement: Weight & Mass, Activities 4, 5 Bridges Practice Book, p 106
v. metric capacity (l, ml)			Set D3 Measurement: Capacity in Metric Units, Activities 1 & 2 and Ind. Worksheet 1
vi. standard capacity (gal, qt, pt, c)	Unit 6, p 685 (HC 44)	October Calendar Collector	Bridges Practice Book, p 127
vii. time (hr, min, sec)			Number Corner Teacher's Guide, Vol. 2, pp 211–214 (Checkup 2)
1b. Record measurement equivalents in a two-column table. For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...			Bridges Practice Book, pp 28, 49, 55, 56, 62, 78, 104
i. metric length (km, m, cm)		Sept. Calendar Collector Number Corner St. Book, p 4	
ii. standard length (yd, ft, in)		Nov. Calendar Collector	
iii. metric mass (kg, g)	Not Yet Addressed		
iv. standard weight (lb, oz)	Not Yet Addressed		
v. metric capacity (l, ml)	Not Yet Addressed		
vi. standard capacity (gal, qt, pt, c)		October Calendar Collector Number Corner St. Book, p 20	
vii. time (hr, min, sec)	Not Yet Addressed		
2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.			
a. distances	Unit 2, Session 14	September Calendar Collector November Calendar Collector March Problem Solving May Calendar Grid May Calendar Collector May Problem Solving	Bridges Practice Book, pp 10, 18, 24, 28, 34, 48, 56, 58, 103, 109, 110, 114, 120

# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

## MEASUREMENT AND DATA 4.MD

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.</b>				
2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.				
b. intervals of time	Unit 3, Session 9 Unit 3, p 329 (HC 23)	January Calendar Grid January Problem Solving	Bridges Practice Book, pp 7, 18, 24, 27, 28, 50, 56, 62, 78, 88, 91, 93, 96, 100, 104	<b>Formal</b> Number Corner Teacher's Guide, Vol. 1, pp 59–63 (Baseline) Number Corner Teacher's Guide, Vol. 2, pp 211–214 (Checkup 2)
c. liquid volumes	Unit 6, p 685 (HC 44)	October Calendar Collector March Calendar Collector Number Corner St. Book, p 21	Set A5 Number & Operations: Multi-Digit Multiplication, Activity 13 Set D3 Measurement: Capacity in Metric Units, Activities 1 & 2 and Ind. Worksheet 1 Bridges Practice Book, pp 108, 127	
d. masses of objects			Set D1 Measurement: Weight & Mass, Activities 1–6 Bridges Practice Book, pp 16, 36, 106, 120	
e. money	Unit 2, Sessions 12, 13 Unit 2, pp 215–216, 248 (HC's 15, 18) Unit 6, Sessions 12, 14, 15 Unit 6, pp 722–723 (WP 6B)	December Calendar Collector	Bridges Practice Book, pp 6, 12, 26, 30, 31, 32, 34, 36, 38, 40, 62, 70, 72, 88, 96, 99, 114, 116, 140	<b>Formal</b> Bridges, Vol. 3, pp 653–657, 759–764 (Unit 6 Pre- and Post-Assessment) Number Corner Teacher's Guide, Vol. 1, pp 59–63 (Baseline)
3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.	Unit 1, Sessions 18–20 Unit 1, pp 123–124 (HC 10) Unit 2, Sessions 3 & 4 Unit 3, p 285 (HC 19) Unit 4, Sessions 10, 11 Unit 4, pp 465–467 (WP 4B) Unit 6, Sessions 1, 4	January Problem Solving April Calendar Grid April Problem Solving	Set A5 Number & Operations: Multi-Digit Multiplication, Activities 4, 8 and Ind. Worksheets 1, 3, Set D6 Measurement: Area & Perimeter, Activities 1–4 and Ind. Worksheets 1 & 2 Set D9 Measurement: Area of Polygons, Activities 1–4 and Ind. Worksheets 1–4 Bridges Practice Book, pp 19, 20, 21, 22, 64, 80, 88, 98, 99, 116, 121, 122, 130, 138, 139, 140	<b>Formal</b> Bridges, Vol. 1, pp 49–53 and 125–134 (Unit 1 Pre- and Post-Assmt) Set A5 Number & Operations: Multi-Digit Multiplication, Act. 14 Number Corner Teacher's Guide, Vol. 2, pp 211–214, 289–292 (Checkups 2, 3)

# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

MEASUREMENT AND DATA 4.MD				
Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Represent and interpret data.</b>				
4. Make a line plot to display a data set of measurements in fractions of a unit ( $\frac{1}{2}$ , $\frac{1}{4}$ , $\frac{1}{8}$ ). Solve problems involving addition and subtraction of fractions by using information presented in line plots. For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.	Not Yet Addressed			
<b>Geometric measurement: understand concepts of angle and measure angles.</b>				
5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:				
a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through $\frac{1}{360}$ of a circle is called a "one-degree angle," and can be used to measure angles.	Grade 4, Unit 4, Session 1 Grade 5, Unit 3, Sessions 6, 8		Set C3 Geometry: Circles & Angles, Activities 1 & 2	
b. An angle that turns through $n$ one-degree angles is said to have an angle measure of $n$ degrees.	Grade 4, Unit 4, Session 1 Grade 5, Unit 3, Sessions 6, 7		Set C3 Geometry: Circles & Angles, Activities 1 & 2	
<b>Geometric measurement: understand concepts of angle and measure angles.</b>				
6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	Grade 5, Unit 3, Sessions 9, 10, 15 Grade 5, Home Connections Vol. 1, HC 26		Set C3 Geometry: Circles & Angles, Activities 1 & 2	

# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

## MEASUREMENT AND DATA 4.MD

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Geometric measurement: understand concepts of angle and measure angles.</b>				
7. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.	Grade 5, Unit 3, Sessions 6, 7, 15 Grade 5, Home Connections Vol. 1, HC 25			

## GEOMETRY 4.G

Standard	Bridges	Number Corner	Bridges Supplement	Assessments
<b>Draw and identify lines and angles, and classify shapes by properties of their lines and angles.</b>				
1a. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines.	Unit 4, Session 1 Unit 4, pp 432, 446 (HCs 29, 30)	April Calendar Grid	Set C1 Geometry: Parallel, Perpendicular & Intersecting, Activity 1 and Ind. Worksheets 1 & 2 Set C2 Geometry: 2- & 3-Dimensional Shapes, Ind. Worksheets 1–4 Set C3 Geometry: Circles & Angles, Activities 3–5	<b>Formal</b> Bridges, Vol. 2, pp 423–426, 517–525 (Unit 4 Pre- and Post-Assessments)
1b. Identify these in two-dimensional figures.	Unit 1, Sessions 2, 3 Unit 4, Sessions 1, 2, 4, 5, 13	April Calendar Grid	Set C2 Geometry: 2- & 3-D Shapes, Ind. Worksheets 1–3 Set C3 Geometry: Circles & Angles, Activities 1, 3 and Ind. Worksheets 1–4	<b>Formal</b> Bridges, Vol. 1, pp 24–27 and 125–134 (Unit 1 Pre- and Post-Assmts) Bridges, Vol. 2, pp 423–426, 517–525 (Unit 4 Pre- and Post-Assessments)
2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.	Unit 1, Sessions 2, 3 Unit 4, Sessions 4, 10, 11 Unit 4, pp 463–465 (WP 4A)	April Calendar Grid	Set C2 Geometry: 2- & 3-D Shapes, Ind. Worksheets 1–3 Set C3 Geometry: Circles & Angles, Activities 1, 3 and Ind. Worksheets 1–3 Set D9 Measurement: Area of Polygons, Activities 1–4 and Ind. Worksheets 1–4	



# Bridges Grade 4 Correlations to Common Core State Standards (cont.)

GEOMETRY 4.G			
Standard	Bridges	Number Corner	Bridges Supplement
<b>Draw and identify lines and angles, and classify shapes by properties of their lines and angles.</b>			
3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.	Unit 1, Sessions 2, 3 Unit 3, Session 1 Unit 4, Sessions 2, 5, 9, 12 Unit 4, pp 473–475 (WP 4C) Unit 4, pp 458, 516 (Home Connections 31, 35)	April Calendar Grid	<b>Formal</b> Bridges, Vol. 1, pp 24–27, 125–134 (Unit 1 Pre- and Post-Assessments) Bridges, Vol. 2, pp 423–426, 517–525 (Unit 4 Pre- and Post-Assessments)



# Bridges in Mathematics & the Common Core State Standards (CCSS) – Grade 4

OPERATIONS & ALG. THINKING		NUMBER/OPS. IN BASE 10		FRACTIONS		MEASUREMENT & DATA		GEOMETRY	
<ul style="list-style-type: none"> <li>Solve Problems with all 4 Operations</li> <li>Factors &amp; Multiples</li> </ul> Bridges Units: 1, 2, 3, 7 Number Corner: Oct–Feb, Mar, May Supplement Sets: A4, A5, A6, B1		<ul style="list-style-type: none"> <li>Place Value for Multi-Digit Whole Number &amp; Operations</li> </ul> Bridges Units: 1–3, 8 Number Corner: Sep–May Supplement Sets: A3, A4, A5		<ul style="list-style-type: none"> <li>Fraction Equivalence</li> <li>Ordering</li> <li>Early Operations</li> <li>Decimal Notation for Fractions</li> </ul> Bridges Units: 3, 6 Number Corner: Sep–Dec, Mar–May Supplement Sets: A6, A9		<ul style="list-style-type: none"> <li>Measurement Conversions</li> <li>Represent &amp; Interpret Data</li> <li>Angle Measurement</li> </ul> Bridges Units: 1, 2, 3, 4, 6 Number Corner: Sep–Jan, Mar–May Supplement Sets: A5, D1, D3, D6, D9		<ul style="list-style-type: none"> <li>Draw &amp; Identify Lines &amp; Angles</li> <li>Classify Shapes</li> </ul> Bridges Units: 1, 4 Number Corner: April Supplement Sets: C1, C2, C3, D9	

## 4

### Pacing Guide (165 Sessions Total)

	SEP 21 SESSIONS	OCT–MID-NOV 24 SESSIONS	MID-NOV–DEC 26 SESSIONS	JAN–MID-FEB 21 SESSIONS	MID-FEB–MID-MAR 18 SESSIONS	MID-MAR–MID-APR 20 SESSIONS	MID-APR–MID-MAY 12 SESSIONS	MID-MAY–JUNE 19 SESSIONS
<b>Units</b>	UNIT 1 21 Sessions Multiplication & Division Models	UNIT 2 17 Sessions Place Value & Multiplication with Larger Numbers	UNIT 3 20 Sessions Fractions & Division	UNIT 4 13 Sessions Geometry & Measurement	SET A5 Multi-Digit Multiplication 14 Sessions 9 IWS	UNIT 6 18 Sessions Fractions & Decimals	UNIT 7 12 Sessions Algebraic Thinking	UNIT 8 19 Sessions Wingspans
<b>CCSS Supplement Sets</b>	SET A3: Place Value to Millions 3 Sessions 3 IWS	SET A9: Fractions 1 Session 2 IWS	SET C1: Parallel, Perpendicular, and Intersecting 1 Session; 2 IWS	SET B1: Equations & Operations 4 Sessions 3 IWS	SET A4: Estimation 2 IWS	SET A6: Fractions & Mixed Numbers 2 Sessions		
	SET D6: Area & Perimeter 4 Sessions 2 IWS	SET D1: Weight & Mass 5 Sessions	SET C2: 2- and 3-D Shapes 4 IWS	SET D3: Metric Capacity 2 Activities 1 IWS				
	IWS = Independent Worksheets to be used as homework or seatwork		SET C3: Circles & Angles 3 Sessions 5 IWS	SET D9: Area of Polygons 4 Sessions 1 IWS				
<b>Number Corner</b>	Numbers to 10,000; expanded notation; basic facts (x ÷); multiples; story problems; growing patterns; and functions; length	Place value; basic facts (x ÷); multiples; story problems; growing patterns; capacity	Basic facts (x ÷); multiples; story problems; multi-digit (x ÷); repeating patterns; transformations; length	Rounding and estimating; basic facts (x ÷); growing patterns; elapsed time; probability and data; story problems; time; perimeter; money	Basic facts (x ÷); factors and multiples; story problems (multi-digit x and ÷); patterns and functions; probability and data	Rounding; basic facts (x ÷); fractions and decimals; number patterns; capacity; line graphs; story problems (graphs, tables, and charts)	Basic facts (÷); story problems (computation, area, perimeter, and fractions); fractions and decimals; number patterns; 2-D shapes; perimeter and area	Basic facts (+ - x ÷); fractions and decimals; story problems (multi-step computation); coordinate grids; reading and constructing tables and graphs

