



CCGPS Frameworks Student Edition

Mathematics

Second Grade Unit Five
Understanding Plane and Solid Figures



Dr. John D. Barge, State School Superintendent
"Making Education Work for All Georgians"

Unit 5: Shapes and Partitions (4 Weeks)

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OVERVIEW

In this unit students will cultivate spatial awareness by:

- further developing understandings of basic geometric figures
- identifying plane figures and solid figures based on geometric properties
- describing plane figures and solid figures according to geometric properties
- expanding the ability to see geometry in the real world
- partitioning shapes into equal shares by cutting, slicing, or dividing
- represent halves, thirds, and fourths using rectangles and circles to create fraction models
- compare fractions created through partitioning same-sized rectangular or circular wholes in different ways
- understand what an array is and how it can be used as a model for repeated addition
- organize and record data using tallies, simple tables and charts, pictographs, and bar graphs

Students describe and analyze shapes by examining their sides and angles. Students investigate, describe, and reason about decomposing and combining shapes to make other shapes. Through building, drawing, and analyzing two- and three-dimensional shapes, students develop a foundation for understanding area, volume, congruence, similarity, and symmetry in later grades.

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as counting, time, money, positional words, patterns, and tallying should be addressed on an ongoing basis through the use of calendar, centers, and games.

To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the tasks listed under “Evidence of Learning” be reviewed early in the planning process. The tasks in these units illustrate the types of learning activities that should be utilized from a variety of sources.

STANDARDS FOR MATHEMATICAL CONTENT

Reason with shapes and their attributes.

MCC.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

Represent and interpret data.

MCC.2.MD.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

STANDARDS FOR MATHEMATICAL PRACTICE

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education.

Students are expected to:

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

ENDURING UNDERSTANDINGS

In this unit students will:

- further develop understandings of basic geometric figures
- identify plane figures and solid or hollow figures according to geometric properties
- describe plane figures and solid or hollow figures according to geometric properties
- develop an understanding of the relationship between solid or hollow figures and plane figures
- understand that the faces of solid or hollow figures are plane figures
- further develop spatial awareness of geometric solids and figures
- investigate what happens when geometric figures are combined
- investigate what happens when geometric figures are cut apart
- recognize plane and solid figures in the real world
- Repeatedly adding the same quantity or forming a rectangular array are strategies for repeated addition.
- Fractional parts are equal shares of a whole number, whole object, or a whole set.

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- The more equal sized pieces that form a whole, the smaller the pieces (fraction) will be.
- When the numerator and denominator are the same number, the fraction equals the number one or one whole (entire object or set).
- The fraction name (half, third, fourth) indicates the number of equal parts in the whole.
- Equal shares of identical wholes may not have the same shape. For example, fourths can be represented in multiple ways (i.e. with diagonal, horizontal, vertical cuts) and although they look different they represent the same amount/size piece.

ESSENTIAL QUESTIONS

- How do we describe geometric figures?
- Where can we find geometric figures in the world around us?
- How do we use the following terms: angle, vertex, face, side, and edge to describe geometric figures?
- How do we apply the use of fractions in everyday life?
- What is a fraction and how can it be represented?
- How do we know how many fractional parts make a whole?
- What do the parts of a fraction tell us?
- When is it appropriate to use fractions?
- What strategies can I use to count the total number of equal-sized squares in a rectangle?
- How are arrays and repeated addition related?
- What is a survey?
- How can we use a pictograph, bar graph, chart, or table to organize data and answer questions?

CONCEPTS/SKILLS TO MAINTAIN

In Grade 1, instructional time focused on four critical areas:

- Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20;
- Developing understanding of whole number relationships and place value, including grouping in tens and ones;
- Developing understanding of linear measurement and measuring lengths as iterating length units;
-

Routine topics such as counting, time, money, positional words, patterns, and tallying should be addressed on an ongoing basis through the use of centers and games. Organizing and graphing data as stated in MCC.MD.10 should be incorporated in activities throughout the year. Students should be able to draw a picture graph and a bar graph to represent a data set with up to four categories as well as solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

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Specifically, it is expected that students will have prior knowledge/experience related to the concepts and skills identified below. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas.

- Composition and decomposition of two- dimensional shapes
- Recognition of shapes from different perspectives and orientations
- Basic geometric figures and spatial relationships
- Sides, vertices, and other geometric attributes
- Extension of counting sequences
- Addition and subtraction within 20
- Finding 10 more or less than a number
- Fractions: halves, fourths
- Measurement : estimating, comparing, and ordering
- Tally marks
- Picture graphs
- Estimation to nearest ten

SELECTED TERMS AND SYMBOLS

The following terms and symbols are often misunderstood. These concepts are not an inclusive list and should not be taught in isolation. However, due to evidence of frequent difficulty and misunderstanding associated with these concepts, instructors should pay particular attention to them and how their students are able to explain and apply them.

The terms below are for **teacher reference only and are not to be memorized by the students**. Teachers should present these concepts to students with models and real life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

- **angle**
- **array**
- **attribute**
- **bar graph**
- **circle**
- **column**
- **concave**
- **cone**
- **convex**
- **cube**
- **cylinder**
- **data set**
- **denominator**
- **edge**

- **face**
- **fourths**
- **fraction**
- **halves**
- **hexagon**
- **irregular polygon**
- **numerator**
- **partition**
- **partition**
- **pentagon**
- **pictograph**
- **plane figure**
- **polygon**
- **quadrilateral**
- **rectangle**
- **regular polygon**
- **row**
- **scale**
- **shapes**
- **solid figure**
- **square**
- **thirds**
- **trapezoid**
- **triangle**
- **unit fraction**
- **vertex/vertices**
- **whole**

STRATEGIES FOR TEACHING AND LEARNING

(Information adapted from the North Carolina DPI Instructional Support Tools)

General Strategies:

- Students should be actively engaged by developing their own understanding.
- Mathematics should be represented in as many ways as possible by using graphs, tables, pictures, symbols, and words.
- Appropriate manipulatives and technology should be used to enhance student learning.
- Students should be given opportunities to revise their work based on teacher feedback, peer feedback, and metacognition which includes self-assessment and reflection.
- Math journals are an excellent way for students to show what they are learning about a concept. These could be spiral bound notebooks that students could draw or write in to

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describe the day's math lesson. Second graders love to go back and look at things they have done, so journals could also serve as a tool for a nine week review, parent conferencing, etc.

Reason with shapes and their attributes

MCC.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

Instructional Strategies

(Information quoted from Van de Walle and Lovin, *Teaching Student-Centered Mathematics: Grades K-3*, page 188)

“Not all people think about geometric ideas in the same manner. Certainly, we are all not alike, but we are all capable of growing and developing in our ability to think and reason in geometric contexts. The research of two Dutch educators, Pierre van Hiele and Dina van Hiele-Geldof, has provided insight into the differences in geometric thinking and how the differences come to be.

The most prominent feature of the model is a five-level hierarchy of ways of understanding spatial ideas. Each of the five levels describes the thinking processes used in geometric contexts. The levels describe how we think and what types of geometric ideas we think about, rather than how much knowledge we have. A significant difference from one level to the next is the objects of thought-what we are able to think about geometrically.”

- Level 0: Visualization
- Level 1: Analysis
- Level 2: Informal Deduction
- Level 3: Deduction
- Level 4: Rigor

For more information on the van Hiele Levels, refer to Van de Walle and Lovin, *Teaching Student-Centered Mathematics: Grades K-3*, Chapter 7.

MCC.2.G.1 calls for students to identify (recognize) and draw shapes based on a given set of attributes. These include triangles, quadrilaterals (squares, rectangles, and trapezoids), pentagons, hexagons and cubes.

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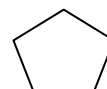
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Example: Draw a closed shape that has five sides. What is the name of the shape?

Student 1

I drew a shape with 5 sides.

It is called a pentagon.

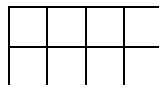


Prior to teaching the unit, you can use the plane shapes graphic organizer as a whole class assessment or give each child a copy and have them list everything they know about the given shapes.

MCC.2.G.2 calls for students to partition a rectangle into squares (or square-like regions) and then determine the total number of squares. This relates to the standard 2.OA.4 where students are arranging objects in an array of rows and columns. Modeling repeated addition with partitioned rectangles provides the foundation for student understanding of multiplication. While discussions of multiplication may arise as an offshoot of work in this standard, the emphasis should be on understanding repeated addition through the array model.

Tell students that they will be drawing a square on grid paper. The length of each side is equal to 2 units. Ask them to guess how many 1 unit by 1 unit squares will be inside this 2 unit by 2 unit square. Students now draw this square and count the 1 by 1 unit squares inside it. They compare this number to their guess. Next, students draw a 2 unit by 3 unit rectangle and count how many 1 unit by 1 unit squares are inside. Now they choose the two dimensions for a rectangle, predict the number of 1 unit by 1 unit squares inside, draw the rectangle, count the number of 1 unit by 1 unit squares inside and compare this number to their guess. Students repeat this process for different-size rectangles. Finally, ask them to share what they observed as they worked on the task.

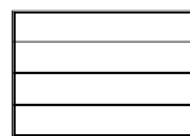
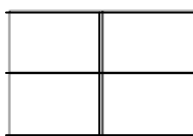
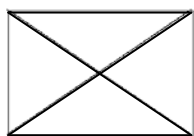
Next example in the series: Split the rectangle into 2 rows and 4 columns. How many small squares did you make?



MCC.2.G.3 calls for students to partition (split) circles and rectangles into 2, 3 or 4 equal shares (regions). Students should be given ample experiences to explore this concept with paper strips and pictorial representations. Students should also work with the vocabulary terms halves, thirds, half of, third of, and fourth (or quarter) of. While students are working on this standard, teachers should help them to make the connection that a —whole is composed of two thirds, or four fourths.

This standard also addresses the idea that equal shares of identical wholes may not have the same shape.

Example: Divide each rectangle into fourths a different way.



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It is vital that students understand different representations of fair shares. Provide a collection of different-size circles and rectangles cut from paper. Ask students to fold some shapes into halves, some into thirds, and some into fourths. They compare the locations of the folds in their shapes as a class and discuss the different representations for the fractional parts. To fold rectangles into thirds, ask students if they have ever seen how letters are folded to be placed in envelopes. Have them fold the paper very carefully to make sure the three parts are the same size. Ask them to discuss why the same process does not work to fold a circle into thirds. Use an analog clock as a model and allow children to draw a line from the center of the clock to the place where the 12, 4 and 8 are on the clock face. This will divide the circle into three equal sections. This clock connection can also be made for discussing halves and fourths and discovering to which numbers (or hours) you would draw the lines to in order to create two or four equal parts/pieces.

Represent and interpret data

MCC.2.MD.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

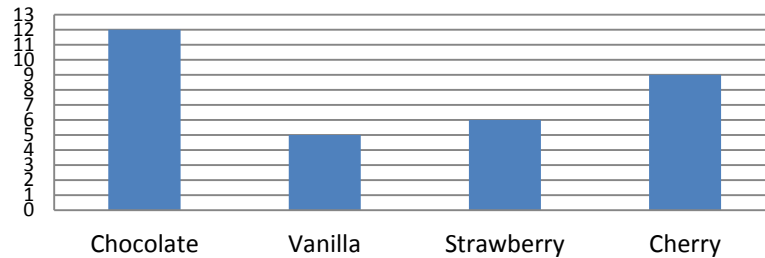
Instructional Strategies

At first students should create real object and picture graphs so each row or bar consists of countable parts. These graphs show items in a category and do not have a numerical scale. For example, a real object graph could show the students' shoes (one shoe per student) lined end to end in horizontal or vertical rows by their color. Students would simply count to find how many shoes are in each row or bar. The graphs should be limited to 2 to 4 rows or bars. Students would then move to making horizontal or vertical bar graphs with two to four categories and a single-unit scale.

Flavor	Number of People
Chocolate	12
Vanilla	5
Strawberry	6
Cherry	9

Students display their data using a picture graph or bar graph using a single unit scale.

Favorite Ice Cream Flavor



Favorite Ice Cream Flavor

Chocolate												
Vanilla												
Strawberry												
Cherry												
	1	2	3	4	5	6	7	8	9	10	11	

As students continue to develop their use of reading and interpreting data it is highly suggested to incorporate these standards into daily routines. It is not merely the making or filling out of the graph but the connections made from the data represented that builds and strengthens mathematical reasoning.

EVIDENCE OF LEARNING

By the conclusion of this unit, students should be able to demonstrate the following competencies:

- Describe plane figures according to their characteristics (edges, corners, angles).
- Describe solid figures according to their characteristics (faces, edges, vertices).
- Describe and understand the relationships (similarities and differences) between solid figures and plane figures.
- Recognize the relationship between geometry and the environment.
- Compare geometric figures to similar objects in everyday life.
- Identify and represent the fractional parts of a whole or of a set (halves, thirds, fourths).

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- Recognize and represent that differently partitioned fractional parts of same-sized rectangles or circles are equal.
- Identify the number of rows and columns in an array and count the same-size squares to find the total.
- Pose questions that will result in data that can be shown on a bar graph or pictographs.
- Use charts, simple tables, and surveys to collect data that can be shown on a bar graph or pictograph.
- Graph data on a bar graph or pictograph and in a simple table.
- Interpret data shown on a bar graph or pictograph.

TASKS

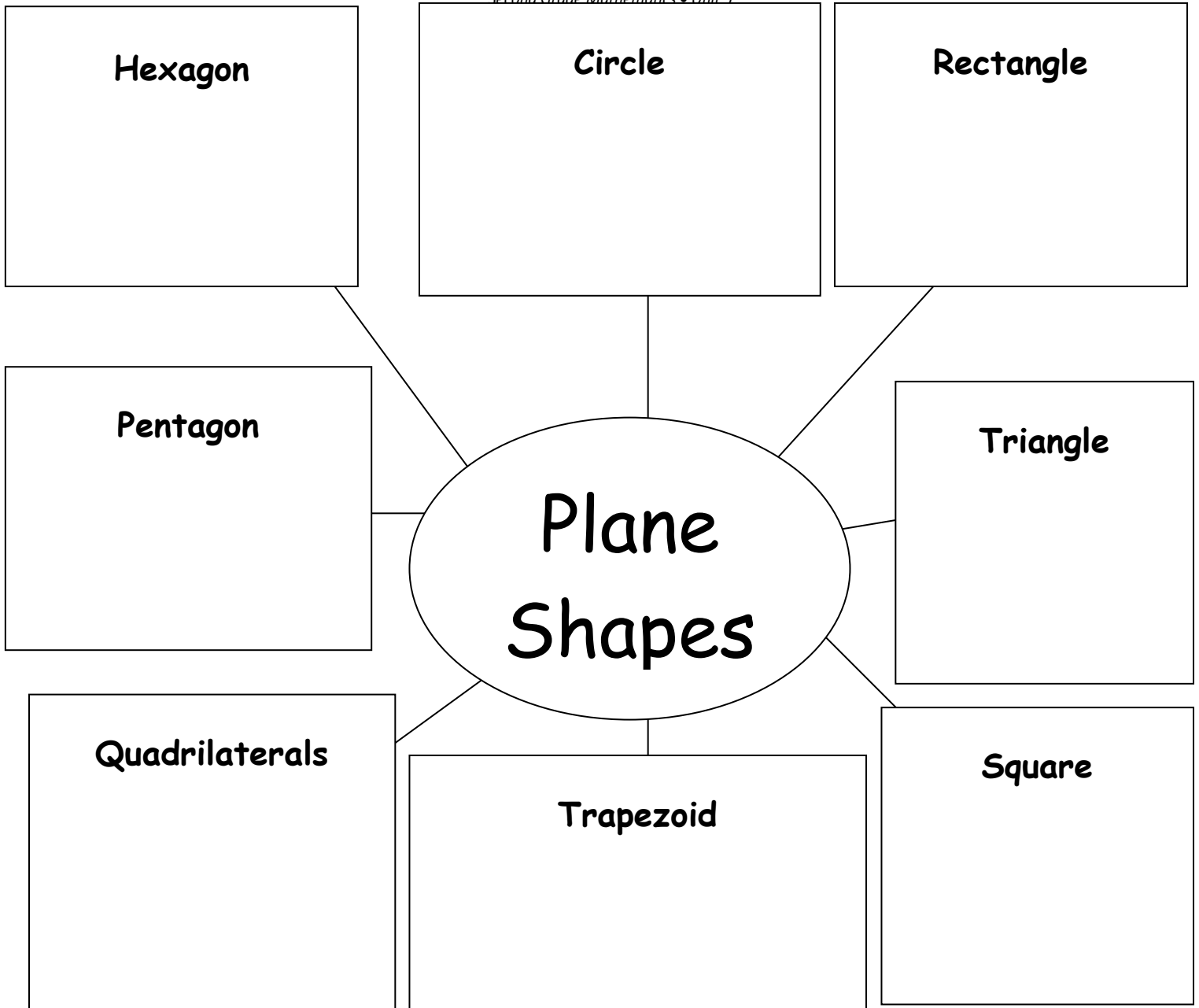
The following tasks represent the level of depth, rigor, and complexity expected of all second grade students. These tasks or a task of similar depth and rigor should be used to demonstrate evidence of learning. It is important that all elements of a task be addressed throughout the learning process so that students understand what is expected of them. While some tasks are identified as a performance task, they also may be used for teaching and learning (learning task). Below is a description of the types of tasks you will see in this unit and their purpose.

Scaffolding Task	Constructing Task	Practice Task	Performance Tasks
Tasks that build up to the constructing task.	Constructing understanding through deep/rich contextualized problem solving tasks	Games/activities	Summative assessment for the unit.

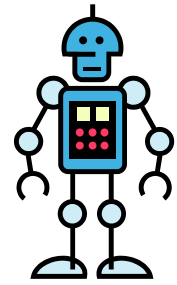
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Task Name	Task Type/ Grouping Strategy	Content Addressed
Shape Robot	Scaffolding Task <i>Large Group/Partners</i>	Describe geometric figures
The Shape of Things	Practice Task <i>Large Group/Partners</i>	Describe geometric figures
Greedy Shapes	Practice Task <i>Large Group/Partners</i>	Describe geometric figures
3-D All Around Me	Practice Task <i>Large Group/Partners</i>	Classify solid figures
Sharing Equally	Constructing Task <i>Partners</i>	Partitioning rectangles Identify, label and compare fractions
Grandma's Quilts	Constructing Task <i>Partners</i>	Partitioning rectangles
Making Rectangles	Practice Task <i>Large Group/Partners</i>	Partitioning rectangles
Zoo Trouble	Constructing Task <i>Partners</i>	Partitioning rectangles
Ribbon Fractions	Constructing Task <i>Large Group/ Small Group</i>	Identify, label and compare fractions
Making A Cake	Constructing Task <i>Large Group/Small Group</i>	Identify, label, and compare fractions
Fraction Cookies	Constructing Task <i>Individual/partner</i>	Label and compare fractions
My Country's Flag	Performance Task <i>Individual</i>	Arrays Describe geometric figures Identify, label, and compare fractions

As this unit has no Culminating Task, you may pair/modify tasks to include all unit standards in combination.



Plane Shape Organizer to be used to determine students' prior knowledge. Have students write or draw everything they know about each shape in the appropriate boxes.



Scaffolding Task: Shape Robot

Approximately 1 Day

Adapted from www.k-5mathteachingresources.com

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson.*****

BACKGROUND KNOWLEDGE

Students should have had prior experiences and/or instruction with plane figures from first grade and kindergarten. Students should be familiar with identifying sides (edges), vertices (corners), angles, circles, triangles, quadrilaterals (squares, rectangles,) and pentagons. Students should have been exposed to these terms since as early as Kindergarten.

Teachers may want to spend some time watching this video to assist in teaching the necessary vocabulary.

<http://gadoe.georgiastandards.org/mathframework.aspx?PageReq=MathName>

ESSENTIAL QUESTIONS

- How do we use the terms: angle, vertices, faces, sides, and edges to describe geometric figures?
- How do we describe geometric figures?

MATERIALS

- *The Shape of Things* by Dayle Ann Dodds or similar text
- Tangrams
- Crayons
- Handout

- Dot paper

GROUPING

Whole group, Individual, Partners

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Gather students together to read *The Shape of Things* by Dayle Ann Dodds, or a similar book about shapes. During the story, ask students questions about the shapes and their observations from the book. Create an anchor chart of vocabulary generated during this discussion for future reference.

Part II

After completing the story, explain to the students that they will be building a robot from shapes and drawing the food that a robot will eat for lunch. Allow the students to build their robot using tangrams or pattern blocks and then draw their robot, either tracing the shapes used or free hand, in the space provided. Ask the students to label each piece of their robot using the shape vocabulary that they know. This will give you an idea of the shapes that the students can identify. This is a great opportunity to integrate writing by having the students create a story about their robot. This writing could include a story about a day in the life of a robot (narrative writing), an advertisement advising the reader of all the uses of your robot (persuasive), or a descriptive paragraph of all the shapes that make up the robot (informational).

FORMATIVE ASSESSMENT QUESTIONS

- What do you notice about the shapes?
- How do we categorize shapes?
- Can you identify the number of vertices?
- Can you identify the number of sides?
- How many of each shape did you use to create your robot?
- Did you use any shapes that you do not know the name of?
- Was it easier to use one shape more than another? Why or why not?
- What did you notice about the (adjacent) sides when you drew two shapes?

DIFFERENTIATION

Extension

- Students who demonstrate an understanding of the shapes presented in this lesson may combine shapes to form a number of different polygons, and name them, based on their understanding of shapes, or by researching the shapes.

Intervention

- Students who have difficulty drawing the shape can choose from pre-cut shapes or build the shapes with tangram pieces and trace the shape.

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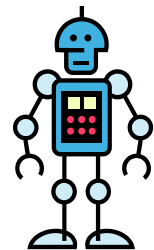
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- Use dot paper to assist students in drawing various shapes such as triangles, quadrilaterals, pentagons, hexagons, etc.
- Use a geoboard to assist students in creating various shapes.

Name: _____

SHAPE ROBOT is READY FOR LUNCH

Draw/create your Shape Robot here.



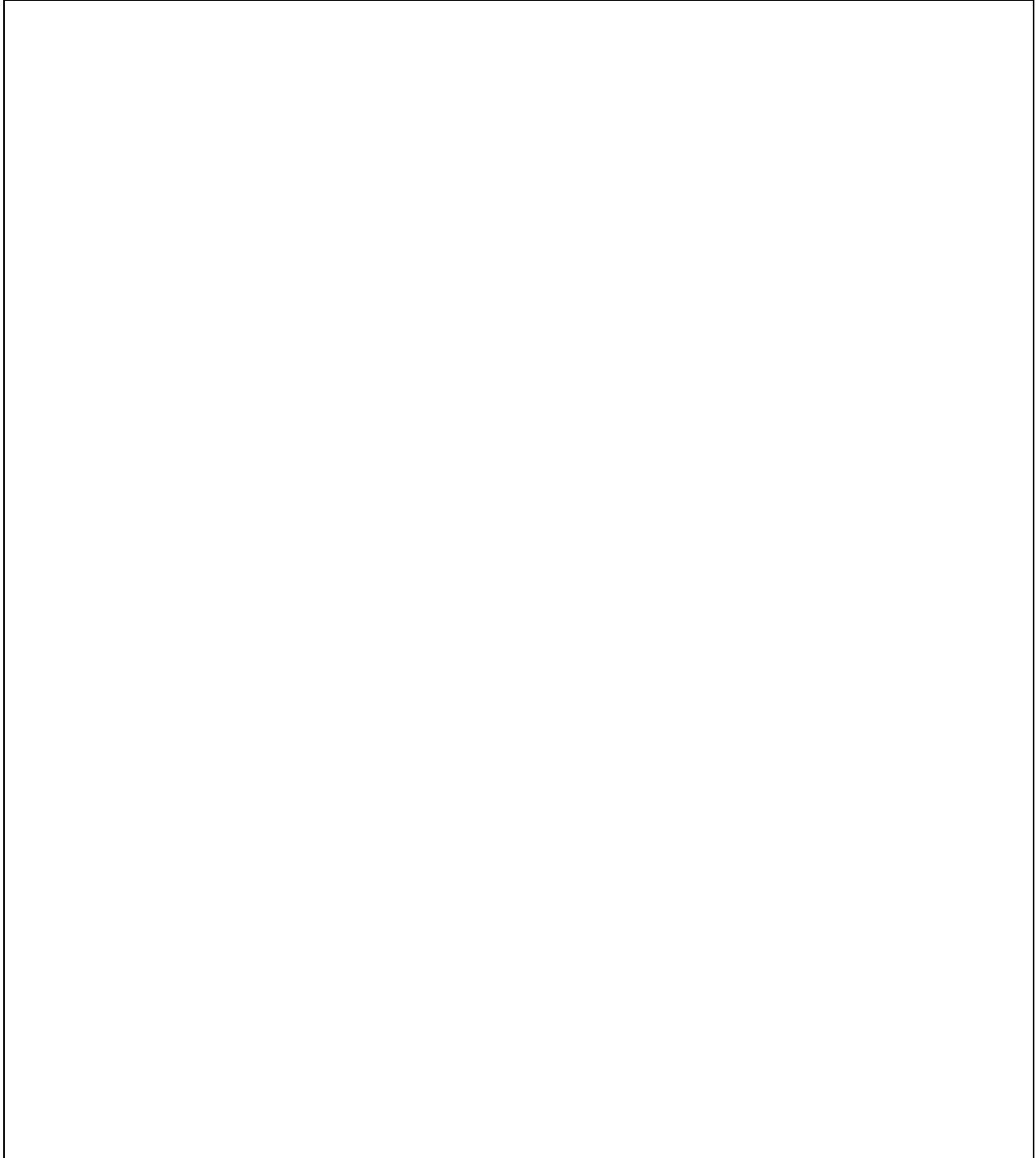
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Practice Task: The Shape of Things

Approximately 1 Day

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson.*****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-2, page 193)

“Children need experiences with a rich variety of both two- and three-dimensional shapes. It is useful for students to be able to identify common shapes, notice likenesses and difference among shapes, become aware of the properties that different shapes have, and eventually use these properties to further define and understand their geometric world. As students find out more about shapes over time, they can begin to appreciate how definitions of special shapes come to be.”

ESSENTIAL QUESTIONS

- How do we use the terms: angle, vertices, faces, sides, and edges to describe geometric figures?
- How do we describe geometric figures?

MATERIALS

- *When a Line Bends, a Shape Begins* by Rhonda G. Greene
- “The Shape of Things” Student recording form.

GROUPING

Individual, partners

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Gather students together to read *When a Line Bends, a Shape Begins* by Rhonda G. Greene. During the story, question the students about the attributes of the shapes mentioned in the book. Students should have demonstrated prior knowledge of shapes in the previous task. This questioning will provide you with knowledge of the students' understanding. After reading the story, ask students to identify the shapes around the classroom. Reinforce the correct terminology of words such as: triangles, quadrilaterals, pentagons, hexagons, and cubes. Don't use this conversation to "teach" these terms, but rather to have students explain what they are noticing around them. If the students produce misconceptions, use that opportunity to better clarify.

Part II

After the class discussion of shapes around the room, present the students with "The Shape of Things" Student Recording Form. Create a connection between the conversation that you had about the classroom and the playground shown on the Student Recording Form. Take this opportunity to go over the expectations of a clear explanation and the illustration of the shapes.

Student Recording Form Directions:

Examine the scene of the playground. There are many different shapes that make up the toys and play-equipment. Name, draw, and describe clearly all shapes you can see in the playground picture.

Part III

Take class outside to investigate and record all the shapes they see on the playground(s) at your school. This could easily be extended into a homework assignment by having students describe the shapes of any play equipment near their home.

FORMATIVE ASSESSMENT QUESTIONS

- What shapes do you see around the room?
- How do you know it is that shape?
- What attributes or characteristics does that shape have?
- How are these shapes similar?
- How are these shapes different?
- Are there any shapes on your playground that you can see around the room?

DIFFERENTIATION

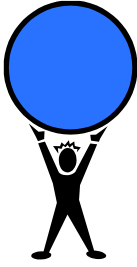
Extension

- Students who demonstrate an understanding of the shapes presented in this lesson may draw a picture using the shapes in this lesson and include the heptagon (7-sided polygon), octagon (8-sided polygon), nonagon (9-sided polygon), and decagon (10-sided polygon).

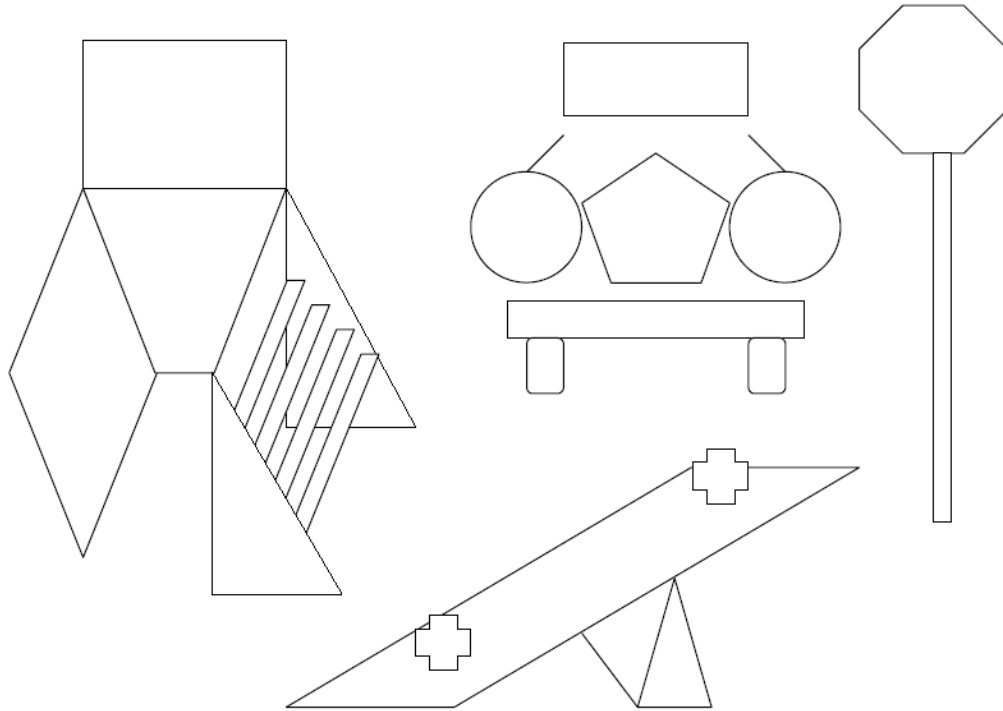
Intervention

- Assist students in creating a chart labeling the polygons in various orientations. This could be created by gluing on pre-cut shapes, or by having students draw and cut out shapes. This student-created chart becomes an anchor chart for whole class reference after being created as an intervention strategy.

Name: _____



The Shape of Things

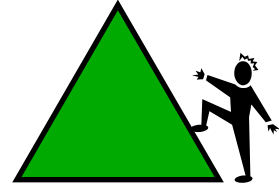


Examine the scene of the playground above. There are a lot of different shapes that make up the toys and play-equipment. Name, draw and describe clearly all shapes you can see in the playground picture.

(Information adapted from the Noyce Foundation, Problems of the Month)

Practice Task: Greedy Shapes

Approximately 2 Days



STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson.*****

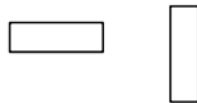
BACKGROUND KNOWLEDGE

Students should have had prior experiences and/or instruction with plane figures from first grade and kindergarten. Students should be familiar with identifying sides (edges), vertices (corners), angles, circles, triangles, quadrilaterals (squares, rectangles,) and pentagons. Students should have been exposed to these terms since as early as Kindergarten.

Teachers may want to spend some time watching this video to assist in teaching the necessary vocabulary.

<http://gadoe.georgiastandards.org/mathframework.aspx?PageReq=MathName>

Some students may think that a shape is changed by its orientation. They may see a rectangle with the longer side as the base, but claim that the same rectangle with the shorter side as the base is a different shape. This is why it is so important to have young students handle shapes and physically feel that the shape does not change regardless of the orientation, as illustrated below.



This task requires students to classify shapes. “As young students work at classification of shapes, be prepared for some of them to notice features that you do not consider to be “real” geometric attributes, such as “curvy” or “looks like a rocket.” Children at this level will also attribute to shapes ideas that are not part of the shape, such as “points up” or “has a side that is

the same as the edge of the board. **In any sorting activity, the students should decide how to sort, not the teacher.** This allows the students to do the activity using ideas they own and understand. By listening to the kinds of attributes that they use in their sorting, you will be able to tell what properties they know and use and how they think about their shapes.”

(Information quoted from Van de Walle and Lovin, *Teaching Student-Centered Mathematics: Grades 3-5*, pages 212-213)

ESSENTIAL QUESTIONS

- How do we use the terms: angle, vertices, faces, sides, and edges to describe geometric figures?
- How do we describe geometric figures?

MATERIALS

- *The Greedy Triangle* by Marilyn Burns or similar book
- Geoboards
- Rubber bands
- (optional) Virtual Manipulative Geoboard:
<http://nlvm.usu.edu/en/nav/vlibrary.html>
- Describing Plane Shapes Class Chart
- Describing Plane Shapes Student Chart
- “What’s my rule” task sheet

GROUPING

Large Group, Partners

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Read students the book, *The Greedy Triangle* by Marilyn Burns. Before reading, discuss the terms side, angle, and vertex. Draw a triangle on the board and have students determine the number of sides and vertices. As you read the book, have the students predict the shape which the greedy triangle will become next.

Ask questions as you read, such as:

- How many sides did the shape have to begin with? (3) How did you figure that out? (Counted them, or recognized the shape as a triangle and I know triangles have three sides)
- How many vertices did the shape have to begin with? How are these different from sides?
- How many sides did the shape have when it became a (quadrilateral, a pentagon, etc.)?

Part II

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Introduce the term quadrilateral to the students. This word is an important term for the students to use and understand. Use a word web to deconstruct the meaning of the word polygon. Break apart the word using prior knowledge of shapes.

Tell students that they will now use geo-boards to recreate the story of *The Greedy Triangle*. Each student should have his or her own geoboard. However, students can sit in partner groups as they create shapes. This will encourage dialogue about the geometry and allow students to comment on each other's work.

Variation

Toothpicks or pretzels sticks could be used to create the shape instead of using the geoboard.

Begin reading the book again, however, this time stop at each shape and allow the students to create that shape on their geo-boards using rubber bands. (Students who can create the shapes quickly may explore creating various sizes and irregular examples of the shapes)

While students are working, ask questions like:

- How many sides does your shape have now?
- What shape have you made? How do you know it is that shape?
- What characteristics of a shape help us figure out/determine the name of the shape?
- How did your shape change?
- What are differences between a (triangle) and a (quadrilateral)?
- Can you make that shape smaller? Larger?
- What would happen if you made that edge longer? Would it still be a (triangle?)

Once all students have created the shape, allow a partner group to come to the board. Have one student demonstrate how to make the shape using the overhead or possibly a virtual geoboard: <http://nlvm.usu.edu/en/nav/vlibrary.html>. Discuss with students the meaning of the word “regular polygon”; that the shape is a regular polygon if all the sides are equal. However, show the students that you can make the figure an irregular polygon by grasping one or more of the vertices and extending the sides. Ask the students, “What do we call this three sided shape that does not have all sides the same length? (*a triangle*) Why do we still call it a triangle? (*because it still has three sides*).” Make sure that students understand and can explain that making sides longer or shorter does not change the name of the shape (*triangle, quadrilateral, pentagon, etc.*) because the number of sides and vertices is still the same. It is very important for students to understand and articulate that knowing the number of sides and vertices of a shape is how we determine/decide the name of the shape. Allow the other student in the partner group to record the number of sides and vertices by the shape name on the class chart. Allow all the students in the class to record the number of edges, vertices, and several of their favorite examples of each shape on their student chart. Continue with the book, stopping at each shape and repeating the process as above.

Note

When students are creating quadrilaterals, encourage them to create various kinds of quadrilaterals (parallelograms, squares, rectangles, and trapezoids).

Part III

Organize students into small groups. Distribute the sets of cut-out figures, one set per group and the recording sheet. “What’s My Rule?” task sheet cards should be distributed. Then review the rules of the game. One participant in each group is the sorter. The sorter writes down a "secret rule" to classify the set of figures into two groups and uses that rule to slowly sort the pieces as the other players observe. At any point in the game, the players can call "stop" and guess the rule. After the correct rule identification, the player who figured out the rule becomes the sorter. The correct identification from the sorter is worth five points. A correct answer, but not the written one, is worth one point. As a variation, each incorrect guess results in a two-point penalty. The winner is the first one to accumulate ten points.

You may also use this set of shapes, which provides more variety, thus expanding the possible conversations about shapes and their attributes-

BLM 20-26: http://www.ablongman.com/vandewalleseries/volume_1.html

As students are sorting the cards and making decisions about the sort, the teacher should be listening for student’s descriptions of the shapes.

FORMATIVE ASSESSMENT QUESTIONS

- What are differences between a (triangle) and a (quadrilateral)?
- How do we determine, or decide, the name of a shape?
- Can you make that shape smaller? Larger?
- What would happen if you made that edge longer? Would it still be the same shape?

DIFFERENTIATION

Extension

- Students who demonstrate an understanding of the shapes presented in this lesson may be introduced to heptagons (7 sides), octagons (8 sides), nonagons (9 sides), decagons (10 sides), and dodecagons (12 sides). Students can create these shapes using their geobords and add information regarding these shapes to their charts.
- Choose a polygon and create a picture using the shape. Describe it with mathematical words and then create a story about your picture.

Intervention

- Some students may have difficulty using the geobards with rubber bands. These students can use dot paper instead. They can draw lines between the dots to create the various shapes.
- Use dot paper to model various shapes such as triangles, quadrilaterals, pentagons, hexagons, etc.

Name _____ Date _____

Describing Plane Shapes



MATHEMATICS • GRADE 2 • UNIT 5: Understanding Plane and Solid Figures

Georgia Department of Education

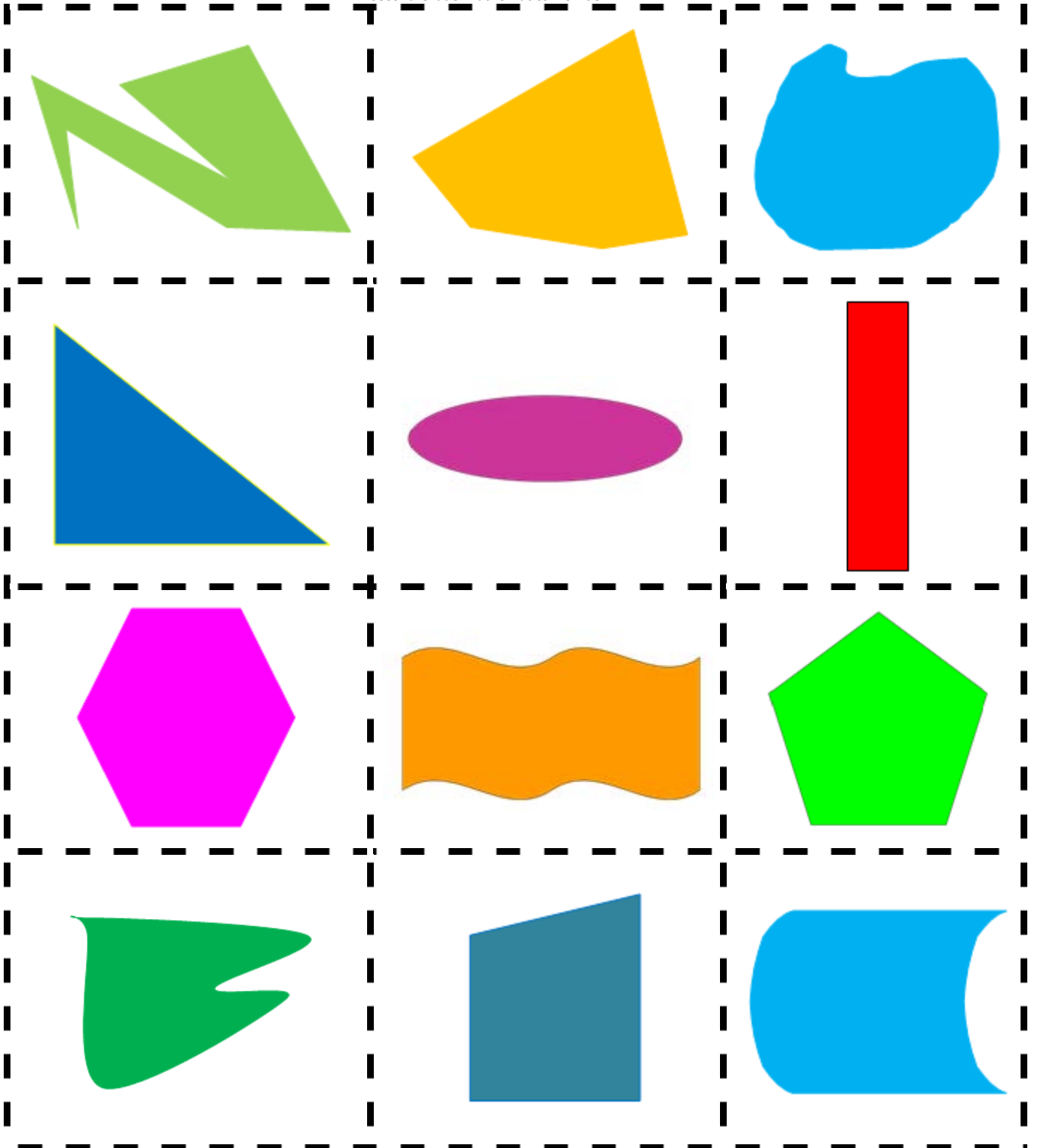
Dr. John D. Barge, State School Superintendent

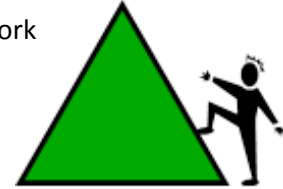
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Shape Name	Model of the Shape	Number of Sides	Number of Vertices	Examples
Triangle				
Quadrilateral				
Pentagon				
Hexagon				

“What’s My Rule?” Cards for Greedy Shapes





Name: _____

WHAT'S MY RULE?

Part III Recording Sheet

GROUP MEMBERS	SCORE

Sorter	Rule
1. _____	_____ _____ _____ _____
2. _____	_____ _____ _____ _____
3. _____	_____ _____ _____ _____
4. _____	_____ _____ _____ _____



Practice Task: 3-D All Around Me
Approximately 2 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

This task references the attributes of two-dimensional shapes such as triangle, quadrilaterals, pentagons, and hexagons as well as a three-dimensional shape, cubes. This task addresses the attributes of the attributes of cubes, as well as other three-dimensional shapes. The solid figures other than cubes, are not covered within the 2nd grade standards, however three dimensional shapes have been focused on since Kindergarten (specifically cubes, right rectangular prisms, right circular cones, right circular cylinders in the First Grade) as well as their parts (e.g. number of sides and vertices/"corners") and other attributes.

Information below quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades 3-5, pages 214:

“Most of the activities in “Shape Sorts” can and should be done with three-dimensional shapes as well. The difficulty is finding or making a collection that has sufficient variability. Geoblocks are a large set of wooden blocks available through various distributors. The variety is good, but no blocks have curved surfaces. Check catalogs for other collections. Consider combining several different sets to get variation.”

ESSENTIAL QUESTIONS

- Where can we find geometric figures in the world around us?
- How do we use the terms; angle, vertices, faces, sides, and edges to describe geometric figures?

MATERIALS

- *Captain Invincible and the Space Shapes* by Stuart J. Murphy or similar book containing geometric solid figures
- 3-D Shape Characteristic Chart
- Various 3-D figures for students to explore (spheres, prisms, cylinders, cones, and pyramids)
- NCTM Geometric Solids Manipulative:
<http://illuminations.nctm.org/ActivityDetail.aspx?ID=70>
- Paper for riddle
- Pencils

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Read aloud *Captain Invincible and the Space Shapes* by Stuart J. Murphy, or similar book, with students. As you read, review each of the shapes with the students. Have students volunteer to share the definition of a face, vertex, and edge. Also, demonstrate for students how to find each of these on the 3-D shapes.

After reading, pass out a variety of 3-D shapes to students. Allow students to explore the shapes and locate the faces, vertices, and edges on each solid figure. Encourage students to use their sense of touch as they identify these characteristics. **Although this task exposes students to a variety of solid shapes in order to help them understand attributes and characteristics of 3-D shapes covered in previous grades, 2nd grade students are only asked to “master” the identification of and description of cubes, specifically the number of equal faces.**

Part II

Give each student the 3-D Shape Characteristic Chart. Have the students work with a partner to explore the shapes and complete the chart. Students may benefit from using the NCTM web resource: <http://illuminations.nctm.org/ActivityDetail.aspx?ID=70> to help them count the faces of their shapes. When using this website, students can color faces which they have already counted. Alternatively, students may put a sticker on each face of the geometric solid as they count. As students are completing the chart, ask questions such as:

- What shape are you holding?

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- How many (faces) does it have?
- What strategies are you using to count the number of (faces)?
- Are there any shapes with similarities?
- What are some of the differences with (rectangular prisms) and (cubes)?
- What are some similarities between cones and pyramids or between cylinders and prisms?
- Where might you find this shape in the real world?

Part III

After students have filled in their charts together, allow them to come up with 3-D riddles about their shapes. Their riddles may look something like this, but do not have to rhyme:

Some of my faces are squares.
I can be stacked, but not rolled.
None of my faces are circles.
I have lots of right angles.

Answer: Rectangular Prism

Allow students to read the riddles they made with their partners in front of the class so the class can guess their 3-D shape.

FORMATIVE ASSESSMENT QUESTIONS

Can you write at least two correct clues for your riddles?

Can you identify each other's 3-D shape based on the clues provided?

Can you find, recognize, and/or name the 2-D shapes found in the 3-D shapes discussed?

DIFFERENTIATION

Extension

- Have students cut out pictures from magazines that are examples of cones, cylinders, prisms, and pyramids. Students can paste their pictures on the 3-D Shape Detective handout. Students should compare pyramids with cones and prisms with cylinders.

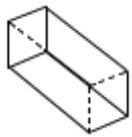
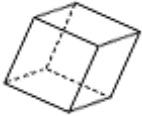


Intervention

- Teacher can use student-created riddles (from students showing mastery) to create riddle cards in a word document, and paste them onto index cards. Students requiring intervention can match the cards to the correct shape.

Name _____ Date _____



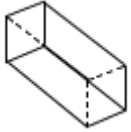
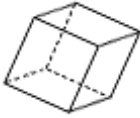

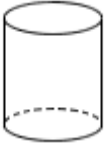

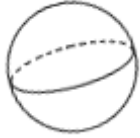
3-D All Around Me!

	3-D Shape picture	3-D Shape name	Total number of Faces	Identify the number of equal faces	Shape of the face
1.					
2.					
3.					
4.					

Name _____ Date _____

3-D Shape Detective



	3-D Shape picture	3-D Shape name	Examples of these shapes found in the real world
1.			
2.			
3.			
4.			
5.			
6.			



Constructing Task: Sharing Equally

Approximately 1 Day

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

While this task is supporting a geometry standard, it also builds fraction understanding through manipulation of shape. It is important for teachers to understand the connections inherent in the task.

(Information quoted from Van de Walle and Lovin, *Teaching Student-Centered Mathematics: Grades K-3*, partial excerpts, pages 252-258)

“The first goal in the development of fractions should be to help children construct the idea of *fractional parts of the whole*- the parts that result when the whole or unit has been partitioned into *equal-sized portions* or *fair shares*. Children seem to understand the idea of separating quantity into two or more parts to be shared fairly among friends. They eventually make connections between the idea of fair shares and fractional parts. Sharing tasks are, therefore, good places to begin the development of fractions.

Students initially perform sharing tasks (division) by distributing items one at a time. When this process leaves leftover pieces, it is much easier to think of sharing them fairly if the items can be subdivided. Typical “regions” to share are brownies (rectangles), sandwiches, pizzas, crackers, cake, candy bars and so on.

Problem difficulty is determined by the relationship between the number of things to be shared and the number of sharers. Because children’s initial strategies for sharing involving halving, a good place to begin is with two, four, or even eight sharers, many children will deal out two to each child and then halve each of the remaining brownies.” ...

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“It is a mistake to think that fractional parts such as sixths or eighths are conceptually more difficult than halves or thirds. Note that in the discussion of sharing, halves, fourths, and eighths were explored prior to thirds, sixths, and fifths. This is done because successive halving of parts is a natural process for young children. The number of parts does not correlate with conceptual difficulty. Most state curricula would lead you to believe differently. In fact, if we want children to generalize the concept of fractional parts and connect to this generalization the numeric names of thirds, fourths, fifths, and so on, they must be exposed to more than just halves and thirds in the earliest stages of exploring fractions.”

ESSENTIAL QUESTIONS

- How many different ways can we divide a rectangle into two equal parts?
- How are square and rectangles related?

MATERIALS

- Math Journal
- “Sharing Equally” Student recording form
- *Give Me Half*, by Stewart Murphy, or similar text

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Begin the lesson by asking students this question, “Have you ever had to share something before?”

Hold up an even set number of items, and ask the students for suggestions on how you could share these items with one other person. Have students record their answer in their math journals including pictures and words. This will allow you to begin to see how students see “sharing”. This will produce a variety of results, possibly including students may describe handing objects out one at a time, some students will match all the items up into pairs and then take half of each pair, and some students may even describe cutting each item in half and then giving each person a series of halves. Have students share their explanations and illustrations with the class.

Part II

Read **Give Me Half** by Stewart Murphy or some other similar book that describes sharing things equally between two people. As you read, stop to discuss the ways the children are sharing the items in the story.

Present students with the situation: Jessica and Katie wanted to share a cake equally. The cake was in the shape of a rectangle. Katie said, “There are two ways to cut the cake to make equal size pieces. Either cut from one vertex to the opposite vertex or cut from the midpoint

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of one side to midpoint of the opposite side. Those are the only two ways to make one straight cut and have two equal size pieces.” Jessica said, “No, there are other ways to make one cut and share the cake equally besides the ways that you named.” Who is right?

Students should explain their thinking on their student recording form using pictures and words.

Part III

Present students with a similar situation as above but this time they need to share the cake between 4 friends. Ask questions such as, “What will happen to the size of the pieces? Would you rather share with 4 friends or 2 friends? Why? How many different ways could they cut the cake and still have four equal pieces? What do you think we should call each of these four pieces? Why wouldn’t the name thirds or fifths or sixths make sense for these pieces? What would those pieces look like? Would they be bigger or smaller than fourths? Bigger or smaller than halves? How do you know? How many pieces (halves or fourths) do we need in order to talk about the whole cake?”

FORMATIVE ASSESSMENT QUESTIONS

- When sharing, how do you make sure all parts are equal?
- Do equal parts have to be the same shape? Why?
- Is there more than one way to cut something in half?
- Is there more than one way to cut something into fourths?

DIFFERENTIATION

Extension

- Students can attempt to divide other polygons into equal halves and fourths.

Intervention

- Students who are having difficulty can use pattern blocks, fraction strips, index cards, or construction paper shapes which they can compare and/or cut into equal parts.

Name: _____

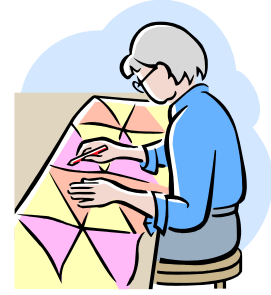


Sharing Equally

Jessica and Katie wanted to share a cake equally. The cake was in the shape of a rectangle. Katie said, "There are two ways to cut the cake to make equal size pieces. Either cut from one vertex to the opposite vertex or cut from the midpoint of one side to midpoint of the opposite side. Those are the only two ways to make one straight cut and have two equal size pieces." Jessica said, "No, there are other ways to make one cut and share the cake equally besides the ways that you named." Who is right?

Prove your findings. Using pictures and words, explain your thinking and who you think is correct.

(Information adapted from the Noyce Foundation, Problems of the Month)



Constructing Task: Grandmas' Quilts

Approximately 3 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, *Teaching Student-Centered Mathematics: Grades K-3*, read pages 234-238, 252. Partial excerpt below.)

“One of the purposes of early comparison activities with areas is to help students distinguish between size (or area) and shape, length, and other dimensions. A long, skinny rectangle may have less area than a triangle with shorter sides. Piagetian experiments indicate that many 8-9 year olds do not understand that rearranging areas into different shapes does not affect the amount of area. Direct comparison of two areas is nearly always impossible except when the shapes involved have some common dimension or property. For example, two rectangles with the same width can be compared directly, as can any two circles. Comparison of these special shapes, however, fails to deal with the attribute of area. Instead, activities in which one area is rearranged are suggested. Cutting a shape into two parts and reassembling it in a different shape can show that the before and after shapes have the same areas, even though they are different shapes. This idea is not at all obvious to children in the K-2 grade range.”

Suggested formative task: Activity 8.8- Two-Piece Shapes, page 234, *Teaching Student-Centered Mathematics, K-3, VandeWalle and Lovin.*

ESSENTIAL QUESTIONS

- What strategies can I use to count the total number of squares in a rectangle?
- How are arrays and repeated addition related?

MATERIALS

- *A Remainder of One* by Elinor J. Pinczes (Houghton Mifflin Co., 1995) or similar book
- *Each Orange has 8 slices: A Counting Book* by P. Giganti
- Array recording sheet (per group)
- Half sheet of chart paper (per group)
- Various manipulatives (connecting cubes, counters, tiles, etc.)
- Construction paper
- Colored pencils, crayons, or markers (optional)

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Begin the lesson explaining to the students they will be creating a quilt. This task will involve the students partitioning rectangles, which will allow that students to develop a conceptual understanding of arrays. You need not focus the lesson around explicit use of this term or the repeated addition to which it leads, as discussion of these ideas will arise naturally through completion of the task and the student discussion at the close of the task. Share pictures of arrays that can be seen in the real world and discuss the difference between a row and a column, and of the role orientation plays in those names. Provide some real world examples- seats in the movie theatre, ice cube tray, egg carton, candy boxes, floor tiles, etc. Read aloud the book, *Each Orange has 8 slices: A Counting Book* by P. Giganti or a similar book. Throughout the book, discuss the number groupings and model for students the rectangles that can be created throughout the story using the illustrations. Before counting the total, have students make predictions about the total number of wheels or balloons.

Ask students if they have ever seen a quilt, or know what one is. Show a photograph of a quilt with an array structure.

Explain to students that quilts are made of fabric with squares that are stitched together. Today they will help a special Grandma decide the number of fabric pieces she needs for the quilts she will make for each of her grandchildren. Each of the squares tells a story or has a message that Grandma's wants to share. Her grandchildren are Zoe, Zachery, Cierra, and Quinton. Grandma wants to begin by creating a quilt for herself by giving each one of her grandchildren a section. Using a sheet of construction paper, have students use folding to partition the rectangular paper to leave a portion for each of her grandchildren. At this point, you may allow students to decorate each portion. Allow students to share their quilt.

Part II

Students will create a quilt for each of the grandchildren. Zoe’s quilt will have 4 rows and 5 columns. Zachery’s quilt will have 3 rows and 4 columns. Cierra’s quilt will have 2 rows and 4 columns. Quinton’s quilt will have 4 rows and 4 columns. Allow the students to work with a partner to fold a piece of construction that resembles the quilt Grandma would create when she has sewn together the pieces. Allow students to use manipulatives or paper folding to create their quilts. Then, encourage the students to draw their quilts for each grandchild on chart paper and record the strategies they used to find the total number of squares on the recording sheet. While students are working, circulate the room and ask questions like:

- What manipulatives are you using to help solve this problem?
- How can you tell the difference between rows and columns?
- What strategies are you using to help figure out the total number of squares?
- How are you communicating the results you have found?
- What patterns are you noticing from your strategies?
- How does addition help you decide how many pieces in all, or how many rows or columns to make?
- Do any of the grandchildren have the same number of pieces?
- How did working with a partner help you?

Part III

After students have completed the task, choose several students to share their discoveries and observations with the class. The teacher or students can record the arrays and strategies the students have found on a larger version of the array recording sheet, along with observations about arrays, creating an anchor chart about arrays and repeated addition.

FORMATIVE ASSESSMENT QUESTIONS

- How can you tell the difference between rows and columns? Why or when does it matter?
- How did working with a partner help you?
- What do you notice about arrays? How is this arrangement helpful?
- Where else can you find arrays? (packaging, tiling) Why might they appear in these places?

DIFFERENTIATION

Extension

If students complete the assigned task, ask students to identify the different dimensions of the quilt (the rows and columns) if Grandma wanted to create a quilt with 36 squares.

Intervention

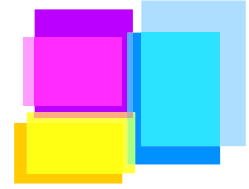
Students may build a quilt using color tiles, or construction paper squares in order to visualize the arrays.

Group Members: _____ **Date:** _____

Grandma's Quilts Recording Sheet



	Dimensions	Array (record with dots or X's)	Strategies
Zoe	4 rows and 5 columns		
Zachery	3 rows and 4 columns		
Cierra	2 rows and 4 columns		
Quinton	4 rows and 4 columns		



Practice task: Making Rectangles

Approximately 1 Day

Adapted from www.k-5mathteachingresources.com

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, *Teaching Student-Centered Mathematics: Grades K-3*, read pages 234-238, and 252-8. Partial excerpt below.)

“It is important to understand that filling regions with units and counting does little to help students develop multiplicative formulas. Even when rectangles are filled with a grid of squares, students are more likely to count the squares than to relate the number of squares to the dimension of the rectangles.”

Suggested formative task: Activity 8.12- Rectangle Compare- Square Units, page 237, *Teaching Student-Centered Mathematics, K-3, VandeWalle and Lovin.*

“The goal is not necessarily to develop an area formula but to apply students’ developing concepts of multiplication to the area of rectangles. Not all students will use a multiplicative approach. Many will draw copies of rectangles and attempt to draw in all the squares. However, it is likely that some will use their rulers to determine the number of squares that will fit along each side and, from that, use multiplication to determine the total area. By having students share their strategies, more students can be exposed to the use of multiplication.”

ESSENTIAL QUESTIONS

- What strategies can I use to count the total number of squares in a rectangle?
- How are arrays and repeated addition related?

MATERIALS

- Square tiles
- “Making Rectangles” Student recording form

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Working alongside a partner, students will build as many rectangles as possible using 12 square tiles. They should record their answers to the questions on the student recording form. Students create a drawing of each rectangle as well as record the number of columns and rows. Encourage discussion of rotation and dialogue about the number of rows and columns.

Student Directions for the Task:

1. Collect 12 square pattern blocks or colored tiles.
2. How many different rectangles can you make using your 12 squares?
3. Record each rectangle that you make.
4. How many rows did you make in each rectangle? How many squares were in each row?

After they have completed the task, bring students together for a class discussion. Ask the students to think about how they could use numbers to represent or describe their pictures/rectangles. Encourage them to talk about how many rows of a certain amount and how many columns of a certain amount they are seeing. Lead a discussion with a line of questions such as, “How many squares are used to create each rectangle? (12) How do you know? (by counting or that’s how many we used for each one). If we used the same number of tiles for each rectangle why are there so many different looking rectangles? Why don’t they all look the same? (we arranged the tiles in different numbers of rows or columns). If we wanted to write an addition sentence for each rectangle what would that look like? For instance, would $3+2+4$ make sense for the 3 by 4 rectangle? Why not? (that is not what is in each row or column and those numbers don’t add up/total 12). What do you notice about these addition sentences?

FORMATIVE ASSESSMENT QUESTIONS

- What strategies did you use to discover the rectangles?
- What is the difference between a row and a column?
- Did you notice any patterns?
- How did you organize your thinking?

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- How do you think the number of square tiles affects the number of different rectangles you can create? What would happen if we used a different number of tiles? How about an odd number?

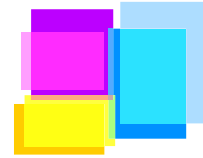
DIFFERENTIATION

Extension

- Students can receive 24 or 36 squares, or an amount of their choice.

Intervention

- Start with a small number of tiles (4), and allow the student to create arrays for the smaller numbers, building understanding to a larger number of tiles. Allow for student exploration, and question along the way to determine whether student truly has an understanding of the concept of an array and what it represents (repeated addition).



Name: _____

Making Rectangles

1. Collect 12 square pattern blocks or colored tiles.
2. How many different rectangles can you make using your 12 squares?
3. Record each rectangle that you make.
4. How many rows did you make in each rectangle? How many squares were in each row?

RECTANGLE	How many rows does your rectangle have?	How many columns does your rectangle have?



Constructing Task: Zoo Trouble

Approximately 2 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, page 84)

“Have students build arrays using square tiles or blocks or by having them draw arrays on centimeter grid paper. Present the exercises by specifying how many squares are to be in the array. You can then specify the number of rows that should be made (partition) or the length of each row (measurement).”

ESSENTIAL QUESTIONS

- What strategies can I use to count the total number of squares in a rectangle?
- How are arrays and repeated addition related?

MATERIALS

- Colored pencils, markers
- Square tiles
- Crayons, colored pencils, markers (optional)

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

MATHEMATICS • GRADE 2 • UNIT 5: Understanding Plane and Solid Figures

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Dr. John D. Barge, State School Superintendent

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Students will be presented with the problem: Annette has a summer job working at the local zoo. One part of her job is to design a new exhibit for the animals. There are a few guidelines that she must follow:

- The shape of the exhibit must be a rectangle
- Within the exhibit she needs to create a pen for each animal
- Each pen must be the same size
- Each pen must have a wall on all four sides

Annette wants to fit the most animals possible in her exhibit. How many equal sized pens can she fit within a rectangle?

Students will be creating a model of the exhibit. The goal of this activity is for them to explore partitioning a rectangle into rows and columns.

FORMATIVE ASSESSMENT QUESTIONS

- How much space do you think each pen should have?
- What patterns are you noticing between the number of columns and rows?

DIFFERENTIATION

Extension

Students can be given limitations on the perimeter of the exhibit.

Intervention

Allow students to use grid paper to create their exhibit.

Name: _____

Zoo Trouble



Annette has a summer job working at the local zoo. One part of her job is to design a new exhibit for the animals. There are a few guidelines that she must follow:

- The shape of the exhibit must be a rectangle
- Within the exhibit she needs to create a pen for each animal
- Each pen must be the same size
- Each pen must have a wall on all four sides

Annette wants to fit the most animals possible in her exhibit. How many equal sized pens can she fit within a rectangle? Show your math thinking using words, numbers, and drawings.

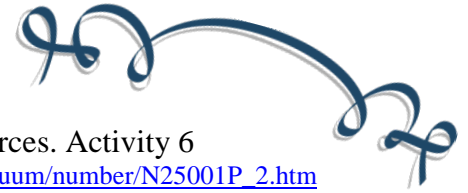
(Information adapted from the Noyce Foundation, Problems of the Month)

Constructing Task: Ribbon Fractions

Approximately 2 Days

This lesson is adapted from State of Victoria, Australia :Teaching Resources. Activity 6

http://www.education.vic.gov.au/studentlearning/teachingresources/maths/mathscontinuum/number/N25001P_2.htm



STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, page 253-254)

“During the discussions of students’ solutions (and discussions are essential!) is a good time to introduce the vocabulary of fractional parts. This can be quite casual and, at least for younger children, should not involve fraction symbolism. When a brownie or other region has been broken into equal shares, simply say, “We call these *fourths*. The whole is cut into four parts. All of the parts are the same size- fourths.

Children need to be aware of two aspects or components of fractional parts: (1) the number of parts and (2) the equality of the parts (in size, not necessarily in shape). Emphasize that the number of equal parts or fair shares that make up a whole determines the name of the fractional

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parts or shares. They will be familiar with halves but should quickly learn to describe thirds, fourths, fifths, and so on.”

ESSENTIAL QUESTIONS

- Why is it important to identify, label, and compare fractions (halves, thirds, fourths) as representations of equal parts of a whole or of a set?
- If you have two fractions, how do you know which is greater or has more value?

MATERIALS

- For the teacher
 - Several pieces of ribbon cut into 1 yard pieces (these pieces will be used for student demonstration, 3-5 pieces may be necessary)
- For each group
 - 1 yard of ribbon (string or adding machine tape would also work)
 - String
 - paper clips
 - ruler
 - scissors
 - unifix cubes or snapping cubes
- For Differentiation groups
 - Adding machine tape
 - Unifix cubes

GROUPING

Large group, Small groups of 3 or 4

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Show the class a length of ribbon that is one yard long and ask how to divide it into two equal pieces. You may wish to have volunteers come up and demonstrate their strategies. Some might suggest folding the ribbon in half so the two parts match and then cutting on the fold. Ask, “how do you know this will work?” Make sure to have them explain their strategies, even if they are wrong! Make sure to demonstrate **ALL** strategies so those that are incorrect can see why what they are thinking does not work, (this is why the teacher will need so many pieces). Allow them an opportunity to change their thinking and have them explain **WHY** they changed their mind!

Once the class has come to an agreement about how to cut the ribbon then cut it. **Make sure to tape an original uncut ribbon (the unit) to the board for comparison.** Label it as 1. Discuss how each section is one half of the original ribbon. Have someone hold up the cut pieces (separately) and compare them to the uncut piece (the unit). Tape them to the board and label

them with half written above each section. Ask students “Why does it take both parts to make one whole piece?” The goal of this task is to have students understand the terms “halves, thirds, and fourths”.

Part II

Divide the class into groups, with some groups of three and some groups of three or four children. Give each group a piece of ribbon that is one yard long and present them with this problem: How could you divide this ribbon so that each person in your group gets an equal piece? You might use string or adding machine tape depending on what you have available. Make it clear that all of the students in the group should get pieces that are the same length. Suggest that students do not cut the ribbon until the whole group agrees that they can make equal parts. If a group cuts their ribbon and then sees that the pieces are not of equal size, provide them with another ribbon and have them try again. **Make sure they can explain to you WHY they need another ribbon and what their new strategy will be for cutting it this time!**

After ample work time is given, allow groups to share the strategies they used. Some might fold the ribbon into 3 or 4 pieces and then cut it. Others might use something to measure the ribbon and make equal parts using a ruler. The measuring could also be done with other non-standard measures – such as Unifix cubes, snapping cubes etc. During the discussion ask the following questions:

- Does each person in the group have a ribbon that is the same size?
- What fraction could be used to explain how much of the whole each person in the group received?

*Some might fold the ribbon in half and then in half again to create 4 equal parts. If this happens be sure to have those students explain why this strategy works for creating fourths. If the students demonstrate an understating of this then you pose the following question: “Now that this ribbon is folded into fourths could I use the same strategy to create another fraction? (i.e. eighths). If I use this strategy on a ribbon folded in thirds what would I create? (i.e. sixths). Can you think of other examples of this same kind of thinking?”

After the group discussion, allow all students to carry their ribbon pieces back to their desk (or floor) and ask the following questions:

- Does each person in the class now have a piece of ribbon the same size? (no)
- Why are some ribbon pieces longer than others?
- What would you expect the pieces to be like for the members of a group of 6? 10?
(Pieces would be smaller)

Part III

Write the fraction words halves, thirds, quarters, and fourths on the board and have a student come up and tape their piece of ribbon underneath the correct spot. Have the students explain which fractional piece they think is the largest and smallest and how they decided. Listen for them to say that if the ribbon is only shared two ways the piece is larger. If it is shared four

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ways, it is smaller. Make sure that the students can explain that this is because more people need a piece of the ribbon.

Draw a number line that is the length of one uncut piece of ribbon on the board with zero at one end and 1 at the other. Tape an uncut piece of ribbon underneath the one. Ask, “Why did I place this uncut piece of ribbon here? (*because it is one whole piece of ribbon*) RIGHT! So where should we tape the half piece of ribbon? How about the third piece and the fourth piece? Listen and look for student recognition and understanding that there are numbers that live in-between other (whole) numbers. Check for transfer of understanding by asking if they can show the placement of halves, thirds, quarters, and fourths on a number line (the line goes from zero to one, so halfway would be $\frac{1}{2}$.)

FORMATIVE ASSESSMENT QUESTIONS

- Does each person in the group have a ribbon that is the same size? How do you know for sure?
- What fraction could be used to explain how much of the whole each person in the group received?
- Does each person in the class now have a piece of ribbon the same size? (no)
- Why are some ribbon pieces longer or shorter than others?
- What would you expect the pieces to be like for the members of a group of 6? 10? 100? (Pieces would be smaller)

DIFFERENTIATION

Extension

Give students a new length of ribbon, and tell them it is $\frac{1}{2}$ of a length. Allow them to decide what the whole length would be.

Make a connection to candy bars. Ask students whether they would rather have a half, third, or a fourth of a candy bar. Again have them explain their thinking. This would be a great topic for journal writing!

Intervention

If students are having difficulty, try going back to using sets of whole objects, such as a collection of counters, color tiles, pennies. Also, using examples that are greater than one, for example $2\frac{1}{2}$ apples or $3\frac{1}{2}$ cookies, may help because the unit they are working with is made explicit.

Constructing Task: Making a Cake

Approximately 2 Days



STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades 3-5, page 138)

“Students should come to think of counting fractional parts in much the same way as they might count apples or other objects. Students who understand fractional parts should not need to arrange pie pieces into a circle to know that four-fourths make a whole. For each collection, tell students what type of piece is being shown and simply count them together: “*one-fourth, two-fourths, three-fourths, and four-fourths*. As students count each collection of parts, discuss the relationship to one whole.”

ESSENTIAL QUESTIONS

- Why is it important to identify, label, and compare fractions (halves, thirds, fourths) as representations of equal parts of a whole or of a set?
- How do you know how many fractional parts make a whole?

MATERIALS

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- *My Half Day* by Doris Fisher or similar book
- Play-dough
- Circular Sheet
- Rectangular Sheet
- Chart paper
- Markers
- Craft stick
- Job descriptions (Students can refer to these to help them remember their role)
- Task Cards (copies for each group to have one task card)

GROUPING

Large group, Small group

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Begin by reading a book similar to *My Half Day* written by Doris Fisher, or *Apple Fractions* by Jerry Pallotta to the class. Use fraction circles to model sharing a pie with a small group of students in the class. You can also make copies of the fractions found within the book – enlarge them on the copy machine. Display each as you read about it in the book.

Part II

After a discussion, have students get into groups. Assign students jobs:

- The Recorder is the person who is in charge of managing the writing that goes on the chart.
- The Materials Collector is the person who is in charge of getting the materials needed and putting the materials up after the task is complete.
- The Reporter is be the person who is in charge of sharing the strategies their group used and any other information they would like to share about discoveries their group made.

Encourage students that although they have certain “jobs” everyone participates and works cooperatively helping one another.

Have groups select one task card. They are to read the situation and determine a solution to the task. Students may use cake pans, play dough, and craft sticks to act out the scenario. Students should also share their thought processes through numbers, pictures, and words.

While students are working on the task using the materials provided, circulate the room and ask questions like:

- How many people must share your cake?
- How will you separate your cake into equal pieces?

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- What if everyone wanted two pieces, how would this change the fraction of each piece?
- Would that change the amount each person received? Why or Why not?
- Can you explain this process through words?

Part III

Allow students to share their task and solution. Have students show their work and explain the strategies they used. Discuss the differences in the sizes of the pieces based on the shape of the cake and the number of ways the cake had to be split. Ask students which cake they would rather be sharing. Allow students in the audience to ask questions, make comments, and give suggestions.

FORMATIVE ASSESSMENT QUESTIONS

- How many people must share your cake?
- How will you separate your cake into equal pieces?
- What if everyone wanted two pieces, how would this change the fraction of each piece?
- Would that change the amount each person received? Why or Why not?
- Can you explain this process through words?

DIFFERENTIATION

Extension

- Present students with this problem and the extension handout: I have a rectangle cake that I want to share with 4 friends. How many different ways can you cut the cake into fourths?
- How would I cut the cake if each of my friends wanted more than two pieces (e.g. 3, 4, or more)?

Intervention

Allow students to review the identification of fractions through the website:
pbskids.org/cyberchase/games/fractions/index.html to play “13 Ways to a Half”



Making a Cake: Task Cards

Task Card #1

Make a rectangle cake and imagine you want to serve the whole thing to three people.

How could you cut your cake to assure that each person had the same amount of cake?

What fraction would each person get to eat? Use pictures, words, and numbers to explain your answers.

Task Card #2

Make a rectangle cake and imagine you want to serve the whole thing to four people.

How could you cut your cake to assure that each person had the same amount of cake?

What fraction would each person get to eat? Use pictures, words, and numbers to explain your answers.

Task Card #3

Make a circle cake and imagine you want to serve the whole thing to three people.

How could you cut your cake to assure that each person had the same amount of cake?

What fraction would each person get to eat? Use pictures, words, and numbers to explain your answers.

Task Card #4

Make a circle cake and imagine you want to serve the whole thing to two people.

How could you cut your cake to assure that each person had the same amount of cake?

What fraction would each person get to eat? Use pictures, words, and numbers to explain your answers.

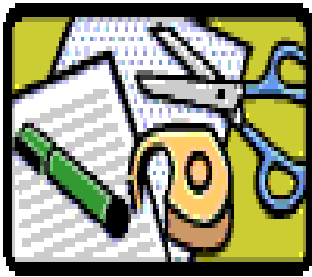


Making a Cake: Job Descriptions

Job Descriptions: These could be copied and given to each group so they remember their "job" within the group.



The Recorder is the person who is in charge of managing the writing that goes on the chart.



The Materials Collector is the person who is in charge of getting the materials needed and putting the materials up after the task is complete.



The Reporter is the person who is in charge of sharing the strategies their group used and any other information they would like to share about discoveries in their group.

Constructing Task: Fraction Cookies

Approximately 2 Days



STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

MCC.2.MD.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson.*****

BACKGROUND KNOWLEDGE

(Information adapted from North Carolina DPI Instructional Support Tools)

Within this task, students will be partitioning circles (cookies) and discussing these circles in reference to their fractional parts. Students will use this information to create graphs. At first students should create real object and picture graphs so each row or bar consists of countable parts. These graphs show items in a category and do not have a numerical scale. For example, a real object graph could show the students' shoes (one shoe per student) lined end to end in horizontal or vertical rows by their color. Students would simply count to find how many shoes are in each row or bar. The graphs should be limited to 2 to 4 rows or bars. Students would then move to making horizontal or vertical bar graphs with two to four categories and a single-unit scale.

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, page 254)

“All of the sharing tasks involved sharing something that could be cut into smaller parts. In these situations the fractions are based on parts of an area or region. This is a good place to begin and

is almost essential when doing sharing tasks. There are many good region models, as shown in Figure 9.3 on page 254.

Circular “pie” piece models are by far the most commonly used area model. The main advantage of the circular region is that it emphasizes the amount that is remaining to make up a whole. The strong emphasis on the circle as a whole also has disadvantages. To use the semicircle or any other piece other than the circle to represent the whole would be very confusing. So there is no challenge for students to construct a whole given one of the pieces as a fractional part. Another disadvantage lies in the fact that each piece is a unit fraction. Drawings of circle models can mislead and be overused. Even adults have difficulty partitioning a circle in a reasonably accurate manner.” *In order to overcome this concern, the flag task which follows this one involves the use of rectangular wholes.*

ESSENTIAL QUESTIONS

- What is a fraction and how can it be represented?
- How do we add fractions?
- How do we apply the use of fractions in everyday life?
- When is it appropriate to use fractions?
- How can we use a pictograph, bar graph, chart, or table to organize data and answer questions?
- What is a survey?

MATERIALS

- “Fraction Cookie Order” worksheet, 2 pages (one per student)
- Crayons, colored pencils, or markers
- Survey
- Paper for constructing graphs

GROUPING

Individual/Partner Task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

In this task, students will create a cookie order in which cookies are divided into fractional parts.

Part I

- Tell the students the following scenario:
 - You own your own bakery. Your specialty is fraction cookies. People place orders from all over the country for your cookies. You have recently received the following orders.
 - Before filling the order by making the cookies, you like to confirm your order with a drawing for the customer. (If the toppings ordered do not cover an entire cookie, customers want the remaining portion of the cookie to be left plain.)

MATHEMATICS • GRADE 2 • UNIT 5: Understanding Plane and Solid Figures

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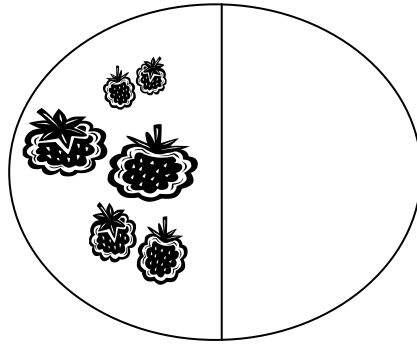
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- Using the circle templates below, show how you would create each cookie with the correct fractional amounts of toppings.
- Share your illustrations with your teacher.
- As students are working, be sure they are dividing the circles into equal-sized pieces and filling the sections as described in the order form.

Example:

This made to order cookie is split equally half raspberries and half plain.



Part II

Ask students to survey ten family members and/or classmates about their favorite cookie topping, each person can choose up to 4 toppings. The students will write a question that will generate the information needed to determine what their families or classmates like on their cookies. Brainstorm a list of possible topping and have the students make the decision for their survey choices based on this discussion. Remind students that most surveys will use information that is common to all people. This could lead to a discussion about how survey items are chosen and their purpose. Responses to the survey will be recorded on the survey form with a check mark. Point out to the students that a survey form is different from a graph.

Discuss possible ways their answers could be recorded. Students will record their answers on their “Cookies Please” survey form. Each student needs to be sure to label the top row of the table with their four topping options.

Once the items have been decided, have students determine what kind of graph will be needed to record the information. Have students create a blank graph they will use for their survey data of the choice of toppings. Allow students to take this survey home if necessary.

When the surveys come back the next day, discuss the results with the class. If students do not have ten responses, they may also ask their classmates and add these results to their survey.

FORMATIVE ASSESSMENT QUESTIONS

- How do you partition a shape?
- How do you know what name to give a fraction?
- When you were creating your survey, what difficulties did you have?

DIFFERENTIATION

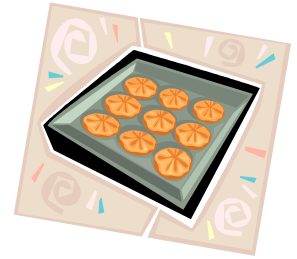
Extension

- Challenge student to become the creator of the triangular or square cookie. Have them convert their illustrations showing the fractional cookies to a triangle template, or square template
- Have students develop a list of survey questions on a topic of their choice. Allow them to survey additional classrooms or grade levels to compare results.

Intervention

- Provide manipulatives such as connecting cubes for students to model the toppings for the cookies.
- Provide the student with the questions and the survey so that their task is limited to collecting the information and recording the results.
- Provide students with shapes already divided up into the fractional shares halves, thirds, and fourths. These students should still select which they need to use, but they will not be physically partitioning them.

Name _____ Date _____



Fraction Cookies

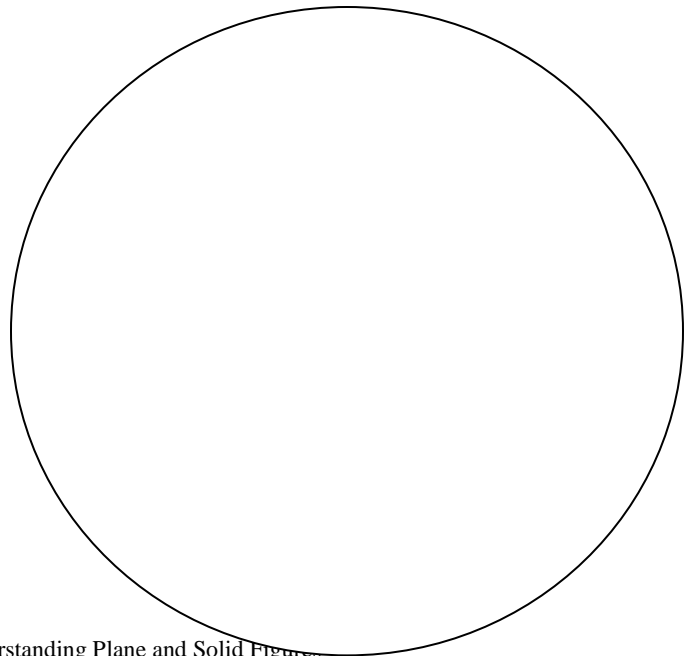
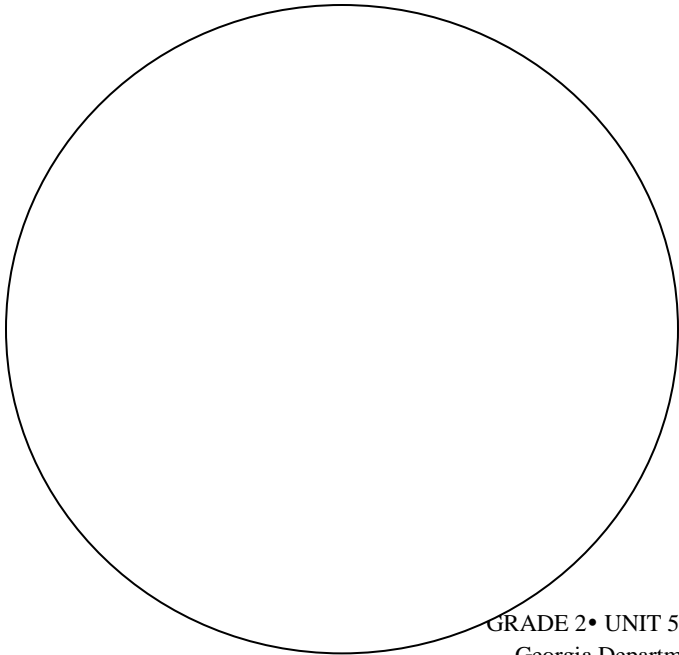
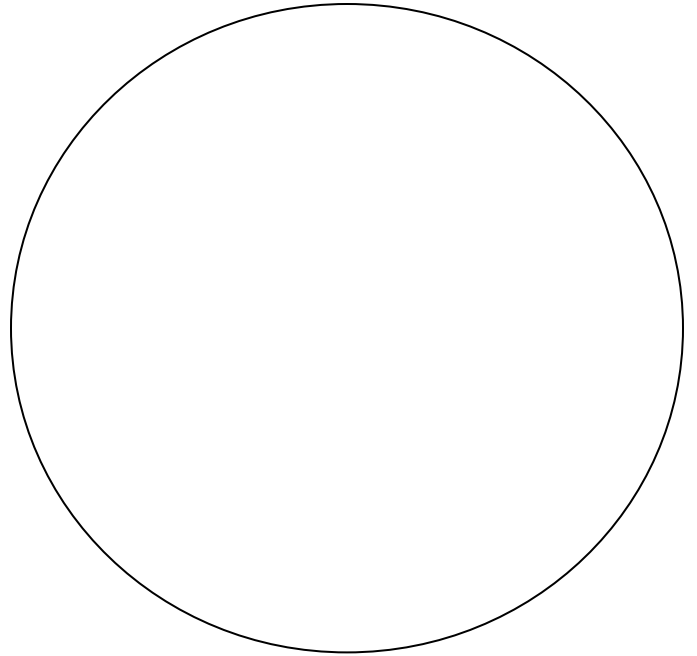
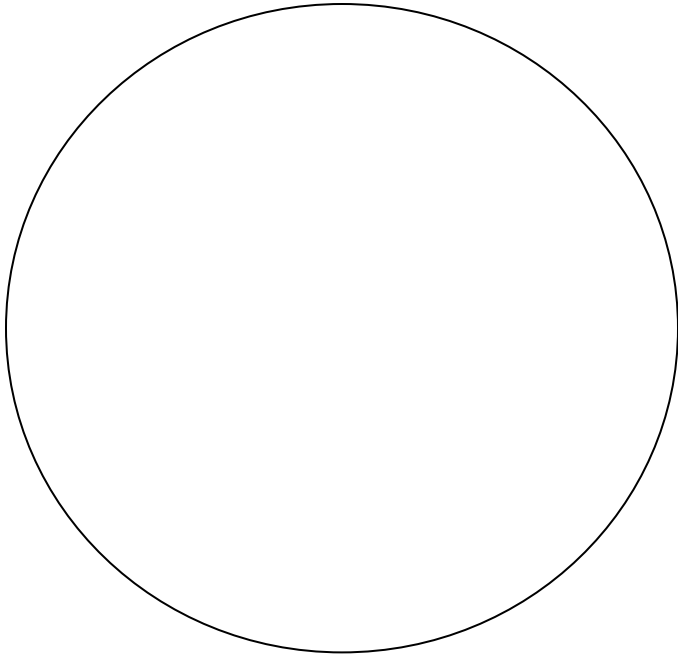
You own your own bakery. Your specialty is fraction cookies. People place orders from all over the country for your cookies. You recently received the following orders. Before filling the order by making the cookies, you like to confirm your order with a drawing for the customer. (If the toppings ordered do not cover an entire cookie, customers want the remaining portion of the cookie to be left plain.) Using the circle templates below, show how you would create each cookie with the correct fractional amounts of toppings. Share your illustrations with your teacher.

Cookie Orders

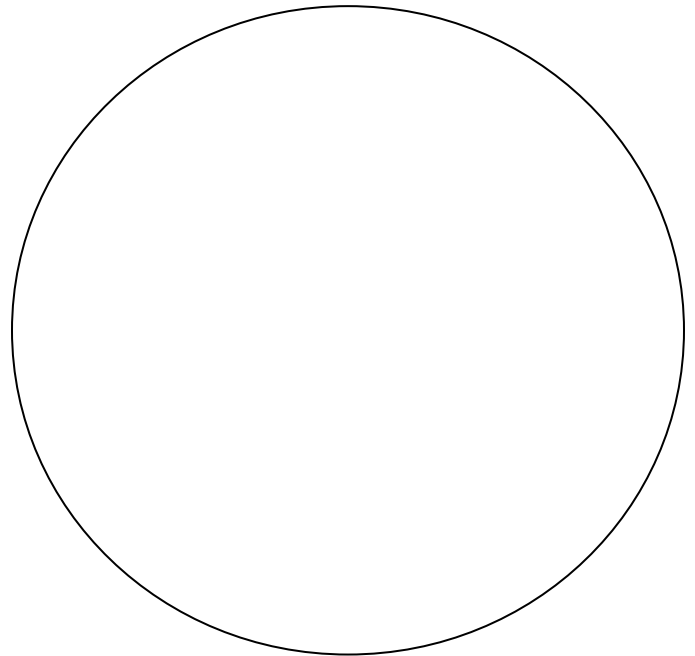
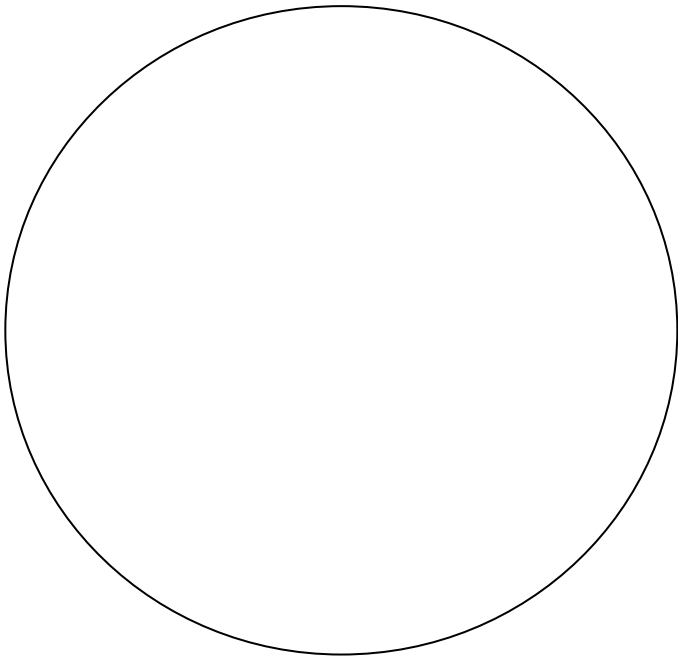
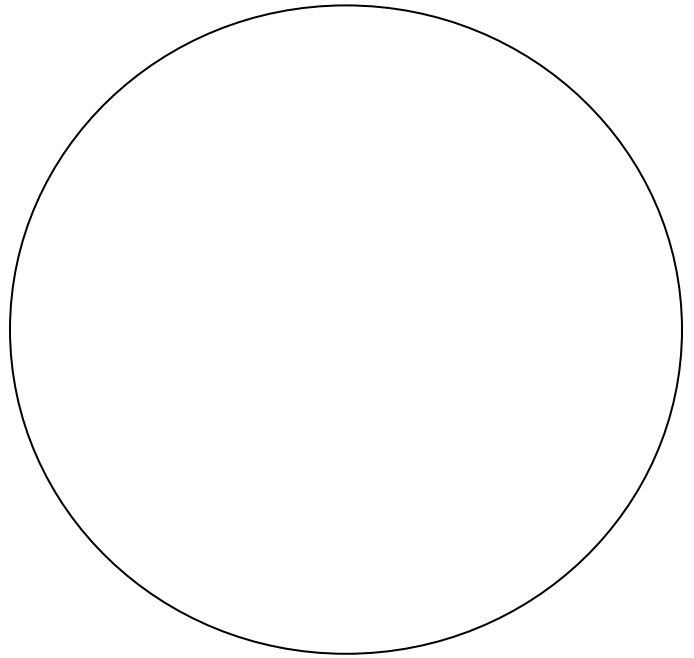
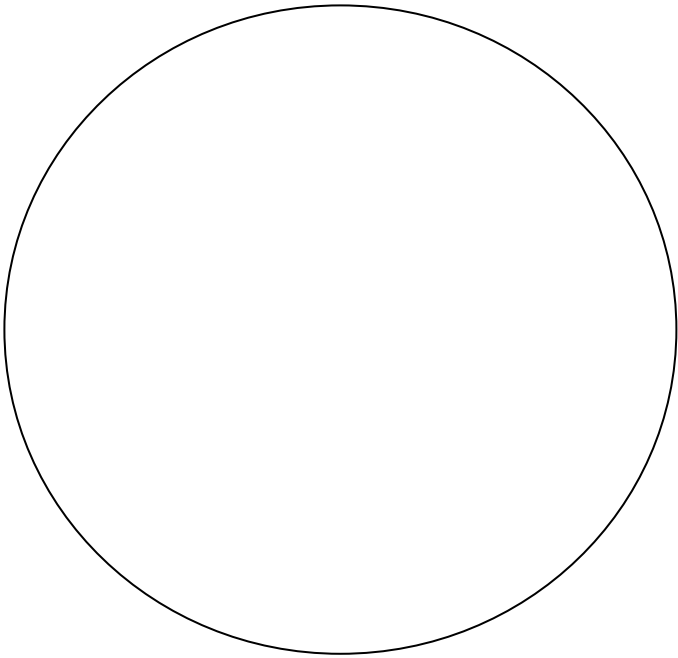
Order Number	M & Ms	Walnuts	Chocolate Chips	Vanilla Icing	Sprinkles	Chocolate Icing
#1	Half	Half				
#2				Two fourth	One fourth	
#3	One fourth				One fourth	Two fourths
#4	One fourth		One fourth			Two fourths
#5	One third		One third	One third		
#6			Two fourths		Two fourths	
#7		One fourth	One fourth	One fourth		One fourth
#8	One third					Two thirds

Name _____ Date _____

Fraction Cookie Orders



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Name: _____

COOKIES PLEASE!



Survey Question:

_____?
_____?

	<u>Topping #1</u>	<u>Topping #2</u>	<u>Topping #3</u>	<u>Topping #4</u>
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Total				



Performance Task: My Country's Flag

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.G.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

MCC.2.G.2 Partition a rectangle into rows and columns of same-size squares to find the total number of them.

MCC.2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

STANDARDS FOR MATHEMATICAL PRACTICE

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.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson.*****

BACKGROUND KNOWLEDGE

This task should help to conclude Unit 5. This unit serves to address fourth Critical Area of Focus. “Students describe and analyze shapes by examining their sides and angles. Students investigate, describe, and reason about decomposing and combining shapes to make other shapes. Through building, drawing, and analyzing two- and three-dimensional shapes, students develop a foundation for understanding area, volume, congruence, similarity, and symmetry in later grades.”

ESSENTIAL QUESTIONS

- Why is it important to identify, label, and compare fractions (thirds, sixths, eighths, tenths) as representations of equal parts of a whole or of a set?
- What is a fraction and how can it be represented?
- What do the parts of a fraction tell us?

MATHEMATICS • GRADE 2 • UNIT 5: Understanding Plane and Solid Figures

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- If we have two fractions, how do we know which is greater or has more value?
- How do we know how many fractional parts make a whole?
- How are arrays and repeated addition related?
- How do we describe geometric figures?

MATERIALS

- Flags from Various Countries
- 1 inch grid paper
- Colored tiles
- Pencils
- Centimeter or dot paper
- Tape or glue stick
- Colored Pencils, markers, or crayons

GROUPING

Individual

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION



Afghanistan



Angola



Congo



Cuba



Singapore

Part I

Show students flags from various countries. Discuss the fractions found within each of the flags. Discuss what happens when you add up each of the fractions. Tell students that today they will get to create their own flag for a make-believe country. They will have to:

- Use 24 square tiles to create the rectangular array for the measurements. The array does not have to result in the shape for a typical flag. Allow students to create a flag from anything 1 row of 24 to 24 rows of 1, as long as the students can explain the number of rows and columns and how many tiles they are using in all. Then trace the array to draw the boundary of the flag.
- Students will use up to 4 colors to decorate their flag. Each color must be used for an equal share, allowing certain colors to have more than one share. (Example, you may have your flag colored one fourth red, one fourth black and two fourths white.)

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- Draw figures with centimeter paper, dot paper, or using a ruler. Create at least one of the following plane shapes to be included on the flag: triangle, quadrilateral, pentagon, and hexagon.

Part II

Give each student 2 pieces of 1-inch grid paper, centimeter or dot paper, glue, paper colored tiles, and colored pencils. Have students brainstorm ideas for flags on one sheet of grid paper to begin with. Then, allow students to create their fraction flags. Students could cut out their shapes and affix them to the flag. While students are working, ask questions such as:

- Can you tell me about your design?
- How did you decide the number of rows and columns?
- How can you use fractions to describe the colors in this flag?
- What will happen when you add all the fractions within your flag together?
- Which fractions within your flag are the largest? Smallest?
- What are the shapes of your fractions?
- Are any of your fractions equal?
- What are the properties of your geometric shapes?

Part III

Students will create a written sample that responds to the prompts below.

- Identify the number of rows and columns in your flag.
- How did you decide the number of rows and columns?
- Explain the fractions that describe the colors in this flag?
- What geometric shapes did you use in your flag?
- What are the attributes of your geometric shapes?

Part IV

After students have created their flags, have them share the flags and the writing sample with the class. Allow other students to ask questions and make comments about the flags their peers have created. Display the flags, their descriptions, and feedback for others to see.

Variation

Students could make/use quilt squares instead of flags.

FORMATIVE ASSESSMENT QUESTIONS

- Identify the number of rows and columns in your flag.
- How did you decide the number of rows and columns?
- Explain the fractions that describe the colors in this flag?
- What geometric shapes did you use in your flag?
- What are the attributes of your geometric shapes?
- Can you tell me about your design?
- How did you decide the number of rows and columns?

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- How can you use fractions to describe the colors in this flag?
- What will happen when you add all the fractions within your flag together?
- Which fractions within your flag are the largest? Smallest?
- What are the shapes of your fractions?
- Are any of your fractions equal?
- What are the properties of your geometric shapes?

DIFFERENTIATION

Extension

Students could be given 36 tiles to create array and asked to identify the number of tiles that make-up each fraction.

Intervention

Students could have a choice of rectangles that have been divided into halves, thirds, or fourths.

Name: _____

MY COUNTRY'S FLAG



Identify the number of rows and columns in your flag.

How did you decide the number of rows and columns?

What other arrays did you consider?

Explain the fractions that describe the colors in this flag?

What geometric shapes did you use in your flag?

What are the attributes of your geometric shapes?
