



CCGPS Frameworks Student Edition

Mathematics

Fifth Grade Unit Five Geometry and the Coordinate Plane



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

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Unit 5: Geometry and the Coordinate Plane

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OVERVIEW

Students extend their Grade 4 pattern work by working briefly with two numerical patterns that can be related and examining these relationships within sequences of ordered pairs and in the graphs in the first quadrant of the coordinate plane.

This work prepares students for studying proportional relationships and functions in middle school.

Analyze patterns and relationships.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **numerical patterns, rules, ordered pairs, coordinate plane.**

Graph points on the coordinate plane to solve real-world and mathematical problems.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: **coordinate system, coordinate plane, first quadrant, points, lines, axis/axes, x-axis, y-axis, horizontal, vertical, intersection of lines, origin, ordered pairs, coordinates, x-coordinate, y-coordinate.**

The Critical Areas are designed to bring focus to the standards at each grade by describing the big ideas that educators can use to build their curriculum and to guide instruction.

This cluster goes beyond the Grade 5 Critical Areas of Focus to address **Modeling numerical relationships with the coordinate plane.**

Based on previous work with measurement and number lines, students develop understanding of the coordinate plane as a tool to model numerical relationships. These initial understandings provide the foundation for work with negative numbers, and ratios and proportional relationships in Grade Six and functional relationships in further grades.

STANDARDS FOR MATHEMATICAL CONTENT

Analyze patterns and relationships.

MCC5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Graph points on the coordinate plane to solve real-world and mathematical problems.

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system,

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with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

The initial understanding of the first quadrant provides the foundation for work in the other three quadrants, which includes negative numbers introduced in Grade Six.

Common Misconceptions:

- Teachers and students often assume that the coordinate system is limited to one quadrant, Quadrant I. However, the initial understanding of the first quadrant provides the foundation for work in the other three quadrants, which includes negative numbers introduced in Grade Six.
- Students reverse the points when plotting them on a coordinate plane. They count up first on the y -axis and then count over on the x -axis. The location of every point in the plane has a specific place.

STANDARDS FOR MATHEMATICAL PRACTICE

This section provides examples of learning experiences for this unit that support the development of the proficiencies described in the Standards for Mathematical Practice. These proficiencies correspond to those developed through the Literacy Standards. The statements provided offer a few examples of connections between the Standards for Mathematical Practice and the Content Standards of this unit. The list is not exhaustive and will hopefully prompt further reflection and discussion.

1. **Make sense of problems and persevere in solving them.** Students make sense of solving real world problems involving points on the coordinate plane.
2. **Reason abstractly and quantitatively.** Students demonstrate abstract reasoning about ordered pairs with their visual representations. Students consider the values of these numbers in relation to patterns and points on a coordinate plane.
3. **Construct viable arguments and critique the reasoning of others.** Students construct and critique arguments regarding patterns and relationship of ordered pairs as they are plotted on a coordinate plane to represent real-world contexts.

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4. **Model with mathematics.** Students use the coordinate plane to compare two numbers in mathematical and real-world contexts.
5. **Use appropriate tools strategically.** Students select and use tools such as colored pencils, number line models and the coordinate plane to represent situations involving positive numbers.
6. **Attend to precision.** Students attend to the language of real-world situations to determine how far to travel from the origin and the given direction of the coordinates being represented.
7. **Look for and make use of structure.** Students relate the structure of number lines to values of positive integers as they use the coordinate plane.
8. **Look for and express regularity in repeated reasoning.** Students relate new experiences to experiences with similar contexts when studying positive representations of distance and quantity.

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

ENDURING UNDERSTANDINGS

- On the coordinate plane, a point represents the two facets of information associated with an ordered pair.
- Graphical representations can be used to make predictions and interpretations about real world situations.
- Given two rules, students can generate two numerical patterns. Students create line graphs from the pattern. This explains a linear function and why straight lines are generated from the pattern.

ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How do coordinate grids help you organize information?
- What relationships can be determined by analyzing two sets of given rules?
- How might a coordinate grid help me understand a relationship between two numbers?
- How can we represent numerical patterns on a coordinate grid?
- How can a line graph help us determine relationships between two numerical patterns?
- How can the coordinate system help you better understand other map systems?

CONCEPTS/SKILLS TO MAINTAIN

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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.

- Transfer data from charts to graphs and graphs to charts.
- Understand that graphs are a visual representation of information called data.
- Interpret data from graphs.
- Classify 2D shapes (on a coordinate grid)
- Extend numerical patterns

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 students. Teachers should first present these concepts to students with models and real life examples. Students should understand the concepts involved and be able to recognize and/or use them with words, models, pictures, or numbers.

- **axis/axes**
- **coordinates**
- **coordinate plane**
- **coordinate system**
- **first quadrant**
- **horizontal**
- **intersection of lines**
- **line**
- **ordered pairs**
- **origin**
- **point**
- **rule**
- **vertical**
- **x-axis**
- **x-coordinate**
- **y-axis**
- **y-coordinate**

Common Core Glossary

<http://www.corestandards.org/Math/Content/mathematics-glossary/glossary>

STRATEGIES FOR TEACHING AND LEARNING

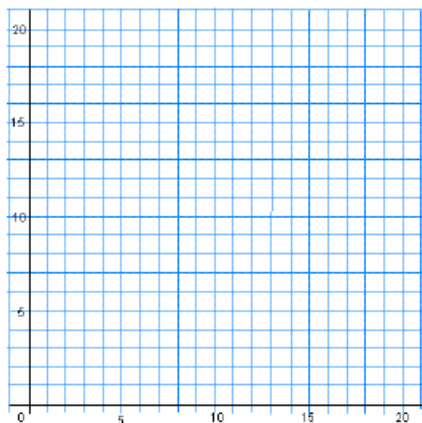
Operations and Algebraic Thinking Cluster: Analyze patterns and relationships. MCC.5.OA.3

Students should have experienced generating and analyzing numerical patterns using a given rule in Grade 4.

Given two rules with an apparent relationship, students should be able to identify the relationship between the resulting sequences of the terms in one sequence to the corresponding terms in the other sequence.

For example, given the rule “add 4” and the starting number 0, and given the rule “add 8” and the starting number 0, generate terms in the resulting sequences of numbers (0, 4, 8, 12, 16, ...) and (0, 8, 16, 24, 32,...). Students should see that the terms in the second sequence are double the terms in the first sequence, or that the terms in the first sequence are half the terms in the second sequence.

Graphing ordered pairs on a coordinate plane is introduced to students in the Geometry domain where students solve real-world and mathematical problems. For the purpose of this cluster, only use the first quadrant of the coordinate plane, which contains positive numbers only. Provide coordinate grids for the students, but also have them make coordinate grids. In Grade 6, students will position pairs of integers on a coordinate plane.



The graph of both sequences of numbers is a visual representation that will show the relationship between the two sequences of numbers.

Encourage students to represent the sequences in T-charts so that they can see a connection between the graph and the sequences.

0	0
1	4
2	8

0	0
1	8
2	16

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3	12
4	16

3	24
4	32

Geometry Cluster: Graph points on the coordinate plane to solve real-world and mathematical problems. MCC5.G.2

Students need to understand the underlying structure of the coordinate system and see how axes make it possible to locate points anywhere on a coordinate plane. This is the first time students are working with coordinate planes, and only in the first quadrant. It is important that students create the coordinate grid themselves. This can be related to two number lines and reliance on previous experiences with moving along a number line.

Multiple experiences with plotting points are needed. Provide points plotted on a grid and have students name and write the ordered pair. Have students describe how to get to the location. Encourage students to articulate directions as they plot points.

Present real-world and mathematical problems and have students graph points in the first quadrant of the coordinate plane. Gathering and graphing data is a valuable experience for students. It helps them to develop an understanding of coordinates and what the overall graph represents. Students also need to analyze the graph by interpreting the coordinate values in the context of the situation.

- 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.
- Students need to write in mathematics class to explain their thinking, talk about how they perceive topics, and justify their work to others.

Teachers need to provide instructional experiences so that students progress from the concrete level, to the pictorial level, then to the abstract level when learning mathematical concepts.

EVIDENCE OF LEARNING

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

- Generate patterns using given rules
- Identify relationships between terms and between two numbers
- Form ordered pairs consisting of corresponding terms from the two patterns
- Create a coordinate grid and graph ordered pairs in the first quadrant of the coordinate plane
- Generate line graphs to represent patterns and linear functions
- Articulate directions as students plot points

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- Interpret coordinate values of points in the context of situations
- Represent real world and mathematical problems using coordinate terminology and graphed model

TASKS

The following tasks represent the level of depth, rigor, and complexity expected of all fourth grade students. These tasks or tasks 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).

Culminating Activity

There is no formal culminating activity for this unit; however, a task seed is suggested and can be used and modified at the teacher's discretion.

Task Seed

Have students research a variety of occupations or careers that use the coordinate grid daily. The teacher will develop a list of guiding questions the students will be expected to answer through their research. The teacher will determine what the final product should be.

IF YOU NEED FURTHER INFORMATION ABOUT THIS UNIT, VISIT THE GaDOE WEBSITE AND REFERENCE THE UNIT WEBINARS.

<https://www.georgiastandards.org/Common-Core/Pages/Math-PL-Sessions.aspx>

Scaffolding Task	Tasks that build up to the learning task.
Learning Task	Constructing understanding through deep/rich contextualized problem solving tasks.
Practice Task	Tasks that provide students opportunities to practice skills and concepts.
Performance Task	Tasks which may be a formative or summative assessment that checks for student understanding/misunderstanding and or progress toward the standard/learning goals at different points during a unit of instruction.
Culminating Task	Designed to require students to use several concepts learned during the unit to answer a new or unique situation. Allows students to give evidence of their own understanding toward the mastery of the standard and requires them to extend their chain of mathematical reasoning.
Formative Assessment Lesson (FAL)	Lessons that support teachers in formative assessment which both reveal and develop students' understanding of key mathematical ideas and applications. These lessons enable teachers and students to monitor in more detail their progress towards the targets of the standards.
CTE Classroom Tasks	Designed to demonstrate how the Common Core and Career and Technical Education knowledge and skills can be integrated. The tasks provide teachers with realistic applications that combine mathematics and CTE content.

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Task Name	Task Type/Grouping Strategy	Content Addressed	Standard(s)
Shoo-Fly	Practice/Small group or pairs	Plotting points on a coordinate grid	MCC5.G.1 MCC5.G.2
Air Traffic Controller	Practice/Small group	Plotting points on a coordinate grid	MCC5.G.1 MCC5.G.2
Beads under the Clouds	FAL	Generating numerical patterns	MCC5.G.1 MCC5.G.2 MCC5.OA.3
Tell Me a Story	Performance/Individual	Plotting points on a coordinate grid	MCC5.G.1 MCC5.G.2
Earth Day Project	Scaffolding/Individual, small group, or partner	Generating numerical patterns from two given rules and graphing using a coordinate grid	MCC5.G.1 MCC5.G.2 MCC5.OA.3
First to Arrive	Constructing Task/Individual	Generating numerical patterns from two given rules and graphing using a coordinate grid	MCC5.G.1 MCC5.G.2 MCC5.OA.3
What's the Better Buy?	Performance Task/Individual	Generating numerical patterns from two given rules and graphing using a coordinate grid	MCC5.G.1 MCC5.G.2 MCC5.OA.3



Practice Task: Shoo-Fly

Adapted from “Fly on the Ceiling”

Lesson: <http://www.uen.org/Lessonplan/preview.cgi?LPid=11237>

Source: <http://www.uen.org/Lessonplan/preview.cgi?LPid=11237> and www.coreknowledge.org

Source: <http://www.uen.org/Lessonplan/preview.cgi?LPid=11237> and www.coreknowledge.org

The two games in this task require students to locate points on a coordinate grid and name ordered pairs.

STANDARDS FOR MATHEMATICAL CONTENT

Graph points on the coordinate plane to solve real-world and mathematical problems.

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

STANDARDS FOR MATHEMATICAL PRACTICE

- SMP 1. Make sense of problems and persevere in solving them.
- SMP 4. Model with mathematics.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

Students need to know the difference between vertical (y -axis) and horizontal (x -axis) lines and how to locate and name points in the first quadrant of the coordinate plane.

COMMON MISCONCEPTIONS

- Students reverse the points when plotting them on a coordinate plane. They count up first on the y -axis and then count over on the x -axis. The location of every point in the plane has a specific place. Have students plot points where the numbers are reversed such as (4, 5) and (5, 4). Begin with students providing a verbal description of how to plot each point. Then, have them follow the verbal description and plot each point.

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- When playing games with coordinates or looking at maps, students may think the order in plotting a coordinate point is not important. Have students plot points so that the position of the coordinates is switched. For example, have students plot (3, 4) and (4, 3) and discuss the order used to plot the points. Have students create directions for others to follow so that they become aware of the importance of direction and distance.

ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How can the coordinate system help you better understand other map systems?
- How do coordinate grids help you organize information?

MATERIALS

- *The Fly on the Ceiling* by Julie Glass, or similar book
- “Fly Tic-Tac-Toe, Directions” student sheet
- “Fly Tic-Tac-Toe, Game board,” student recording sheet
- “Shoo Fly” game board (laminated) for each student
- Markers (wet erase/dry erase)
- Flashlight

GROUPING

Partner task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

Comments: Identifying points on a coordinate grid is important in understanding how the coordinate system works and in constructing simple line graphs to display data or to plot points. These skills further help us to examine algebraic functions and relationships. The skills developed in this lesson can be applied cross-curricular to reading latitude and longitude on a map and to plotting data points.

One way to introduce this task is to read the book *Fly on the Ceiling* by Julie Glass or a similar book about plotting points on in the first quadrant of a coordinate plane.

Another introductory activity is to ask students to look at the ceiling and ask them what they see. (In most schools, you will have a modified grid system on the ceiling from the ceiling tiles. If you do not have this, skip this.) If you have a metal frame supporting the ceiling tiles, use these to create a coordinate grid. You might want to label them just below the ceiling on the wall. (If no metal frame is visible, you may need to point out the grid that is created where the ceiling tiles meet.) Be sure to label the lines created by the grid and not the tiles themselves. Turn the lights out and pretend you found a fly. Using a flashlight, shine the light on an intersection in the ceiling grid. Ask students to identify the ordered pair. Continue on until the class has grasped the concept. Then give the students flashlights and call out different ordered pairs for students to identify with the flashlight.

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The game boards used for this task can be laminated and used with water-based, fine-tip markers (such as Vis-à-Vis® markers) so the game boards can be reused.

TASK:

Students will follow the directions below from the “Shoo Fly, Directions” student sheet.

Shoo Fly

Materials: 2 “Shoo Fly, Game Board” student recording sheets
2 water-based Vis-à-Vis® markers
“Shoo Fly, Directions” student sheet

Number of Players: 2

Objective: To “swat” all of the opponent’s flies by calling out the coordinates that identify the location of the “fly families.”

Directions:

(This game is similar to Battleship.)

- Each player has five fly families: one (1) family of two, two (2) families of three and two (2) families of four.
- Provide each player with a “Shoo Fly, Game Board” student recording sheet. Have them draw their fly families on the top grid using a water based Vis-à-Vis® marker. They can draw the families vertically or horizontally. Each family member must be placed where two lines intersect.
- On a turn, a player calls out the location of a point, (e.g. (3,2)). The opponent responds with “hit” if the point is located where one of the members of a fly family is hidden and “miss” if no fly is on that point. On the bottom grid the player records an “O” for a miss and an “X” for a hit on that point. (Recording on the bottom grid helps to prevent calling out the same location twice during a game.)
- The opponent will also mark a “hit” on his/her grid so s/he will know when all members of the fly family have been hit. When a player has hit all of the flies in a fly family, the opponent calls out “swatted” to signal all flies in a family have been hit.
- Play proceeds until one of the players has “swatted” all his/her opponent’s fly families.
- The first player to locate and “swat” all of their opponent’s fly families wins the game.

Students will follow the directions below from the “Fly Tic-Tac-Toe, Directions” student sheet.

Fly Tic-Tac-Toe

Materials: “Fly Tic-Tac-Toe, Directions” student sheet
“Fly Tic-Tac-Toe, Game board,” student recording sheet
Pencil

Number of Players: 2

Objective: To mark four points in a row

Directions:

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- Players choose to be the “X” or the “O” and choose who will go first.
- The first player chooses a point and describes it using an ordered pair of numbers to describe it, e.g., (2,3). Mark the point on the “Fly Tic-Tac-Toe” game board and record the correct ordered pair on the Player 1 list.

Remember:

- ◊ The first number of the ordered pair tells how far to go across, the second number tells how far to go up.
- ◊ Points are marked at intersections of a grid.
- ◊ The size of the grid is 4 x 4 with corners at (0,0), (0,4), (4,4), and (4,0).
- If a player states the wrong coordinates, their turn ends.
- Players take turns choosing and plotting points on the game board.
- To win, a player must get four coordinate points in an uninterrupted straight line—horizontally, vertically, or diagonally.

FORMATIVE ASSESSMENT QUESTIONS

- What is the coordinate for the horizontal (x-axis) and vertical (y-axis) axis?
- Why do you need to plot your point where two lines intersect?
- How do you graph and name a point on the coordinate plane?
- Explain how you used an ordered pair to locate a point on the coordinate plane?

DIFFERENTIATION

Extension

- Play a variation of the Fly Tic-Tac-Toe game by using a 5 x 5 grid and a die labeled with the numbers 0-5. Instead of choosing a point, students need to roll the die using the number rolled as the first coordinate (the x value) of the ordered pair. Students are able to choose (if possible) a point whose coordinates start with the rolled number. This limits the students' choice a little bit and focuses on the meaning of the coordinates of an ordered pair.
- Have students create a picture on a coordinate grid. List the ordered pairs of the points that need to be plotted to complete the mystery picture on a separate sheet of paper. Have a partner try to recreate the mystery picture following the coordinates given.

Intervention

- Ask students to plot coordinate points in order to create a mystery picture, with a set of points provided by the teacher. Visual students will be able to see their mistakes when working in the context of a picture.

Name _____ Date _____

Shoo Fly

Directions



Materials: 2 "Shoo Fly, Game Board" student recording sheets
2 water-based Vis-à-Vis® markers
"Shoo Fly, Directions" student sheet

Number of Players: 2

Objective: To "swat" all of the opponent's flies by calling out the coordinates that locate the "fly families."

Directions:

(This game is similar to Battleship.)

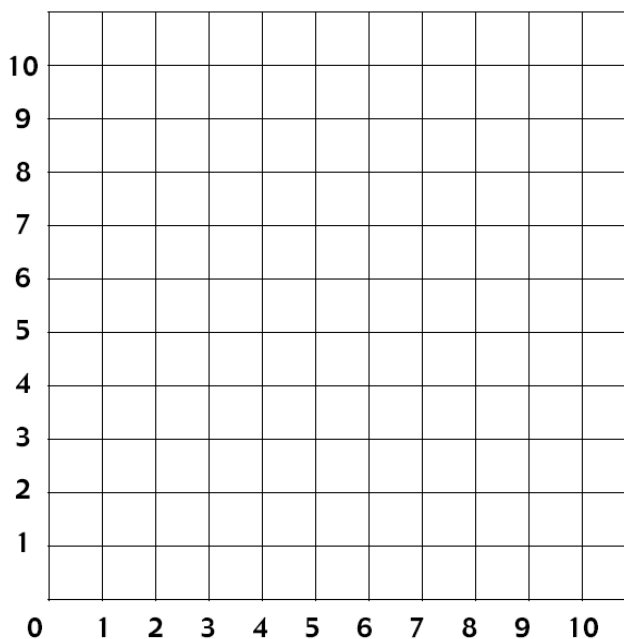
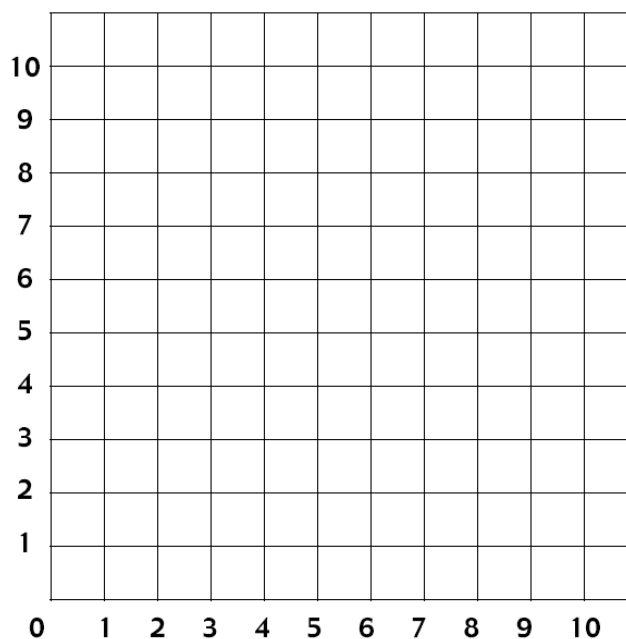
- Each player has five fly families: one (1) family of two, two (2) families of three and two (2) families of four.
- Provide each player with a "Shoo Fly, Game Board" student recording sheet. Have them draw their fly families on the top grid using a water based Vis-à-Vis® marker. They can draw the families vertically or horizontally. Each family member must be placed where two lines intersect.
- On a turn, a player calls out the location of a point, (e.g. (3,2)). The opponent responds with "hit" if the point is located where one of the members of a fly family is hidden and "miss" if no fly is on that point. On the bottom grid the player records an "O" for a miss and an "X" for a hit on that point. (Recording on the bottom grid helps to prevent calling out the same location twice during a game.)
- The opponent will also mark a "hit" on his/her grid so s/he will know when all members of the fly family have been hit. When a player has hit all of the flies in a fly family, the opponent calls out "swatted" to signal all flies in a family have been hit.
- Play proceeds until one of the players has "swatted" all his/her opponent's fly families.
- The first player to locate and "swat" all of their opponent's fly families wins the game.

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Name _____ Date _____

Shoo Fly

Game Board



Name _____ Date _____

Fly Tic-Tac-Toe

Directions



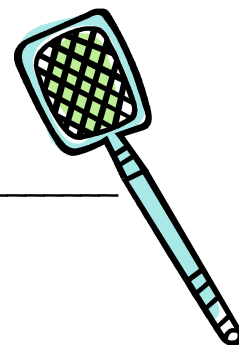
Materials: "Fly Tic-Tac-Toe, Directions" student sheet
"Fly Tic-Tac-Toe, Game board," student recording sheet
Pencil

Number of Players: 2

Objective: To mark four points in a row

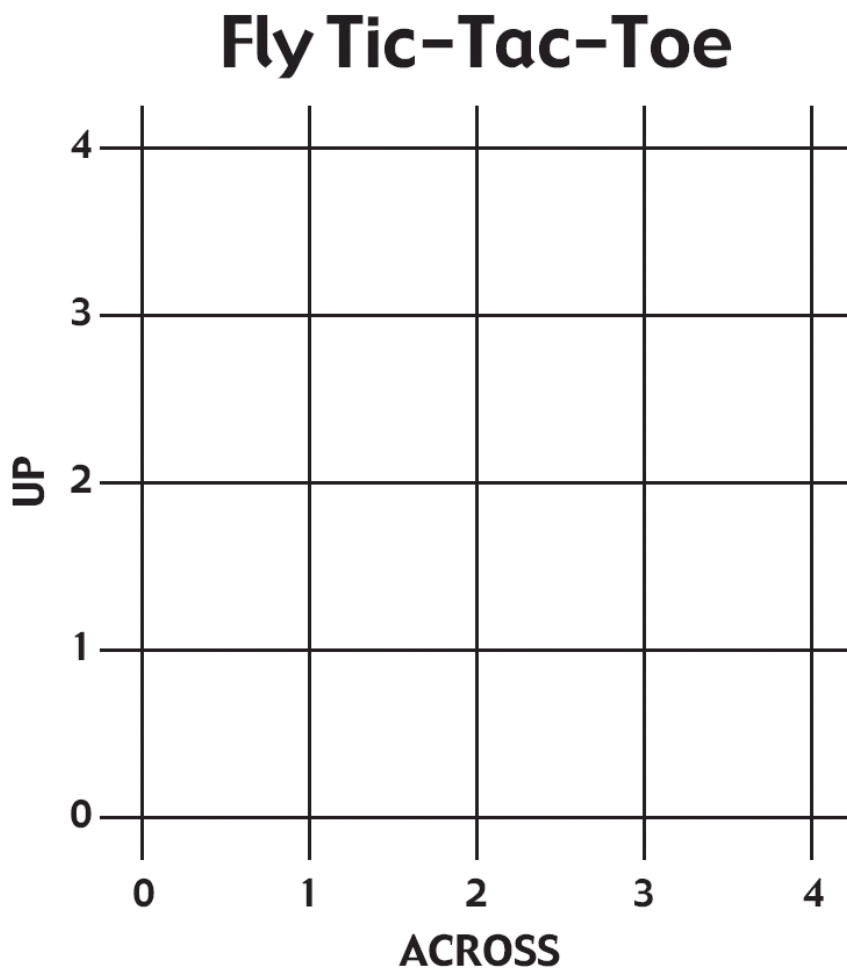
Directions:

- Players choose to be the "X" or the "O" and choose who will go first.
- The first player chooses a point and describes it using an ordered pair of numbers to describe it, e.g., (2,3). Mark the point on the "Fly Tic-Tac-Toe" game board and record the correct ordered pair on the Player 1 list.
- Remember:
 - ◊ The first number of the ordered pair tells how far to go across, the second number tells how far to go up.
 - ◊ Points are marked at intersections of a grid.
 - ◊ The size of the grid is 4×4 with corners at (0,0), (0,4), (4,4), and (4,0).
- If a player states the wrong coordinates, their turn ends.
- Players take turns choosing and plotting points on the game board.
- To win, a player must get four coordinate points in an uninterrupted straight line — horizontally, vertically, or diagonally.



Name _____ Date _____

Fly Tic-Tac-Toe



Fly Tic-Tac-Toe Player 1 Recording Sheet

FLY COORDINATES

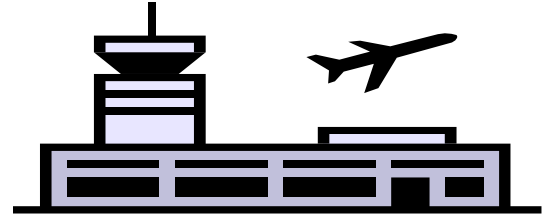
Across	Up
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()

Fly Tic-Tac-Toe Player 2 Recording Sheet

FLY COORDINATES

Across	Up
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()
()	()

Game Board



Practice Task: Air Traffic Controller

Adapted from “Paths-Activity 20.22” in Van de

Walle’s Elementary and Middle School Mathematics, Teaching Developmentally

This task requires students to create travel paths for three airplanes attempting to land safely at the airport.

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

STANDARDS FOR MATHEMATICAL PRACTICE

- SMP 1. Make sense of problems and persevere in solving them.
- SMP 2. Reason abstractly and quantitatively.
- SMP 4. Model with mathematics.
- SMP 5. Use appropriate tools strategically.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

Students need to know the difference between vertical (y -axis) and horizontal (x -axis) lines and how locate and name points in the first quadrant of the coordinate plane.

COMMON MISCONCEPTIONS

- Students reverse the points when plotting them on a coordinate plane. They count up first on the y -axis and then count over on the x -axis. The location of every point in the plane has a specific place. Have students plot points where the numbers are reversed such as (4, 5) and (5, 4). Begin with students providing a verbal description of how to plot each point. Then, have them follow the verbal description and plot each point.

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- When playing games with coordinates or looking at maps, students may think the order in plotting a coordinate point is not important. Have students plot points so that the position of the coordinates is switched. For example, have students plot (3, 4) and (4, 3) and discuss the order used to plot the points. Have students create directions for others to follow so that they become aware of the importance of direction and distance.

ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How can the coordinate system help you better understand other map systems?
- How do coordinate grids help you organize information?

MATERIALS

- “Air Traffic Controller” recording sheet
- Floor grid (could be created with tiles on the floor) or shower curtain grid
- One Person to be the air traffic controller
- Three people to be airplanes
- Colored pencils/markers

GROUPING

Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

Comments: Identifying points on a coordinate grid is important in understanding how the coordinate system works and in constructing simple line graphs to display data or to plot points. These skills further help us to examine algebraic functions and relationships. The skills developed in this lesson can be applied cross-curricular to reading latitude and longitude on a map and to plotting data points.

TASK

Getting Started:

1. The Air Traffic Controller tells the planes where they need to go using coordinates on the grid.
2. Each plane enters the grid at the origin (0,0). This is where the Air Traffic Controller’s radar first picks up each plane’s signal. Once the Air Traffic Controller “sees” a plane, he or she must tell them where to go using coordinates.
3. The Air Traffic Controller is responsible for keeping the planes, pilots, and their passengers safe from collisions with other aircrafts.
4. The more planes there are in the sky, the more difficult it is to keep planes safe.
5. Each Air Traffic Controller has to keep track of each plane by doing the following:
 - a. Each plane’s name must be written on the recording sheet.
 - b. The coordinates for the path that each plane takes must be written down.

MATHEMATICS • GRADE 5 • UNIT 5: Geometry and the Coordinate Plane

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Dr. John D. Barge, State School Superintendent

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- c. The Air Traffic Controller must draw a flight plan on the recording sheet for each plane. Each plane must go from point A (0,0) to the final destination or landing strip, point B (10,10).
 - d. Submit both the coordinates and the flight plan to the FAA President (Your Teacher) at the end of this exercise.
6. The job of Air Traffic Controller passes from one person to the next until all students have had the job. Once students have constructed their flight plan, the group may move to the floor grid or shower curtain grid to make sure all planes will land safely.

Finishing Up:

Air Traffic Controllers:

Before you turn in your flight paths and coordinates, please be sure to complete the following:

1. Highlight or shade each plane's flight path a different color with a key at the bottom that shows which color represents each plane.
2. Put your name on your papers.
3. Turn them in to the FAA President.

FORMATIVE ASSESSMENT QUESTIONS

- What is the coordinate for the horizontal (x-axis) and vertical (y-axis) axis?
- Why do you need to plot your point where two lines intersect?
- How do you graph and name a point on the coordinate plane?
- Explain how you used an ordered pair to locate a point on the coordinate plane?

DIFFERENTIATION

Extension

- This task can be extended by giving students an opportunity create flight plans for planes ahead of time. Once the students have their plans, they must enter the “radar map” one at a time, moving at a consistent pace. Planes take turns moving from one point to the next, following the flight plan. The students must follow their flight plan, and the “Air Traffic Controller” must facilitate this, should there be any confusion.

Intervention

- If students are still struggling with plotting points on the coordinate plane, there are two activities in Van de Walle's Elementary and Middle School Mathematics Teaching Developmentally: Activity 20.21 “Hidden Positions” and Activity 20.22 “Paths”.

Name _____

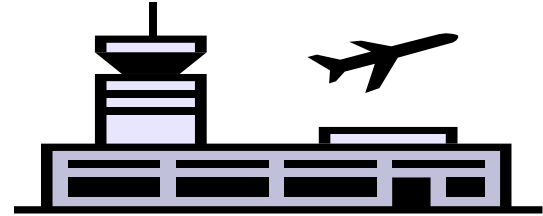
Date _____

Air Traffic Controller

Directions

Materials:

- "Air Traffic Controller" recording sheet
- Floor grid (could be created with tiles on the floor) or shower curtain grid
- One Person to be the air traffic controller
- Two or Three people to be airplanes
- Colored pencils/markers



Objective: To create flight plans to safely direct all planes from point A (0,0) to point B (10,10).

Directions:

Getting Started:

1. The Air Traffic Controller tells the planes where they need to go using coordinates on the grid.
2. Each plane enters the grid at the origin-point A (0,0). This is where the Air Traffic Controller's radar first picks up each plane's signal. Once the Air Traffic Controller "sees" a plane, he or she must tell them where to go using coordinates.
3. The Air Traffic Controller is responsible for keeping the planes, pilots, and their passengers safe from collisions with other aircrafts.
4. The more planes there are in the sky, the more difficult it is to keep planes safe.
5. Each Air Traffic Controller has to keep track of each plane by doing the following:
 - a. Each plane's name must be written on the recording sheet.
 - b. The coordinates for the path that each plane takes must be written down.
 - c. The Air Traffic Controller must draw a flight plan on the recording sheet for each plane. Each plane must go from point A (0,0) to the final destination or landing strip, point B (10,10).
 - d. Submit both the coordinates and the flight plan to the FAA President (Your Teacher) at the end of this exercise.
6. The job of Air Traffic Controller passes from one person to the next until all students have had the job. Once students have constructed their flight plan,

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the group may move to the floor grid or shower curtain grid to make sure all planes will land safely.

Finishing Up:

Air Traffic Controllers:

Before you turn in your flight paths and coordinates, please be sure to complete the following:

1. Highlight or shade each plane's flight path a different color with a key at the bottom that shows which color represents each plane.
2. Put your name on your papers.
3. Turn them in to the FAA President.

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Name _____ Date _____
Air Traffic Controller

FlightPlan

	<u>Name & Color</u>					<u>Coordinates</u>					
Plane #1											
10											
Plane #2											
8											
Plane #3											
7											
6											
5											
4											
3											
2											
1											
0	1	2	3	4	5	6	7	8	9	10	

[Beads Under the Clouds \(FAL\)](#)

Formative Assessments Lessons (FALs)

What is a Formative Assessment Lesson (FAL)? The Formative Assessment Lesson is designed to be part of an instructional unit typically implemented approximately two-thirds of the way through the instructional unit. The results of the tasks should then be used to **inform** the instruction that will take place for the remainder of the unit. Formative Assessment Lessons are intended to support teachers in formative assessment. They both reveal and develop students' understanding of key mathematical ideas and applications. These lessons enable teachers and students to monitor in more detail their progress towards the targets of the standards. They assess students' understanding of important concepts and problem solving performance, and help teachers and their students to work effectively together to move each student's mathematical reasoning forward.

What does a Formative Assessment Lesson look like in action? Videos of Georgia Teachers implementing FALs can be accessed [HERE](#) and a sample of a FAL lesson may be seen [HERE](#)

Where can I find more information on FALs? More information on types of Formative Assessment Lessons, their use, and their implementation may be found on the [Math Assessment Project](#)'s guide for teachers.

Where can I find samples of FALs?

Formative Assessment Lessons can also be found at the following sites:

[Mathematics Assessment Project](#)
[Kenton County Math Design Collaborative](#)
[MARS Tasks by grade level](#)

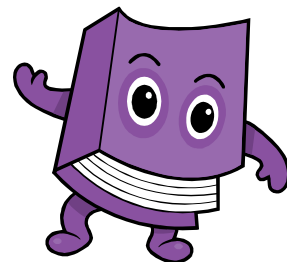
A **sample FAL** with extensive dialog and suggestions for teachers may be found [HERE](#). This resource will help teachers understand the flow and purpose of a FAL.

Where can I find more training on the use of FALs? The Math Assessment Project has developed Professional Development Modules that are designed to help teachers with the practical and pedagogical challenges presented by these lessons.

[Module 1](#) introduces the model of *formative assessment* used in the lessons, its theoretical background and practical implementation. [Modules 2](#) & [3](#) look at the two types of *Classroom Challenges* in detail. [Modules 4](#) & [5](#) explore two crucial pedagogical features of the lessons: asking probing questions and collaborative learning.

All of our Georgia RESAs have had a math specialist trained to provide instruction on the use of formative assessment lessons in the classroom. The request should be made through the teacher's local RESA and can be referenced by asking for more information on the Mathematics Design Collaborative (MDC). Also, if done properly, these lessons should take about 120-150 minutes, 2-3 classroom periods.

Sources of Information: Vicki Mixon, Former MDC (Math Design Collaborative) trainer, <http://www.reneeyates2math.com/> and from [The Mathematics Assessment Project](#) and [http://melissatabor.wikispaces.com/Formative+Assessment+Lessons+%28FALs%29 Division and Interpreting Remainders \(FAL\)](http://melissatabor.wikispaces.com/Formative+Assessment+Lessons+%28FALs%29+Division+and+Interpreting+Remainders+(FAL))



Performance Task: Tell Me a Story

Adapted from NCTM Illuminations

lesson: <http://illuminations.nctm.org/LessonDetail.aspx?id=L777>

In this lesson students will review plotting points and labeling axis. Students generate a set of random points all located within the first quadrant. Students will plot and connect the points and then create a short story that could describe the graph. Students must ensure that the graph is labeled correctly and that someone could recreate their graph from their story.

STANDARDS FOR MATHEMATICAL CONTENT

Graph points on the coordinate plane to solve real-world and mathematical problems.

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

STANDARDS FOR MATHEMATICAL PRACTICE

- SMP 1. Make sense of problems and persevere in solving them.
- SMP 2. Reason abstractly and quantitatively.
- SMP 4. Model with mathematics.
- SMP 5. Use appropriate tools strategically.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.

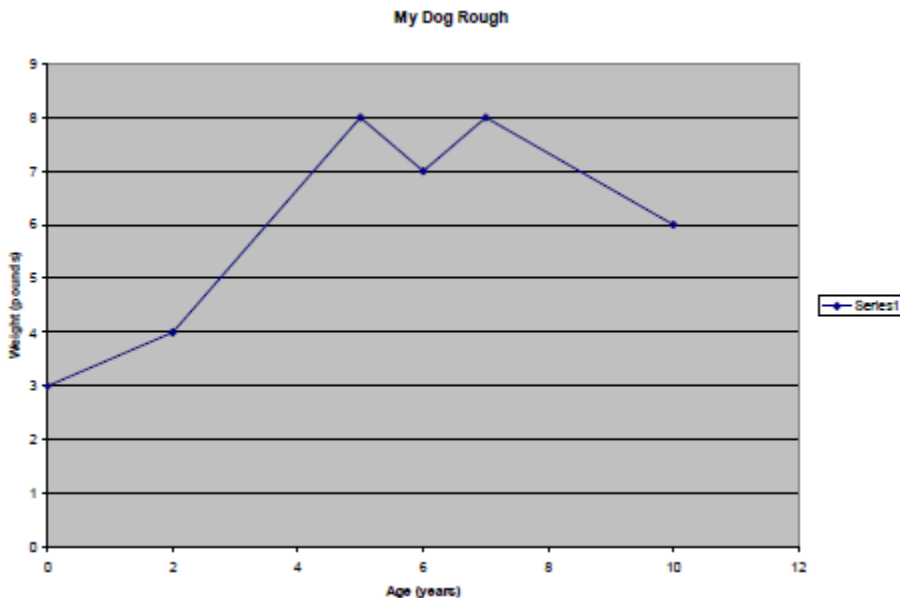
BACKGROUND KNOWLEDGE

Here is a sample graph and story that was created by generating 6 random ordered pairs. This example could serve as the whole class model for students.

Ordered pairs:

(7 , 8), (2 , 4), (5 , 8), (10 , 6), (0 , 3), (6 , 7)

Graphical representation:



Short story:

My Dog Rough

My dog only weighed 3 pounds when he was born so I named him Rough because I thought he would have a rough go at life. Rough's first couple years matched his name as he only managed to gain a pound during those first 2 years. Rough did much better over the next few years so that by the time he was 5 years old he had doubled his weight from the 2 year mark. The next year we spent a lot of time outside playing and running and he managed to lose a pound. The next year I made sure he ate healthier and Rough managed to gain back that pound he had lost the year before. Eight pounds was the most Rough ever weighed because during his 7th year he began to steadily lose weight and only weighed 6 pounds when he died at age 10.

COMMON MISCONCEPTIONS

- Students reverse the points when plotting them on a coordinate plane. They count up first on the y-axis and then count over on the x-axis. The location of every point in the plane has a specific place. Have students plot points where the numbers are reversed such as (4, 5) and (5, 4). Begin with students providing a verbal description of how to plot each point. Then, have them follow the verbal description and plot each point.
- When playing games with coordinates or looking at maps, students may think the order in plotting a coordinate point is not important. Have students plot points so that the position of the coordinates is switched. For example, have students plot (3, 4) and (4, 3) and

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discuss the order used to plot the points. Have students create directions for others to follow so that they become aware of the importance of direction and distance.

ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How can the coordinate system help you better understand other map systems?
- How do coordinate grids help you organize information?

MATERIALS

- “Tell Me a Story” recording sheet
- Playing cards (#’s 1-10, Ace serves as 1)
- Graph paper (for students to recreate other’s graphs)

GROUPING

Individual task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Comments: Identifying points on a coordinate grid is important in understanding how the coordinate system works and in constructing simple line graphs to display data or to plot points. These skills further help us to examine algebraic functions and relationships. The skills developed in this lesson can be applied cross-curricular to reading latitude and longitude on a map and to plotting data points.

TASK

- Each student will pull 12 playing cards to generate ordered pairs randomly. Be sure that no ordered pairs are repeated. If so, pull another card to generate new coordinates. List the ordered pairs on the recording sheet.
- Students will plot their points on their coordinate grid and connect them with line segments from left to right.
- Have the students observe their graph and determine labels for each axis as well as a title for their graph.
- Students will then create a short story to depict what is occurring in their graph. Encourage students to write with enough detail that another student reading their story would be able to recreate the graph. Having students write a rough draft on a separate sheet of paper first is suggested.
- When students are finished they may share their stories with the class and see if the students can recreate their graph on graph paper or students may switch papers and recreate each other’s graphs.

FORMATIVE ASSESSMENT QUESTIONS

- What is the coordinate for the horizontal (x-axis) and vertical (y-axis) axis?
- Why do you need to plot your point where two lines intersect?
- How do you graph and name a point on the coordinate plane?
- Explain how you used an ordered pair to locate a point on the coordinate plane?

DIFFERENTIATION

Extension

- Have students create a short story with two sets of given rules which would require another student or themselves to continue the numerical pattern and graph them on the coordinate grid.

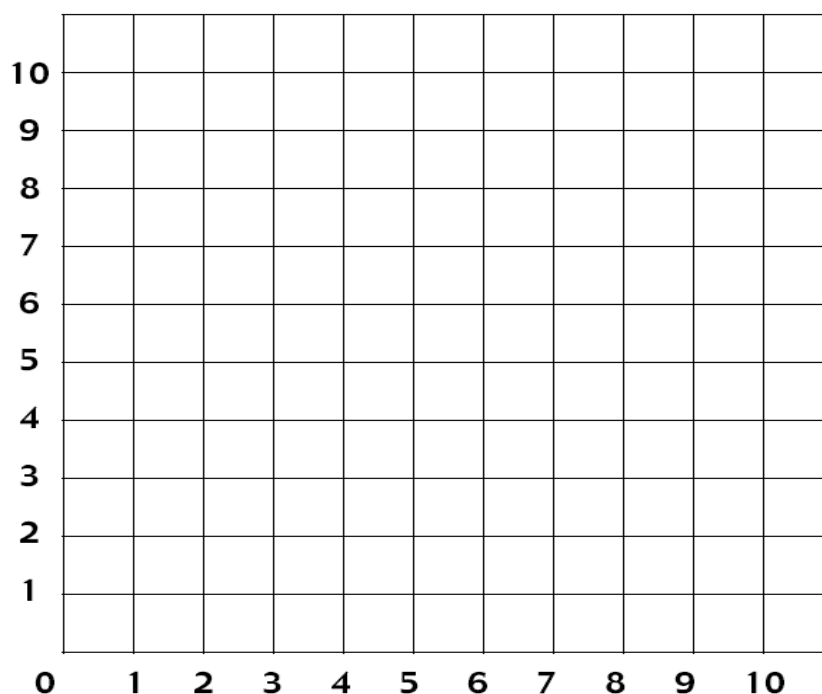
Intervention

- Have students decrease the number of coordinates created and work in small groups to create their graph and short story.

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Name _____ Date _____

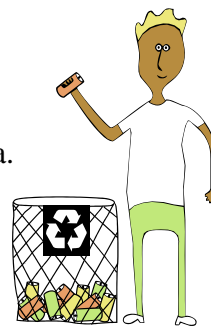
Tell Me a Story



Ordered Pairs:

(____, ____) (____, ____) (____, ____) (____, ____) (____, ____) (____, ____)

Short Story:



Scaffolding Task: Earth Day Project

In this activity, students consider a real-world situation involving a set of data. Using the data, students determine the pattern formed by the numbers in the data set. Then they extend the pattern and use the pattern to make predictions.

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. Graph points on the coordinate plane to solve real-world and mathematical problems.

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

The following is a maintenance standard from 4th grad and is addressed in this task.

MCC4.OA.5 Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule “Add 3” and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way. Analyze patterns and relationships.

STANDARDS FOR MATHEMATICAL PRACTICE

- SMP 1. Make sense of problems and persevere in solving them.
- SMP 2. Reason abstractly and quantitatively.
- SMP 4. Model with mathematics.
- SMP 5. Use appropriate tools strategically.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

Students should have had prior experiences working with and extending patterns.

Also, students should be able to graph points easily. After points are graphed, ask students if it is appropriate to connect the points. In this situation, it is not appropriate because students collect cans just once a day and they do not (typically) collect a fraction of a can. However, students may want to line up the points along the edge of a ruler or sheet of paper to make predictions using the graph.

For Teacher information only:

Teachers should give some thought to this pattern before presenting this problem to their students. Start by looking at the relationship of the numbers in the two columns. Teachers should try to express this relationship in words. See the examples below.

Some students may think about the pattern in this way:

Day 1 shows a column of 4 and 1 more.

Day 2 shows 2 columns of 4 and 1 more.

Day 3 shows 3 columns of 4 and 1 more

Day 4 will show 4 columns of 4 and 1 more.

Therefore the pattern is generated by $4 \times \square + 1$, where \square represents the number of the day. While it is not expected that students will be able to generalize this pattern to an expression (except possibly as an extension for some students), asking students to talk about what they see changing/growing in the pattern is important to help them develop an awareness of the structure of a pattern.

Keep in mind some students may see the pattern differently. For example, it is possible for students to describe it as follows:

Day 1 shows a 2×4 rectangle with 3 missing.

Day 2 shows a 3×4 rectangle with 3 missing.

Day 3 shows a 4×4 rectangle with 3 missing.

Day 4 will show a 5×4 rectangle with 3 missing.

Of course, this can be written as $(\square + 1) \times 4 - 3$, with the \square representing the number of the day. Using the distributive property gives you $4 \times \square + 4 - 3$, which is the same as $4 \times \square + 1$. Asking students about their thinking is a good way to understand how students see the relationship of the numbers in the two columns.

ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How do coordinate grids help you organize information?
- How can we represent numerical patterns on a coordinate grid?
- How can we determine the relationships between numbers?
- How can we use patterns to solve problems?
- How can we describe a pattern?

MATERIALS

- “Earth Day Project” student recording sheet, 3 pages
- Blocks to use to build the pattern (for those students who wish to use them)

GROUPING

Individual/Partner/Small group task

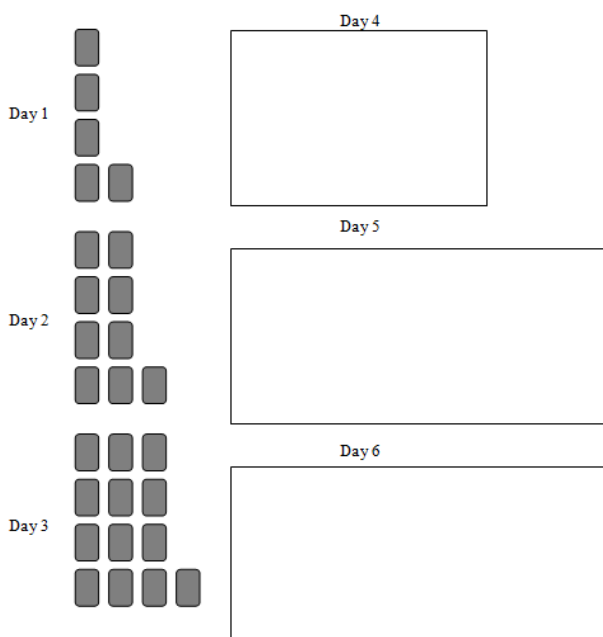
TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Comments: In this task, students are generating one numerical pattern. Although this concept is one that is developed in the fourth grade, students may benefit from reviewing one pattern before moving to two patterns.

Task Directions

Students will follow the directions below from the “Earth Day Project” student recording sheet.

Fifth graders in Ms. Smith’s class have decided to start a recycling project for Earth Day. They put a bin in the cafeteria to collect used aluminum cans. At the end of each school day, they take the bin back to their classroom and count the cans collected for the day. Ms. Smith’s class is keeping notes about how many cans are being collected. It seems that the number of cans collected each day follows a pattern. If the pattern continues, sketch the number of cans collected on days 4-6 in the boxes below.



Day	Cans
1	5
2	9
3	13
4	17
5	21
6	—
7	—
8	—
9	—
10	—
⋮	
⋮	
⋮	
20	—
⋮	
⋮	
100	—

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The students recorded the number of cans they collected each day in the t-table below. When they collect one hundred cans, the students can turn them in to the recycling center and earn money to be used for an upcoming field trip. If the pattern continues how many days will it take to collect at least 100 cans?

1. Use what you know about the cans collected in the first five days to make a prediction about how many days it will take to collect at least 100 cans. Show your work and explain in words why you predicted the number of days that you chose.
2. Continue the pattern in the t-table. Fill in the missing values.
3. Explain how you found the missing values in the t-table.
4. How many days will it take the class to collect enough cans for the field trip. Show all work and explain your thinking.
5. On the graph paper below, label the horizontal axis “Number of Days,” label the vertical axis “Number of Cans.” Label the horizontal axis 1-25 by 1s; label the vertical axis 1-100 by 5s. Make sure you start at zero. Plot the number of cans collected each day for days 1 - 5.
If the pattern continues, use the graph to predict the number of cans the students will collect on the 25th day.

FORMATIVE ASSESSMENT QUESTIONS

- What is the coordinate for the horizontal (x-axis) and vertical (y-axis) axis?
- Why do you need to plot your point where two lines intersect?
- How do you graph and name a point on the coordinate plane?
- Explain how you used an ordered pair to locate a point on the coordinate plane?
- How do you use an ordered pair to identify a point on the coordinate plane?
- How did you determine how to number your x and y axis?
- What is changing each day in the pattern?
- How many cans will be collected on day 4? How do you know? How will the pattern look?
- How did you complete the chart? How do you know you are correct?
- What do you notice about the numbers in each column? What do you notice about how the numbers in each row are related?
- How did you find the number of cans collected on day 20? On day 100? How do you know your answers are correct?

DIFFERENTIATION

Extension

- Ask students to write in words what is happening in the pattern (i.e. each day the number of cans increases by 4; the number of cans each day can be found by

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multiplying the day number by 4 and adding 1 or the expression $4 \times \square + 1$ where \square is the day number.). Also, ask students to make other predictions based on the graph and check their predictions using the expression $4 \times \square + 1$.

- If students are ready, they could generate another pattern from a competing fifth grade class/school. This could be graphed along with the original pattern to observe relationships.

Intervention

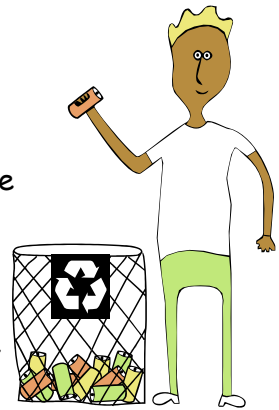
- Some students will benefit by using manipulatives to help them demonstrate the problem with concrete objects prior to drawing a model or attempting to extend the pattern.

Name _____ Date _____

Earth Day Project

Fifth graders in Ms. Smith's class have decided to start a recycling project for Earth Day. They put a bin in the cafeteria to collect used aluminum cans. At the end of each school day, they take the bin back to their classroom and count the cans collected for the day. Ms. Smith's class is keeping notes about how many cans are being collected.

Look at the data for the number of cans collected on each of the first three days. What do you notice? If this continues, sketch the number of cans collected on days 4 through 6.



<p>Day 1</p> <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> </div>	<p style="text-align: center;">Day 4</p> <div style="border: 1px solid black; height: 150px; margin-top: 10px;"></div>
<p>Day 2</p> <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> </div>	<p style="text-align: center;">Day 5</p> <div style="border: 1px solid black; height: 150px; margin-top: 10px;"></div>
<p>Day 3</p> <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: gray; margin-right: 5px;"></div> </div>	<p style="text-align: center;">Day 6</p> <div style="border: 1px solid black; height: 150px; margin-top: 10px;"></div>

MATHEMATICS

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The students recorded the number of cans they collected each day in the t-table below. When they collect one hundred cans, the students can turn them in to the recycling center and earn money to be used for an upcoming field trip. If the pattern continues how many days will it take to collect at least 100 cans?

1. Use what you know about the cans collected in the first five days to make a prediction about how many days it will take to collect at least 100 cans. Show your work and explain in words why you predicted the number of days that you chose.

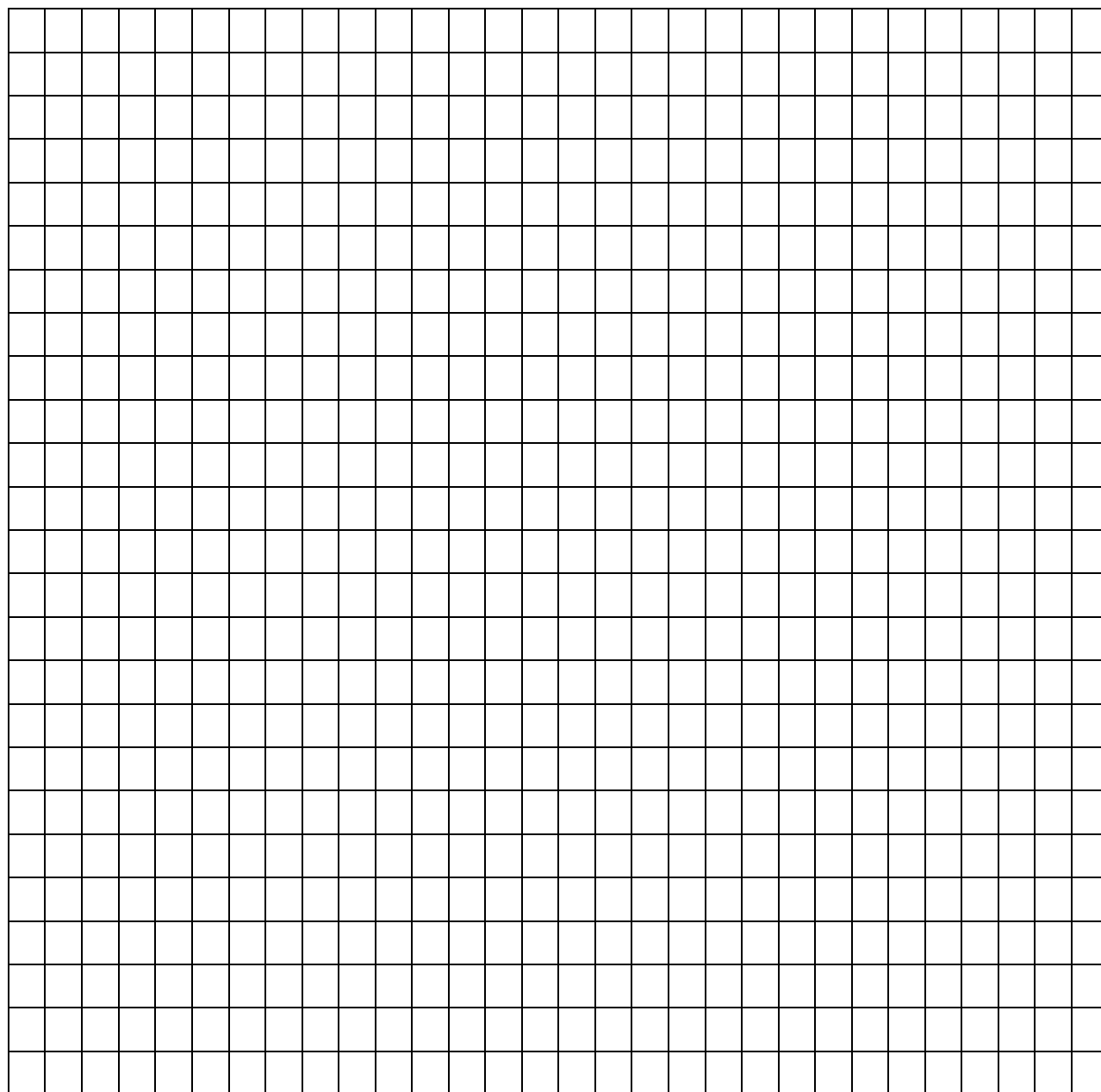
2. Continue the pattern in the t-table. Fill in the missing values.
3. Explain how you found the missing values in the t-table.

4. How many days will it take the class to collect enough cans for the field trip? Show all work and explain your thinking.

Day	Cans
1	5
2	9
3	13
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____
⋮	
⋮	
⋮	
20	_____
⋮	
⋮	
⋮	
100	_____

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5. On the graph paper below, label the horizontal axis "Number of Days," label the vertical axis "Number of Cans." Label the horizontal axis 1-25 by 1s; label the vertical axis 1-100 by 5s. Make sure you start at zero. Plot the number of cans collected each day for days 1 - 5. If the pattern continues, use the graph to predict the number of cans the students will collect on the 25th day.





Constructing Task: First to Arrive

In this task, students will determine which vehicle will arrive at a destination first based on the speed traveled.

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

STANDARDS FOR MATHEMATICAL PRACTICE

- SMP 1. Make sense of problems and persevere in solving them.
- SMP 2. Reason abstractly and quantitatively.
- SMP 4. Model with mathematics.
- SMP 5. Use appropriate tools strategically.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

The teacher may want to review the meaning of miles per hour and how it relates to the problem. Students should have experience creating their own coordinate grid and graphing the points.

ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How can the coordinate system help you better understand other map systems?
- How do coordinate grids help you organize information?
- How can we represent numerical patterns on a coordinate grid?
- What relationships can be determined by analyzing two sets of given rules?

MATERIALS

- “First to Arrive” recording sheet
- Centimeter grid paper

GROUPING

Individual task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

Two vehicles are traveling along the same path for 5 hours. Vehicle A is traveling at a rate of 30 miles per hour. Vehicle B is traveling at a rate of 60 miles per hour. At the completion of the trip, which vehicle will have traveled the farthest? How much farther? Complete the tables and graph the data by creating a coordinate grid to justify your reasoning.

Car A: 30 MPH			Car B: 60 MPH	
<u>Number of Hours</u>	<u>Total Miles</u>		<u>Number of Hours</u>	<u>Total Miles</u>
0			0	
1			1	
2			2	
3			3	
4			4	
5			5	

FORMATIVE ASSESSMENT QUESTIONS

- What is the coordinate for the horizontal (x-axis) and vertical (y-axis) axis? Justify your answer.
- Why do you need to plot your point where two lines intersect?
- How do you graph and name a point on the coordinate plane based on the information in the table?
- Explain how you used an ordered pair to locate a point on the coordinate plane?
- Explain the relationships between the data in the two tables?

DIFFERENTIATION

Extension

- Adjust the task so both cars have already traveled a certain number of miles. For example, Car A has already traveled 15 miles and Car B has only traveled 5. After traveling, who would have traveled the farthest?

Intervention

- Allow students to work with a partner or small group.

Name _____ Date _____

Car A: 30 MPH			Car B: 60 MPH	
<u>Number of Hours</u>	<u>Total Miles</u>		<u>Number of Hours</u>	<u>Total Miles</u>
0			0	
1			1	
2			2	
3			3	
4			4	
5			5	

[illegible]



Performance Task: What's the Better Buy?

Adapted from http://www.ait.net/lessons/Math_5.pdf

In this task, students will have to factor in the admission cost at the beginning of the numerical pattern.

STANDARDS FOR MATHEMATICAL CONTENT

MCC5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. Graph points on the coordinate plane to solve real-world and mathematical problems.

MCC5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

MCC5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

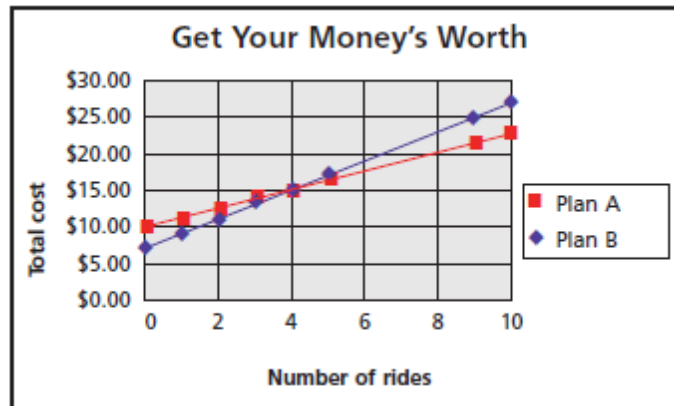
STANDARDS FOR MATHEMATICAL PRACTICE

- SMP 1. Make sense of problems and persevere in solving them.
- SMP 2. Reason abstractly and quantitatively.
- SMP 4. Model with mathematics.
- SMP 5. Use appropriate tools strategically.
- SMP 6. Attend to precision.
- SMP 7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

Students in fourth grade were exposed to generating numerical patterns given one rule. In fifth grade, students are generating numerical patterns given two rules and representing them on a coordinate grid. Previous tasks in this unit provided exposure to the coordinate grid and how to graph ordered pairs. Students will see that Plan B starts off being the better deal and costs less for fewer rides. However, the two Plans will intersect and Plan A quickly becomes the better buy. See the graph below.

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ESSENTIAL QUESTIONS

- How does the coordinate system work?
- How can the coordinate system help you better understand other map systems?
- How do coordinate grids help you organize information?
- How can we represent numerical patterns on a coordinate grid?
- What relationships can be determined by analyzing two sets of given rules?

MATERIALS

- “What’s the Better Buy” recording sheet

GROUPING

Individual/Partner/Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

Comments: In this task, students will have to factor in the admission cost at the beginning of the numerical pattern. **This may need to be discussed because students will most likely want to begin at zero. Emphasize that the starting point may not always be located at zero.**

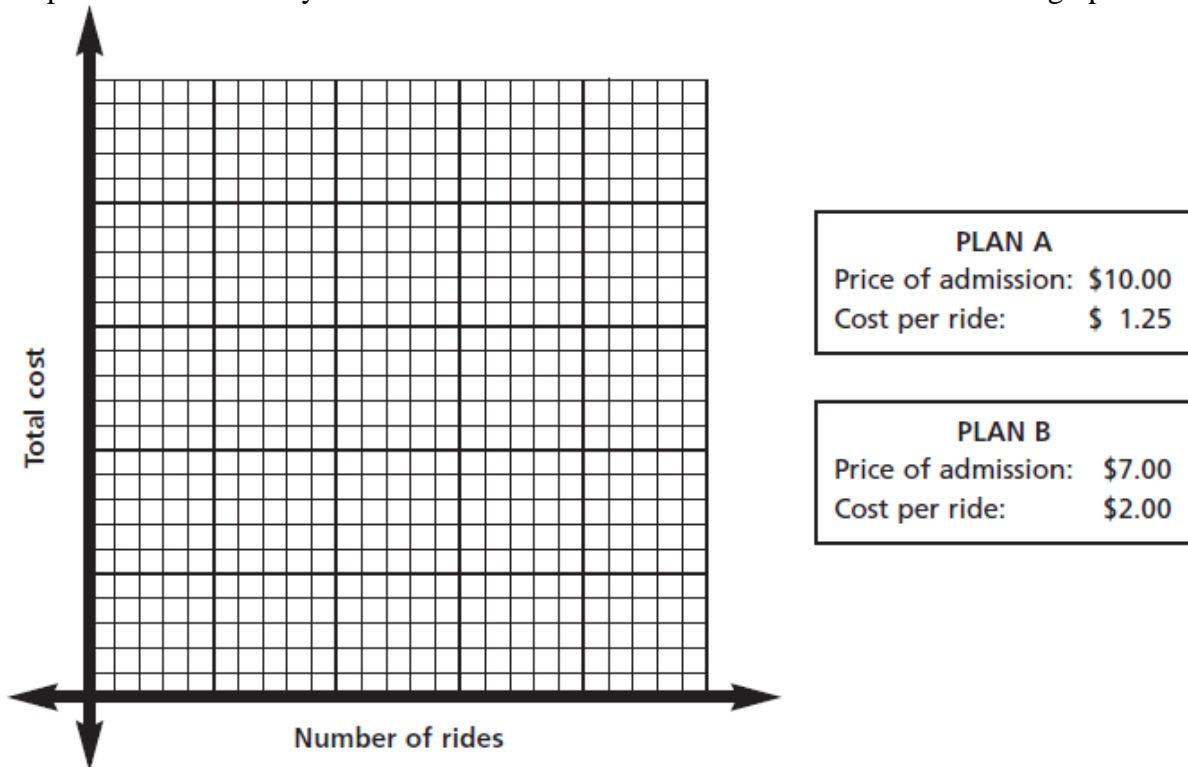
This summative task represents the level of depth, rigor, and complexity expected of all fifth grade students to demonstrate evidence of learning. The purpose of the task is to introduce real life problem solving and banking skills, while **reinforcing the concepts of decimals** taught throughout the unit. The previously taught concepts of **order of operations** and **algebraic expressions including variables** should also be reviewed as they will be reinforced through this task when solving tables A and B.

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Students should be given opportunities to revise their work based on teacher feedback, peer feedback, and metacognition which includes self-assessment and reflection.

TASK:

A new amusement park has just opened in your town and you want to make sure you get as many rides as possible for your money. The park has two cost plans for visitors. Each plan includes a fee for admission and an additional charge for each ride. It's up to you to decide which plan works best for you. Check out Plan A and Plan B in the boxes beside the graph.



Complete the table for each plan to generate ordered pairs and create a graph to represent your results. Be sure to add numbers to the x and y axis before plotting your points. Highlight each plan with a different color. Review your results and create an argument for which plan you feel is the better buy.

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Plan A-Rule	
Number of Rides	Total Cost
0	10.00
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Plan B-Rule	
Number of Rides	Total Cost
0	7.00
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Which plan is the better buy? Justify your reasoning. _____

FORMATIVE ASSESSMENT QUESTIONS

- Why do you need to plot your point where two lines intersect?
- Explain how to create, graph, and name points on the coordinate plane?
- How do you use an ordered pair to identify a point on the coordinate plane?
- Explain how grouping symbols in equations and using the order of operations makes the equation true.

DIFFERENTIATION:

Extension

- Give students the task of creating a possible third plan that “fits” between the first two and compare it to the two original plans. Students can poll classes to see which of the three would be more popular with consumers and justify why it should replace one of the other two.

Intervention

- Remove the admission cost and have students begin from zero to plot points.

Samples of Student Work:

<http://ccgpsmathematicsk-5.wikispaces.com/file/view/Work%20samples.pdf/439404436/Work%20samples.pdf>

(These are a bit topsy turvy- you can cut them apart if you print them. We are unable to fix the rotation issue as these were submitted as a single document. If you can make it better, please do!)

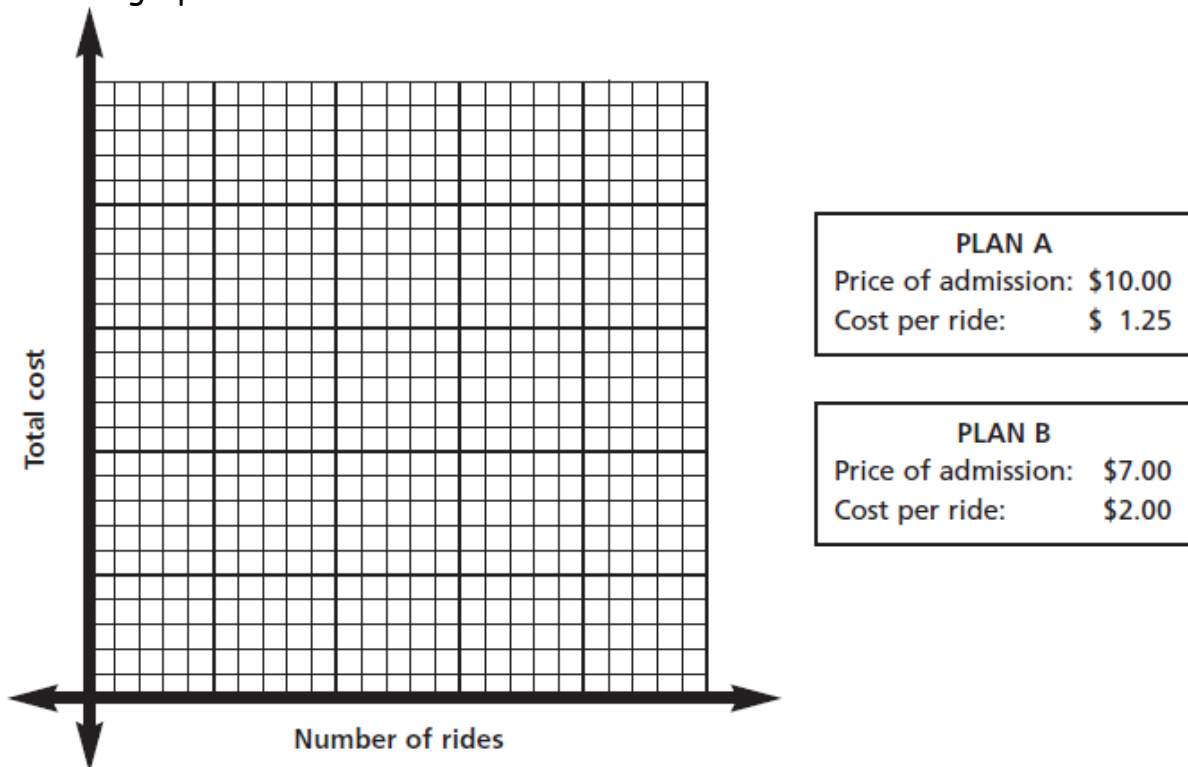
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Name _____ Date _____

What's the Better Buy?

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Complete the table for each plan to generate ordered pairs and create a graph to represent your results. Be sure to add numbers to the x and y axis before plotting your points. Highlight each plan with a different color. Review your results and create an argument for which plan you feel is the better buy.

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Plan A-Rule:

Number of Rides	Total Cost
0	10.00
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Plan B-Rule:

Number of Rides	Total Cost
0	7.00
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Which plan is the better buy? Justify your reasoning. _____
