Georgia Standards of Excellence Curriculum Frameworks

Mathematics

GSE Fifth Grade

Unit 7: Geometry and the Coordinate Plane

Georgia Department of Education

Richard Woods, Georgia's School Superintendent

"Educating Georgia's Future"

Unit 7: Geometry and the Coordinate Plane

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IF YOU HAVE NOT READ THE 5th GRADE CURRICULUM OVERVIEW IN ITS ENTIRETY PRIOR TO USE OF THIS UNIT, PLEASE **STOP** AND CLICK HERE:
https://www.georgiastandards.org/Georgia-Standards/Frameworks/5th-Math-Grade-Level-Overview.pdf

Return to the use of this unit once you've completed reading the Curriculum Overview. Thank you!

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.

For more detailed information about unpacking the content standards, unpacking a task, math routines and rituals, maintenance activities and more, please refer to the Grade Level Overview.

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.

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*****

STANDARDS FOR MATHEMATICAL CONTENT

Analyze patterns and relationships.

MGSE5.OA.3 Generate two numerical patterns using a given rule. Identify apparent relationships between corresponding terms by completing a function table or input/output table. Using the terms created, form and graph ordered pairs on a coordinate plane.

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

MGSE5.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).

MGSE5.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.

BIG IDEAS

- 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 AND SKILLS TO MAINTAIN

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

Fluency: Procedural fluency is defined as skill in carrying out procedures flexibly, accurately, efficiently, and appropriately. Fluent problem solving does not necessarily mean solving problems within a certain time limit, though there are reasonable limits on how long computation should take. Fluency is based on a deep understanding of quantity and number.

Deep Understanding: Teachers teach more than simply "how to get the answer" and instead support students' ability to access concepts from a number of perspectives. Therefore students are able to see math as more than a set of mnemonics or discrete procedures. Students demonstrate deep conceptual understanding of foundational mathematics concepts by applying them to new situations, as well as writing and speaking about their understanding.

Memorization: The rapid recall of arithmetic facts or mathematical procedures. Memorization is often confused with fluency and automaticity. Fluency implies a much richer kind of mathematical knowledge and experience.

Number Sense: Students consider the context of a problem, look at the numbers in a problem, make a decision about which strategy would be most efficient in each particular problem. Number sense is not a deep understanding of a single strategy, but rather the ability to think flexibly between a variety of strategies in context.

Fluent students:

- flexibly use a combination of deep understanding, number sense, and memorization.
- are fluent in the necessary baseline functions in mathematics so that they are able to spend their thinking and processing time unpacking problems and making meaning from them.
- are able to articulate their reasoning.
- find solutions through a number of different paths.

For more about fluency, see: http://www.youcubed.org/wp-content/uploads/2015/03/FluencyWithoutFear-2015.pdf and: https://bhi61nm2cr3mkdgk1dtaov18-wpengine.netdna-ssl.com/wp-content/uploads/nctm-timed-tests.pdf

STRATEGIES FOR TEACHING AND LEARNING

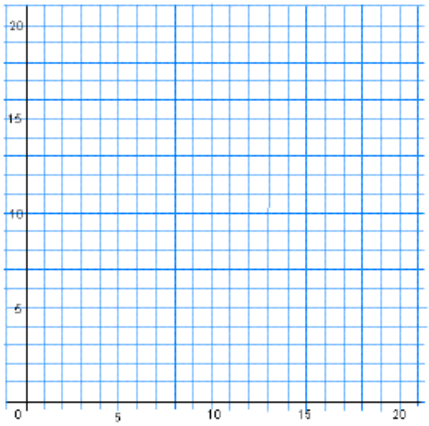
Operations and Algebraic Thinking Cluster: Analyze patterns and relationships. MGSE5.OA.3

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
3	12
4	16

0	0
1	8
2	16
3	24
4	32

Geometry Cluster: Graph points on the coordinate plane to solve real-world and mathematical problems. MGSE5.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.

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**

Mathematics Glossary
http://www.corestandards.org/Math/Content/mathematics-glossary/glossary

TASKS

Scaffolding Task	Tasks that build up to the learning task.
Constructing 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.
Intervention Table	The Intervention Table provides links to interventions specific to this unit. The interventions support students and teachers in filling foundational gaps revealed as students work through the unit. All listed interventions are from New Zealand's Numeracy Project.
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 Career and Technical Education knowledge and skills can be integrated. The tasks provide teachers with realistic applications that combine mathematics and CTE content.
3-Act Task	A Three-Act Task is a whole-group mathematics task consisting of 3 distinct parts: an engaging and perplexing Act One, an information and solution seeking Act Two, and a solution discussion and solution revealing Act Three. More information along with guidelines for 3-Act Tasks may be found in the ***Guide to Three-Act Tasks*** on georgiastandards.org.

Task Name	Task Type/Grouping Strategy	Content Addressed	Standard(s)	Task Description
Shoo-Fly	Practice/Small group or pairs	Plotting points on a coordinate grid	MGSE5.G.1 MGSE5.G.2	Discovering how to plot points on a coordinate grid
Air Traffic Controller	Practice/Small group	Plotting points on a coordinate grid	MGSE5.G.1 MGSE5.G.2	Using a coordinate grid as a map
Beads under the Clouds	FAL	Generating numerical patterns	MGSE5.G.1 MGSE5.G.2 MGSE5.OA.3	Formative Assessment
Atlanta Landmarks	Scaffolding Task/Individual	Plotting points on a coordinate grid	MGSE5.G.1 MGSE5.G.2	Plotting points on a coordinate grid and using it as a map
Earth Day Project	Scaffolding/Individual, small group, or partner	Generating numerical patterns from two given rules and graphing using a coordinate grid	MGSE5.G.1 MGSE5.G.2 MGSE5.OA.3	Using a table to plot points on a coordinate grid
First to Arrive	Constructing Task/Individual	Generating numerical patterns from two given rules and graphing on a coordinate grid	MGSE5.G.1 MGSE5.G.2 MGSE5.OA.3	Determining which vehicle is the fastest using a coordinate grid
What's the Better Buy?	Performance Task/Individual	Generating numerical patterns from two given rules and graphing using a coordinate grid	MGSE5.G.1 MGSE5.G.2 MGSE5.OA.3	Plotting a numerical pattern on a coordinate grid
The Slow Forty	Culminating Task 3-Act Task	Generating numerical sequences and graphing using a coordinate grid	MGSE5.G.1 MGSE5.G.2 MGSE5.OA.3	Wonderings about football and the forty yard dash
Coordinate Grid Geoboards	Scaffolding Task/Pairs	Creating polygons on geoboards and plotting the vertices a coordinate grid	MGSE5.G.1 MGSE5.G.2	Plotting points and comparing it to the polygon on the geoboard

IF YOU NEED FURTHER INFORMATION ABOUT THIS UNIT, VISIT THE GaDOE WEBSITE AND REFERENCE THE UNIT WEBINARS.
https://www.georgiastandards.org/Archives/Pages/default.aspx

INTERVENTION TABLE

The Intervention Table below provides links to interventions specific to this unit. The interventions support students and teachers in filling foundational gaps revealed as students work through the unit. All listed interventions are from New Zealand's Numeracy Project.

Cluster of Standards	Name of Intervention	Snapshot of summary or Student I can statement. . .	Materials Master
Graph points on the coordinate plane to solve real-world and mathematical problems **MGSE5.G.1** **MGSE5.G.2** Analyze patterns and relationships **MGSE5.OA.3**	Mapping Relationships	Understand the connection between the coordinate systems of maps and graphs Use a 'mapping diagram' to show a number relationship.	Resource Master
Analyze patterns and relationships **MGSE5.OA.3**	Pede Patterns	Generalize a rule for a pattern and continue the pattern.	
	Operation Time	Use tables to represent and continue patterns.	Resource Master
	Spreadsheet Challenge	Create a table using a spreadsheet with a rule formula	Resource Master
	Bits and Pieces	Use a table to find and predict patterns	Resource Master
	Doubles Rules	Find a number rule using two calculators	Resource Master
	Seeing Dots	Find a rule to describe a geometric pattern	Resource Master Square Dot Paper

Practice Task: Shoo-Fly

Back to Task Table

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
Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

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

MGSE5.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).

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
4. Model with mathematics.
6. Attend to precision.
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.
- 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 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:

The two games in this task require students to locate points on a coordinate grid and name ordered pairs.
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, there is a modified grid system on the ceiling because of the ceiling tiles.) 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 off the lights 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.

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:

- 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.

Intervention Table

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."

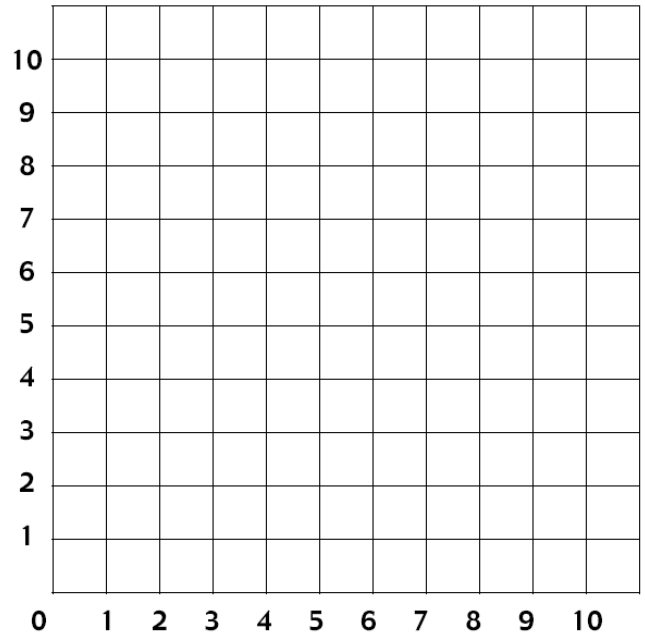
Directions:
(This game is similar to Battleship.)

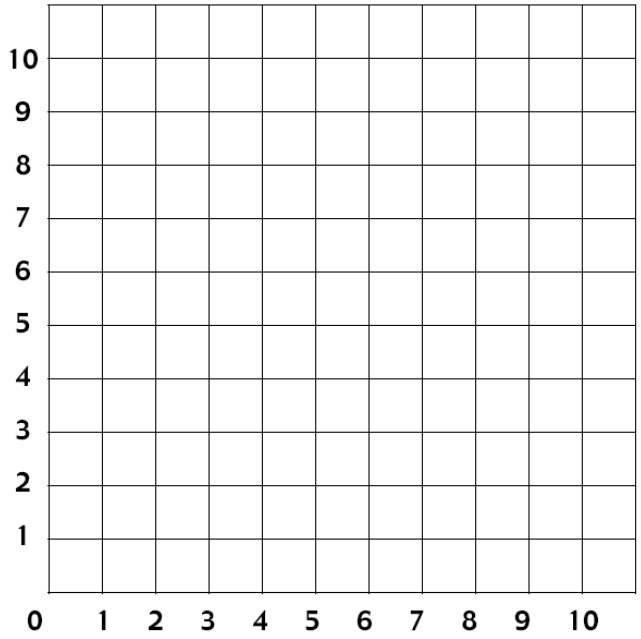
- Each player has five fly families: one (1) family of two, two (2) families of three and two (2) families of four.
- Provide each player with a "Shoo Fly, Game Board" student recording sheet. Have them draw their fly families on the top grid using a water based Vis-à-Vis® marker. They can draw the families 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.

Name _____ Date _____

Shoo Fly

Game Board





Name _____ Date _____

Fly Tic-Tac-Toe

Directions

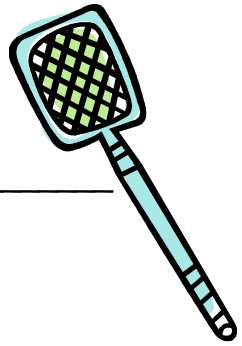
Materials: "Fly Tic-Tac-Toe, Directions" student sheet
"Fly Tic-Tac-Toe, Game board," student recording sheet
Pencil

Number of Players: 2

Objective: To mark four points in a row

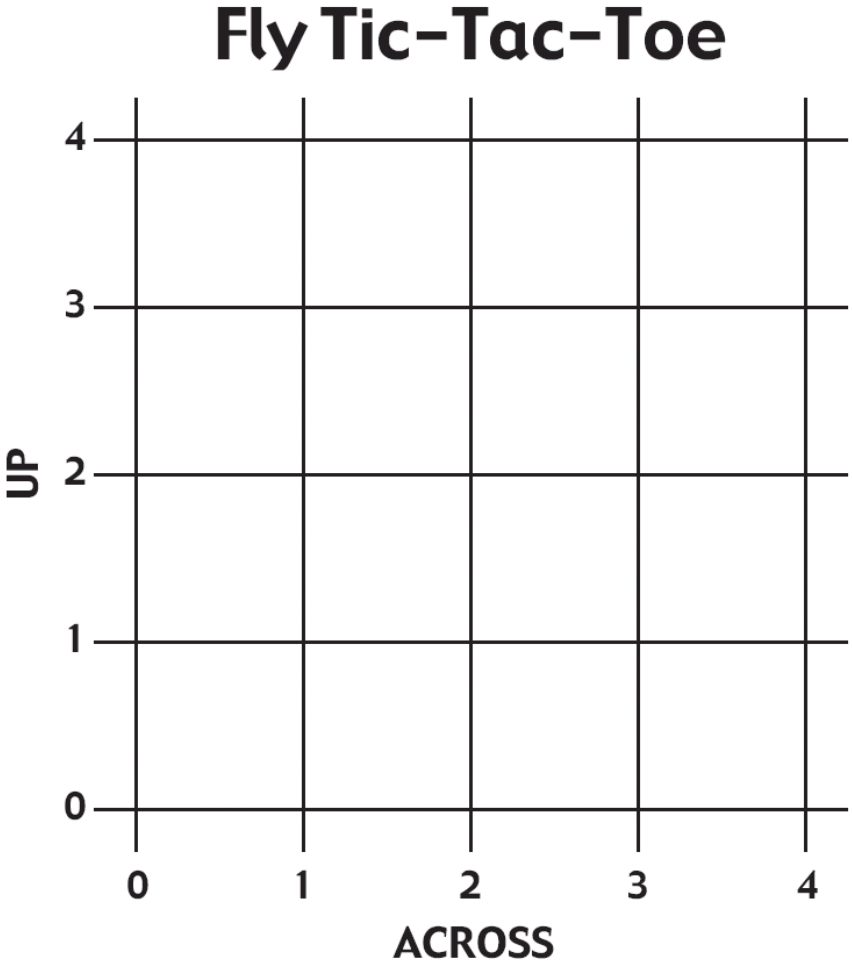
Directions:

- 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 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.



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
(	)
(	)
(	)
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Game Board

Practice Task: Air Traffic Controller

Back to Task Table

Adapted from "Paths-Activity 20.22" in Van de Walle's Elementary and Middle School Mathematics, Teaching Developmentally
Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

MGSE5.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).

MGSE5.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

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

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

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.

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

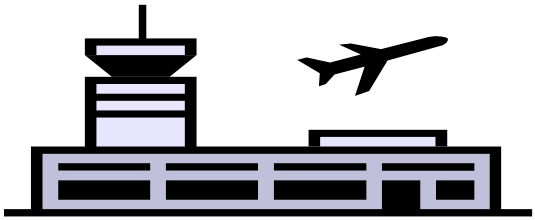
- If students are still struggling with plotting points on the coordinate plane, there are two activities in Van de Walle's Elementary and Middle School Mathematics Teaching Developmentally: Activity 20.21 "Hidden Positions" and Activity 20.22 "Paths".

Intervention Table

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,

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:

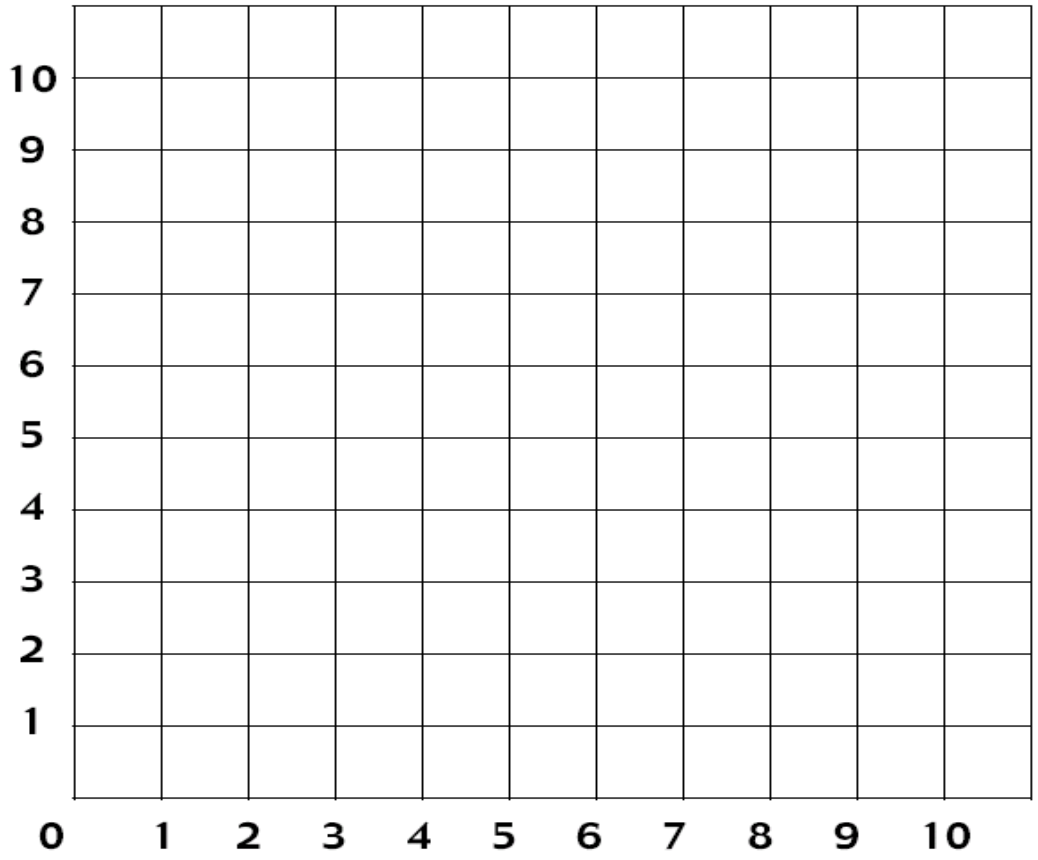
1. Highlight or shade each plane's flight path a different color with a key at the bottom that shows which color represents each plane.
2. Put your name on your papers.
3. Turn them in to the FAA President.

Name _____ Date _____

Air Traffic Controller

Flight Plan

	Name & Color	Coordinates
Plane #1		
Plane #2		
Plane #3		



Beads Under the Clouds (FAL)

Formative Assessments Lessons (FALs)

Back to Task Table

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
Kentucky Department of Education FALs
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 https://education.ky.gov/curriculum/conpro/Math/Pages/ElemFormAssessLessons.aspx.

Scaffolding Task: Atlanta Landmarks

Back to Task Table

Adapted from Howard County, Maryland
Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

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

MGSE5.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).

MGSE5.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

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

BACKGROUND KNOWLEDGE

Students haven't been taught about the coordinate grid in the past. This is their first time being exposed to the coordinate grid. It is important for students to know there are four quadrants in the grid but the students will only be working in quadrant one. This task is simply assisting students in determining locations of points on the plane. Future tasks require them to determine mathematical connections between x and y coordinates.

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

MATERIALS

- "Atlanta Landmarks" recording sheet

GROUPING

Individual task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this lesson students will review plotting points and labeling axis. Students plot various Atlanta landmarks and then analyze their map. Students must ensure that the graph is labeled correctly and that someone could recreate their graph from their story.

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 plot the famous landmarks of Atlanta, Georgia.
- Have the students observe their graph and determine the relationships between the landmarks.
- Students will then analyze the coordinate grid.

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 can you use a coordinate grid to determine locations?

DIFFERENTIATION

Extension

- Have students add more landmarks to the coordinate grid using a map of Atlanta, Georgia.

Intervention

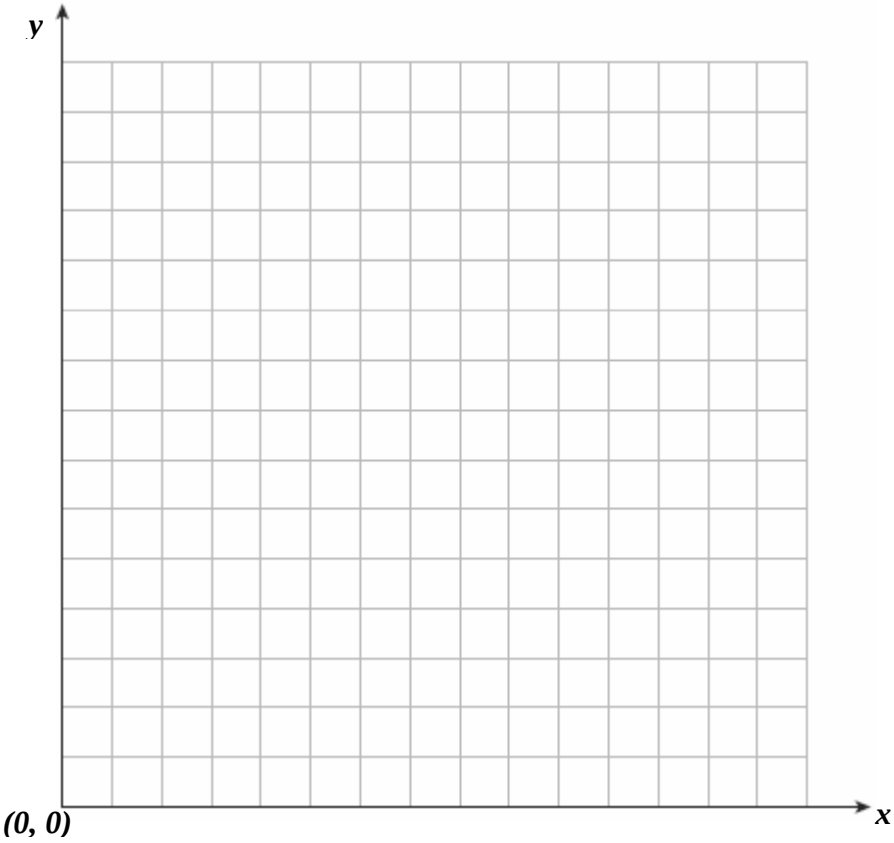
- Have students only plot three of the Atlanta, Georgia landmarks.

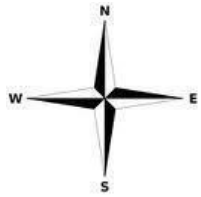
Intervention Table

Name _____ Date _____

Atlanta Landmarks

Directions: Use the coordinate grid to plot some famous landmarks of Atlanta, Georgia. Label each point.





World of Coca Cola at origin (3, 0)

Truist Park (0, 9)

Georgia Aquarium at (2, 1)

Fernbank Natural History Museum at (6, 5)

Stone Mountain at (14, 6)

Name a landmark located south of the Georgia Aquarium? Explain how you can tell that this landmark is south of the Aquarium just by looking at its coordinate points.

_____

_____

_____

_____

_____

Scaffolding Task: Earth Day Project

Back to Task Table

Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

MGSE5.OA.3 Generate two numerical patterns using a given rule. Identify apparent relationships between corresponding terms by completing a function table or input/output table. Using the terms created, form and graph ordered pairs on a coordinate plane.
Graph points on the coordinate plane to solve real-world and mathematical problems.

MGSE5.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).

MGSE5.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 grade and is addressed in this task.
MGSE4.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.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
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× ☐ + 1, where ☐ 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 (☐ + 1) × 4 – 3, with the ☐ representing the number of the day. Using the distributive property gives you 4 × ☐ + 4 – 3, which is the same as 4 × ☐ + 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 do coordinate grids help you organize information?
- How can we represent numerical patterns on a coordinate grid?

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

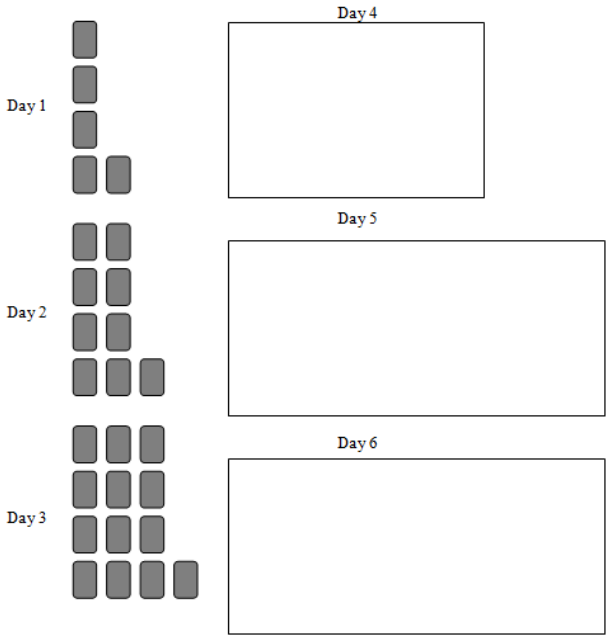
In this activity, students consider a real-world situation involving a set of data. Using the data, students determine the pattern formed by the numbers in the data set. Then they extend the pattern and use the pattern to make predictions.

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	____

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 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 25^{th} 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 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.

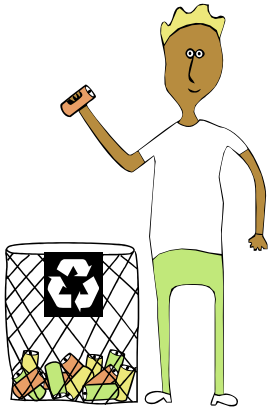
Intervention

- 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.

Intervention Table

Name_____ Date _____

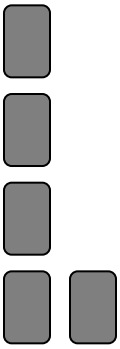
Earth Day Project



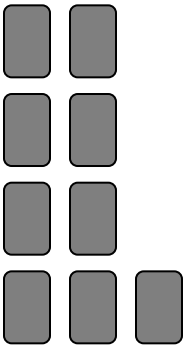
Fifth graders in Ms. Smith's class have decided to start a recycling project for Earth Day. They put a bin in the cafeteria to collect used aluminum cans. At the end of each school day, they take the bin back to their classroom and count the cans collected for the day. Ms. Smith's class is keeping notes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

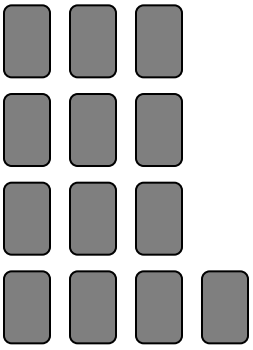
Day 1



Day 2



Day 3



Day 4

Day 5

Day 6

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?

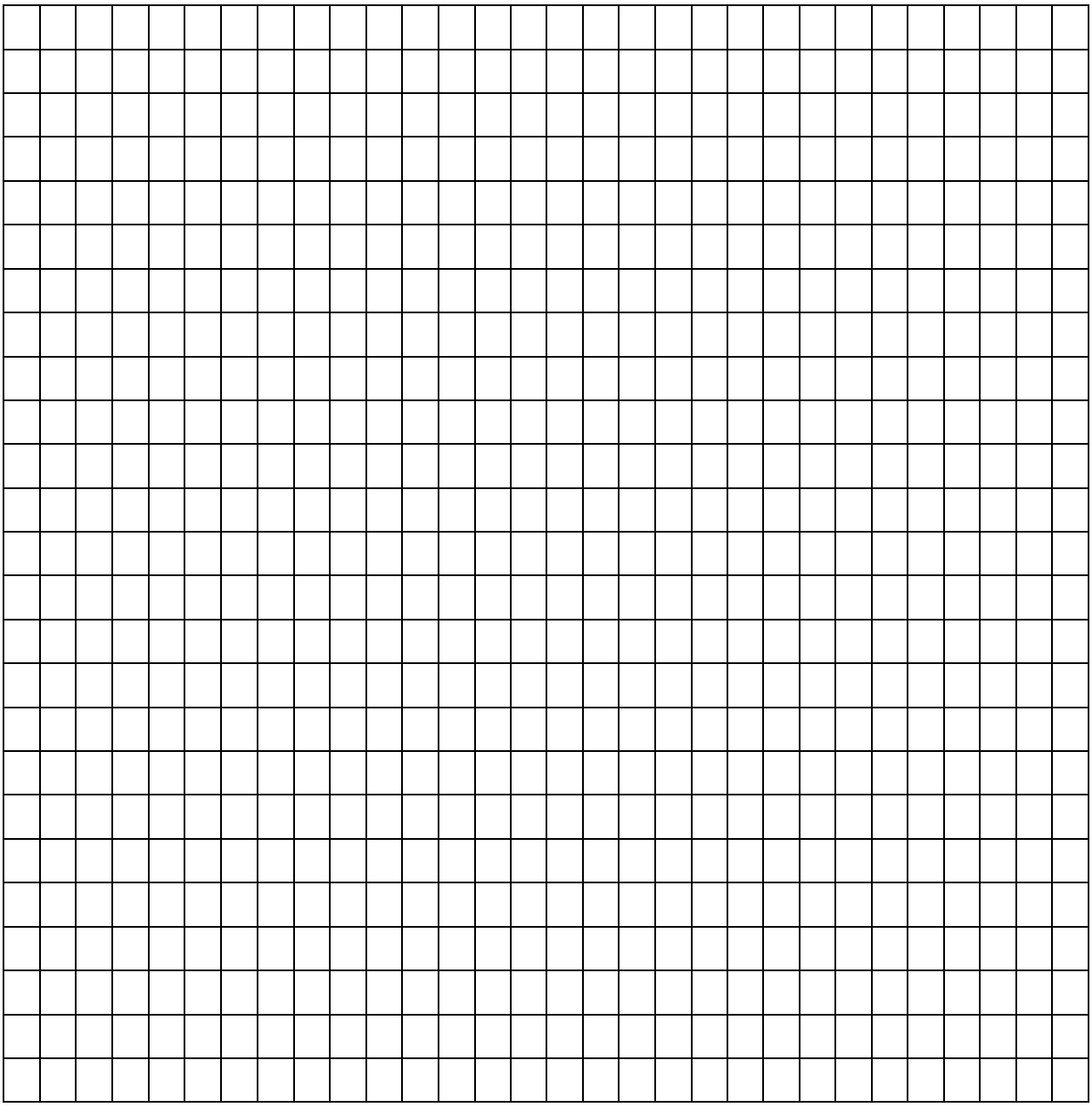
1. Use what you know about the cans collected in the first five days to make a prediction about how many days it will take to collect at least 100 cans. Show your work and explain in words why you predicted the number of days that you chose.

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	____

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

Back to Task Table

Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

MGSE5.OA.3 Generate two numerical patterns using a given rule. Identify apparent relationships between corresponding terms by completing a function table or input/output table. Using the terms created, form and graph ordered pairs on a coordinate plane.

MGSE5.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).

MGSE5.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

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
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 do coordinate grids help you organize information?
- How can we represent numerical patterns on a coordinate grid?

MATERIALS

- "First to Arrive" recording sheet
- Centimeter grid paper

GROUPING

Individual task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:

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

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	
Number of Hours	Total Miles		Number of Hours	Total Miles
0			0	
1			1	
2			2	
3			3	
4			4	
5			5	

FORMATIVE ASSESSMENT QUESITONS

- 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.

Intervention Table

Name _____ Date _____

First to Arrive

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, graph the data by creating a coordinate grid, and include a justification for your reasoning.

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

Justification:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Performance Task: What's the Better Buy?

Back to Task Table

Adapted from http://www.ait.net/lessons/Math_5.pdf
Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

MGSE5.OA.3 Generate two numerical patterns using a given rule. Identify apparent relationships between corresponding terms by completing a function table or input/output table. Using the terms created, form and graph ordered pairs on a coordinate plane.
Graph points on the coordinate plane to solve real-world and mathematical problems.

MGSE5.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).

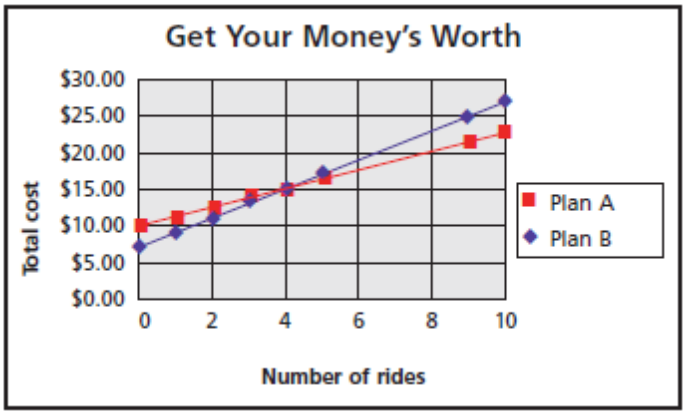
MGSE5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
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.



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:

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

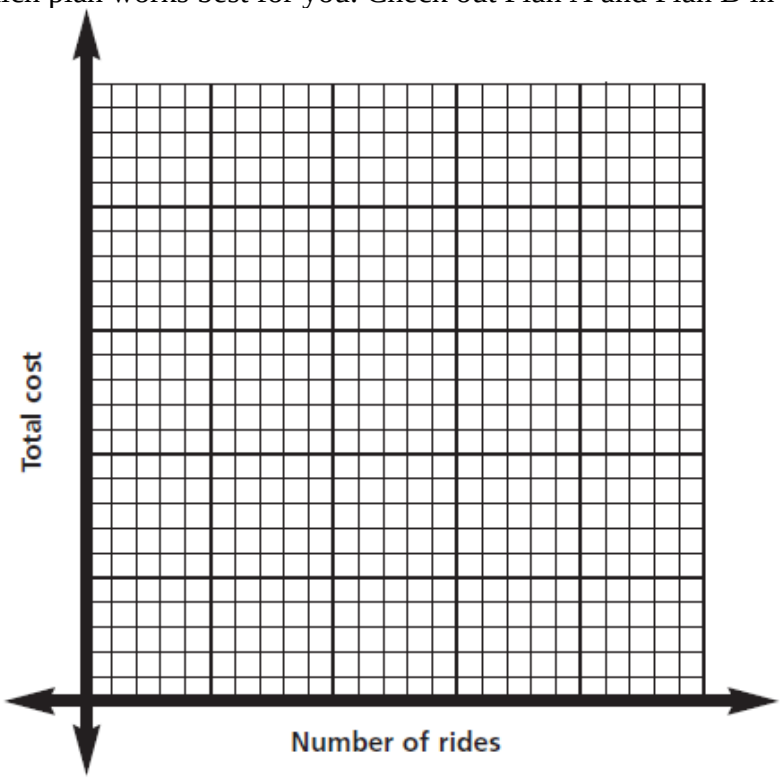
Comments: In this task, students will have to factor in the admission cost at the beginning of the numerical pattern. **This may need to be discussed because students will most likely want to begin at zero. Emphasize that the starting point may not always be located at zero.**

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.

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.



PLAN A	
Price of admission:	$10.00
Cost per ride:	$ 1.25

PLAN B	
Price of admission:	$7.00
Cost per ride:	$2.00

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.

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.

Intervention Table

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Fifth Grade Mathematics • Unit 5

Plan A-Rule: +1.25

Number of Rides	Total Cost
0	10.00
1	11.25
2	12.50
3	13.75
4	15.00
5	16.25
6	17.50
7	18.75
8	20.00
9	21.25
10	22.50

Plan B-Rule: +2.00

Number of Rides	Total Cost
0	7.00
1	9.00
2	11.00
3	13.00
4	15.00
5	17.00
6	19.00
7	21.00
8	23.00
9	25.00
10	27.00

Which plan is the better buy? Justify your reasoning. Plan A is the better plan for me, because I can ride a ton of rides for 22.50 or I can ride a little bit of rides for 21.00, but also I can get snacks, Plan A is best for me because I like to ride alot of rides.

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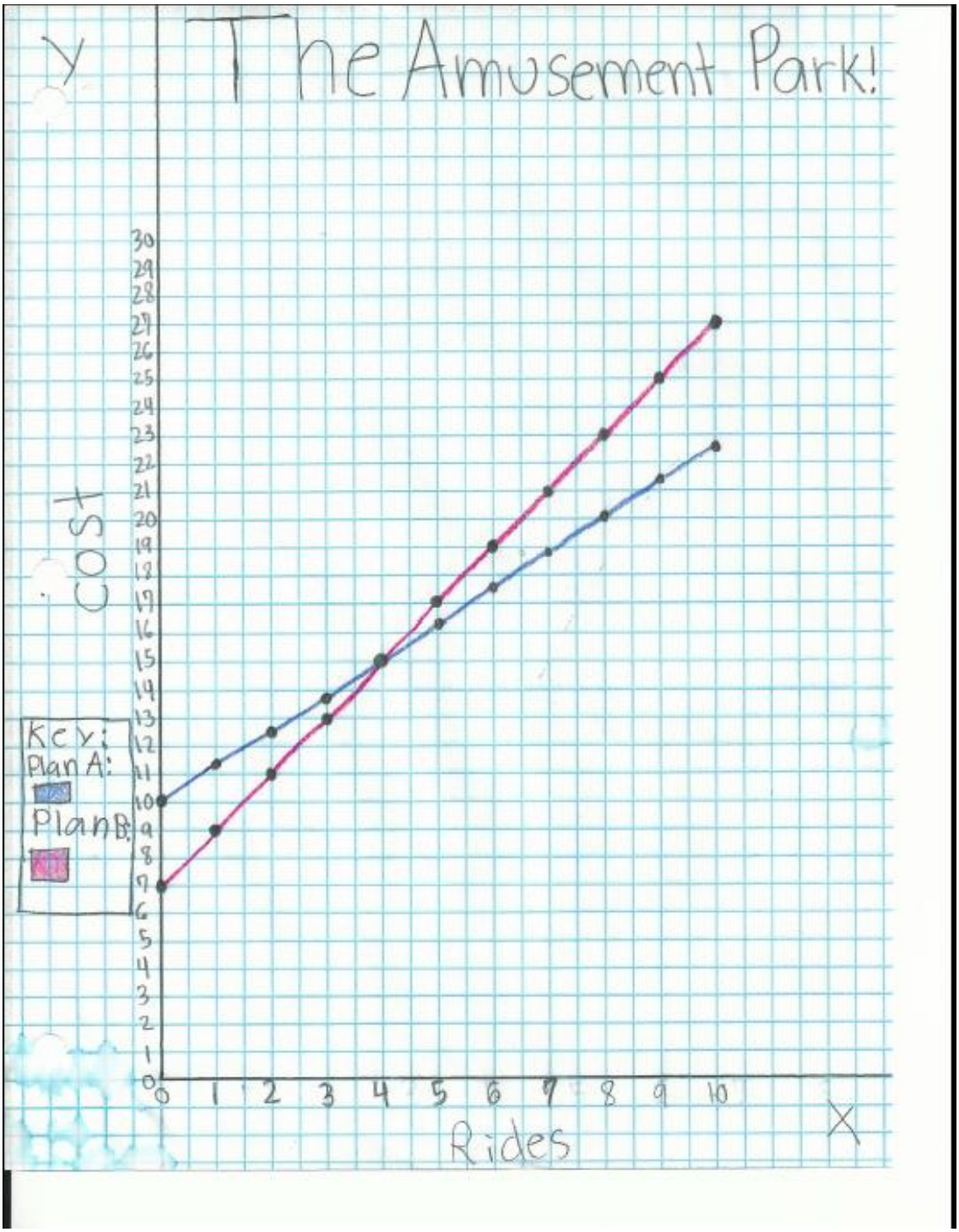
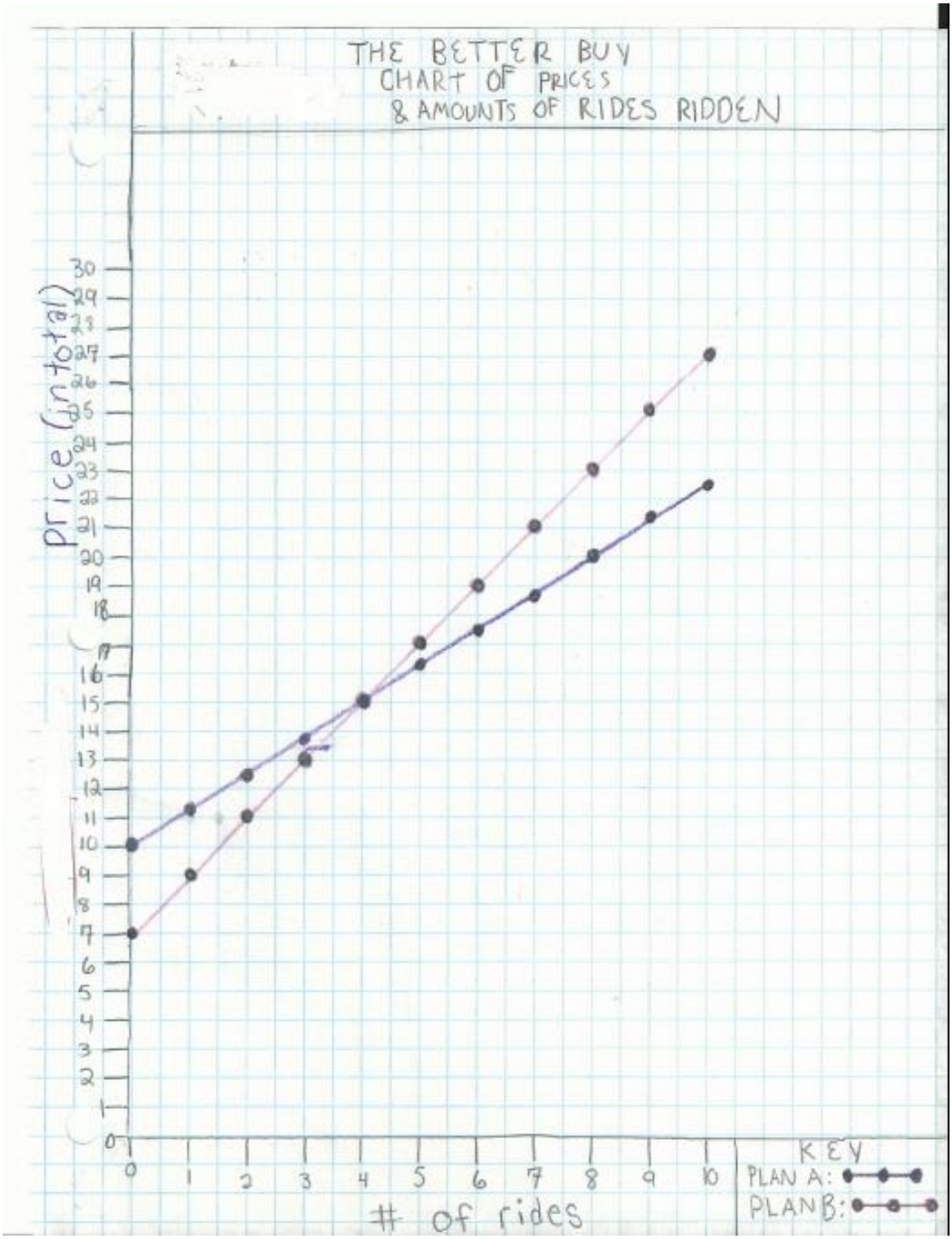
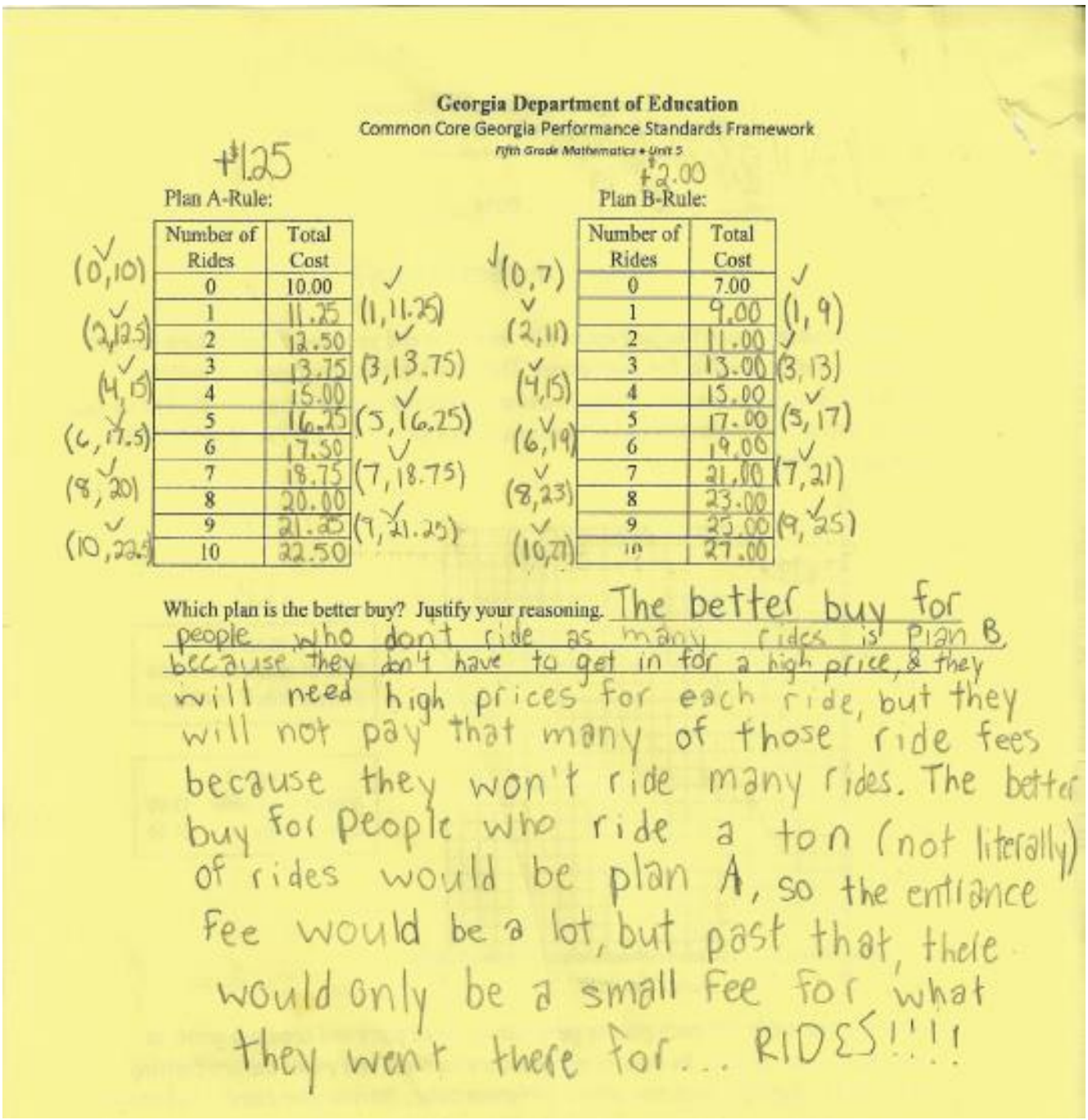






Georgia Department of Education
Common Core Georgia Performance Standards Framework
Fifth Grade Mathematics • Unit 5

+$1.25

Plan A-Rule:

Number of Rides	Total Cost
0	10.00
1	11.25
2	12.50
3	13.75
4	15.00
5	16.25
6	17.50
7	18.75
8	20.00
9	21.25
10	22.50

(0,10) (1,11.25) (2,12.5) (3,13.75) (4,15) (5,16.25) (6,17.5) (7,18.75) (8,20) (9,21.25) (10,22.5)

+$2.00

Plan B-Rule:

Number of Rides	Total Cost
0	7.00
1	9.00
2	11.00
3	13.00
4	15.00
5	17.00
6	19.00
7	21.00
8	23.00
9	25.00
10	27.00

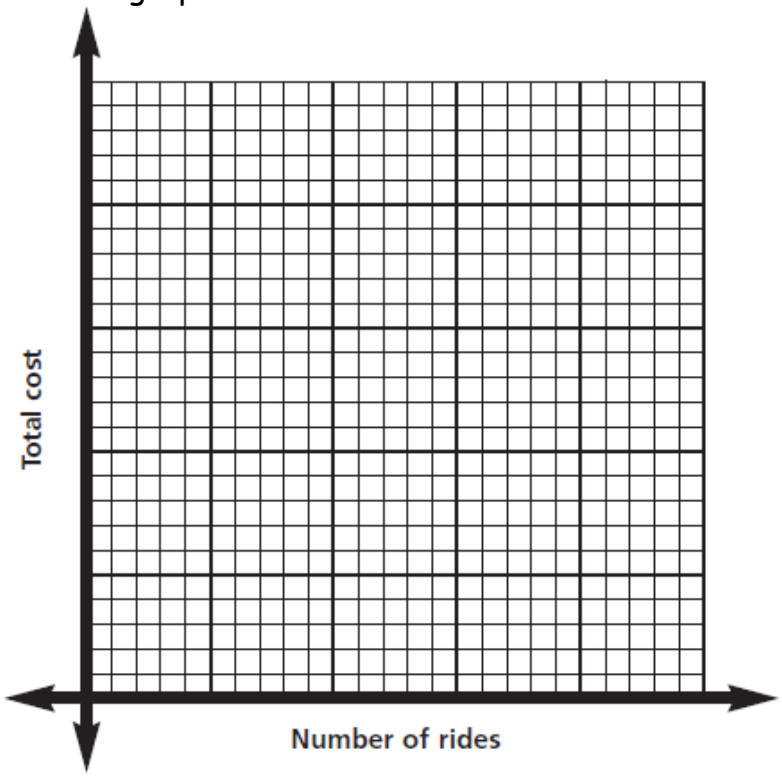
(0,7) (1,9) (2,11) (3,13) (4,15) (5,17) (6,19) (7,21) (8,23) (9,25) (10,27)

Which plan is the better buy? Justify your reasoning. The better buy for people who don't ride as many rides is Plan B, because they don't have to get in for a high price, & they will need high prices for each ride, but they will not pay that many of those ride fees because they won't ride many rides. The better buy for people who ride a ton (not literally) of rides would be plan A, so the entrance fee would be a lot, but past that, there would only be a small fee for what they went there for... RIDES!!!!

Name _____ Date _____

What's the Better Buy?

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.



PLAN A	
Price of admission:	$10.00
Cost per ride:	$ 1.25

PLAN B	
Price of admission:	$7.00
Cost per ride:	$2.00

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.

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. _____

_____

_____

_____

_____

_____

_____

3 ACT TASK: The Slow Forty

Back to Task Table

Task adapted from Dan Meyer (http://threeacts.mrmeyer.com/theslowforty/)
Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

MGSE5.OA.3 Generate two numerical patterns using a given rule. Identify apparent relationships between corresponding terms by completing a function table or input/output table. Using the terms created, form and graph ordered pairs on a coordinate plane.

MGSE5.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).

MGSE5.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

1. Make sense of problems and persevere in solving them. After watching the video, students will pair pieces of data into ordered pairs and graph the data to tell a story. Students will make sense of images detailing the run in 10 yard increments in order to extract the necessary data that will allow generalizations to be made of how his run progressed over time. The data that can be gathered from the images are time, strides, miles per hour and total yards.

5. Use appropriate tools strategically. Students will organize data in tables and charts with appropriate headings to help determine if there is a rule for the data being gathered. Knowing the rule or relationship between the data helps make predictions about future performances. Students will create graphs that display the data gathered. Students will need to pick the most appropriate increments to display the information in the graph.

6. Attend to precision. After watching a video of Rich Eisen running 40 yards, students will gather precise information about his run by looking at data provided for each 10 yard mark. Students will accurately graph the data, labeling axes with headings, so that they can make generalizations about the story of Rich Eisen's 40 yard run shown in the video.

7. Look for and express regularity in repeated reasoning. As they work with the data gathered in this problem, students will work to find patterns that they see occurring between the pieces of data. Once a relationship is noticed, students work to find the most efficient way of using that relationship

to repeat calculations. In addition, the goal of the student is to make generalizations about Rich Eisen's performance during the 40 yard run using the relationships discovered between the data gathered and the resulting graph.

ESSENTIAL QUESTIONS

During Act 1, students view a video Rich Eisen running his yearly 40 yard run at an NFL Scouting Combine. It is imperative that teachers allow students to ask questions of each other and participate in discussion that will lead the students to infer that information during Act 2. Students will gather mathematical data about the run using images from the video during Act 2. The essential questions below can be shared at the beginning of Act 2 to define the emphasis of the problem solving opportunity being presented.

- How does the coordinate grid system help organize information?
- What generalizations and predictions can be made using the data displayed in graphs like a coordinate grid?
- What relationships can be determined between two sets of data?

MATERIALS

Act 1 video "The Slow Forty" http://threeacts.mrmeyer.com/theslowforty/
Student recording sheet
Act 2 images (attached)
Graph paper

GROUPING

Whole group, partners or small groups

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Students will watch a video of Rich Eisen, a sportscaster, running a 40 yard dash. In 2005, during an interview with a player, Eisen wondered how fast he could run 40 yards. Since that interview, he has run a yearly 40 yard dash at an NFL Scouting Combine. After watching video, students will be asked to discuss what they wonder about or are curious about mathematically. These questions will be recorded on a class chart or on the board and on the student recording sheet. Students will then use mathematics to answer one of the questions generated on the chart. Students will be given information to solve the problem based on need. When they realize they don't have the information they need, and ask for it, it will be given to them.

BACKGROUND KNOWLEDGE

This task follows the 3-Act Math Task format originally developed by Dan Meyer. More information on this type of task may be found at http://blog.mrmeyer.com/category/3acts/. A Three-Act Task is a whole-group mathematics task consisting of 3 distinct parts: an engaging and perplexing Act One, an

information and solution seeking Act Two, and a solution discussion and solution revealing Act Three. More information along with guidelines for 3-Act Tasks may be found in the ***Guide to Three-Act Tasks*** on georgiastandards.org.

In this problem, students are given an example of a real world situation that contains data that can be gathered and organized into two numerical sequences. Students can gather data about the following aspects of Rich Eisen's 40 yard dash:

- time
- yards completed
- miles per hour
- number of strides

Students could choose to collect data on the yards completed and the number of strides taken. Students could also choose to gather data on the time and miles per hour he has traveled. Students have flexibility in choosing the data they would like to use to make generalizations about the progress of Eisen's run.

Once the student gathers the data using the images in Act 2, the students will organize the data so that ordered pairs can be formed. Students will use the ordered pairs to graph the data using the coordinate system. It is important for students to experience how important it is to precisely locate where the ordered pair would be placed. If an ordered pair is placed incorrectly, the accuracy of predictions and inferences can be affected.
Students will use the numerical sequences and the resulting graph to make generalizations about Rich Eisen's performance on that particular day and predict what his performance might be like in the future. Students need to be able to take an ordered pair from the graph and explain what it means in the context of the problem. They should also be able to predict what would happen if Eisen continued to run an additional 10, 20 or 30 yards given the relationship between the two sets of data in the graph. For instance, the data in the chart below shows Rich Eisen's time and the number of strides taken at that time.

Time (in seconds)	**Number Of Strides Taken**	**Ordered Pair**
0	0	(0,0)
3	7	(3,7)
4	13	(4,13)
5	19	(5,19)
7	25	(7,25)

Looking at the data in the chart, a student could predict that if the race continued, Eisen would reach 31 strides in eight or nine seconds. Students can make viable arguments to support their claims using the data that shows what has already occurred in the run. Students could also generalize that if Eisen continued to run for another seven seconds, he would take around 50 strides to complete the run. Given the variety of data that students can use in this task, there are many other generalizations that students can make about the run shown in the video.

COMMON MISCONCEPTIONS

It is important that students see the connection between the numerical patterns that they discover and the resulting graph that serves as a visual representation of the relationship between the data. If taught in isolation, students might think that tables or charts are the only way to organize data in numerical sequences, when coordinate grids are an additional way that the information can be organized.

It is also common to see students only noticing the relationship between the *x* coordinates in the table or just the *y* coordinates in the table. While students need to see those patterns, it is important to support them as they discover the relationship between the *x* and *y* coordinates. Students would benefit from hearing explicit teacher or peer think alouds as they develop their proficiency in this area.

TASK DIRECTIONS

Act 1 – Whole Group - Pose the conflict and introduce students to the scenario by showing Act I video or picture. **(Dan Meyer** http://blog.mrmeyer.com/2011/the-three-acts-of-a-mathematical-story/**)** **"Introduce the central conflict of your story/task clearly, visually, viscerally, using as few words as possible."**

- Show the Act 1 video "The Slow Forty" to students. Since this task has been adapted, show the video under Act 3. The Act 1 video has covered the miles per hour (mph) Eisen is traveling. http://threeacts.mrmeyer.com/theslowforty/
- Ask students what they noticed in the video, what they wonder about, and what questions they have about what they saw in the video.
- Give each student a copy of the Student Recording Sheet. Have students record their questions and curiosities in the Act 1 section that asks "What mathematical questions come to your mind?" Consider doing a think-pair-share so that students have an opportunity to talk with each other before sharing questions with the whole group. Students may need to watch the video several times.
- Share and record students' questions. The teacher may need to guide students so that the questions generated are math-related.
- Share the main question that will be investigated during today's lesson. In the list below it is denoted with an asterisk. (*) Students will record the main question on their recording sheet.
- For this task, allow students to estimate answers for how fast the runner was traveling and how long it took the runner to travel forty yards. (think-pair-share). Students will write their best estimate, then write two more estimates – one that is too low and one that is too high so that they establish a range in which the solution should occur. Students should plot their three estimates on a number line. Space is available on the recording sheet for students to record an open number line with all three estimates.

Anticipated questions students may ask and wish to answer:

- What distance did the man run?
- How long did it take the man to run the entire distance?
- How fast is he running?
- What are strides? How do the strides relate to how fast he is running?
- *What story does the data tell about the man's run?
- What is the relationship between the man's time and how fast he is running?

**Main question(s) to be investigated*

Act 2 – **Student Exploration** - Provide additional information as students work toward solutions to their questions. **(Dan Meyer** http://blog.mrmeyer.com/2011/the-three-acts-of-a-mathematical-story/**)**
"The protagonist/student overcomes obstacles, looks for resources, and develops new tools."

- During Act 2, students review the main question from Act 1 and decide on the facts, tools, and other information needed to answer the question. The main question for this task is "What story does the data tell about the man's run?"
- When students decide what they need to solve the problem, they should ask for those things. It is pivotal to the problem solving process that students decide what is needed without being given the information up front. Images from the video are available for student viewing. The images show Rich Eisen at every ten yard mark with the time in seconds, number of strides and miles per hour data. Copies of the images can be given to the students at their request. The document with the images are attached.
- Students can record information that they need to solve the problem, given information, estimates and work on the student recording sheet under Act 2.
- The teacher provides guidance as needed during this phase. Students should be led to create a two column chart that contains two sets of data. Students could select to look at the relationship between the time every ten yards and the number of strides taken. They could also look at the relationship between the time every ten yards and the miles per hour he was running. Students could also investigate the relationship between the number of strides taken every ten yards and the miles per hour he was running. There are many ways to pair the data to create ordered pairs that can be plotted on a coordinate grid to show the story of Rich Eisen's run.
- Some groups might need scaffolds to guide them. The teacher should question groups who seem to be moving in the wrong direction or might not know where to begin. Questioning is an effective strategy that can be used, with questions such as:
    - What is the problem you are trying to solve?
    - What do you think affects the situation?
    - Can you explain what you've done so far?
    - What strategies are you using?
    - What assumptions are you making?
    - What tools or models may help you?
    - Why is that true?
    - Does that make sense?

Additional Information for Act 2

Act 2 images video (attached)

Important note: Although students will only investigate the main question for this task, it is important for the teacher to not ignore student generated questions. Additional questions may be answered after they've found a solution to the main question, or as homework or extra projects.

Act 3 – Whole Group – Share solutions and strategies.

- Students present their coordinate grids and ordered pairs.
- Students explain strategies used and compare them.
- Lead discussion to compare these, asking questions such as:
    - How reasonable was your estimate?
    - Which strategy was most efficient?
    - Can you think of another method that might have worked?
    - What might you do differently next time?

Act 4, The Sequel - "The goals of the sequel task are to a) challenge students who finished quickly so b) I can help students who need my help. It can't feel like punishment for good work. It can't seem like drudgery. It has to entice and activate the imagination." Dan Meyer
http://blog.mrmeyer.com/2013/teaching-with-three-act-tasks-act-three-sequel/

Rich Eisen runs 40 yards at the NFL Scouting Combine in Indianapolis every year. He started the challenge in 2005 and continues the tradition at the present time. What story would that data tell? Students can investigate this question using the link http://www.nfl.com/qs/runrichrun/runrichrun-history.jsp. Creating a set of data that contains the ordered pair (year, running time in seconds) and graphing the data using the corrdinate grid system would tell the story of Rich Eisen's progress in this challenge over the past nine years.

FORMATIVE ASSESSMENT QUESTIONS

- What models did you create?
- What organizational strategies did you use?
- What are the generalizations that can be made from the points plotted on the coordinate grid?
- What relationships do you see between the two sets of data that you chose to use during the investigation?

DIFFERENTIATION

Extension

Students can record themselves running 40 yards and compare the time and number of strides taken every ten yards to Rich Eisen's performance. Students can graph their data on the same coordinate

grid used for Rich Eisen's data and write generalizations that compare and contrast their data to Rich Eisen's data.

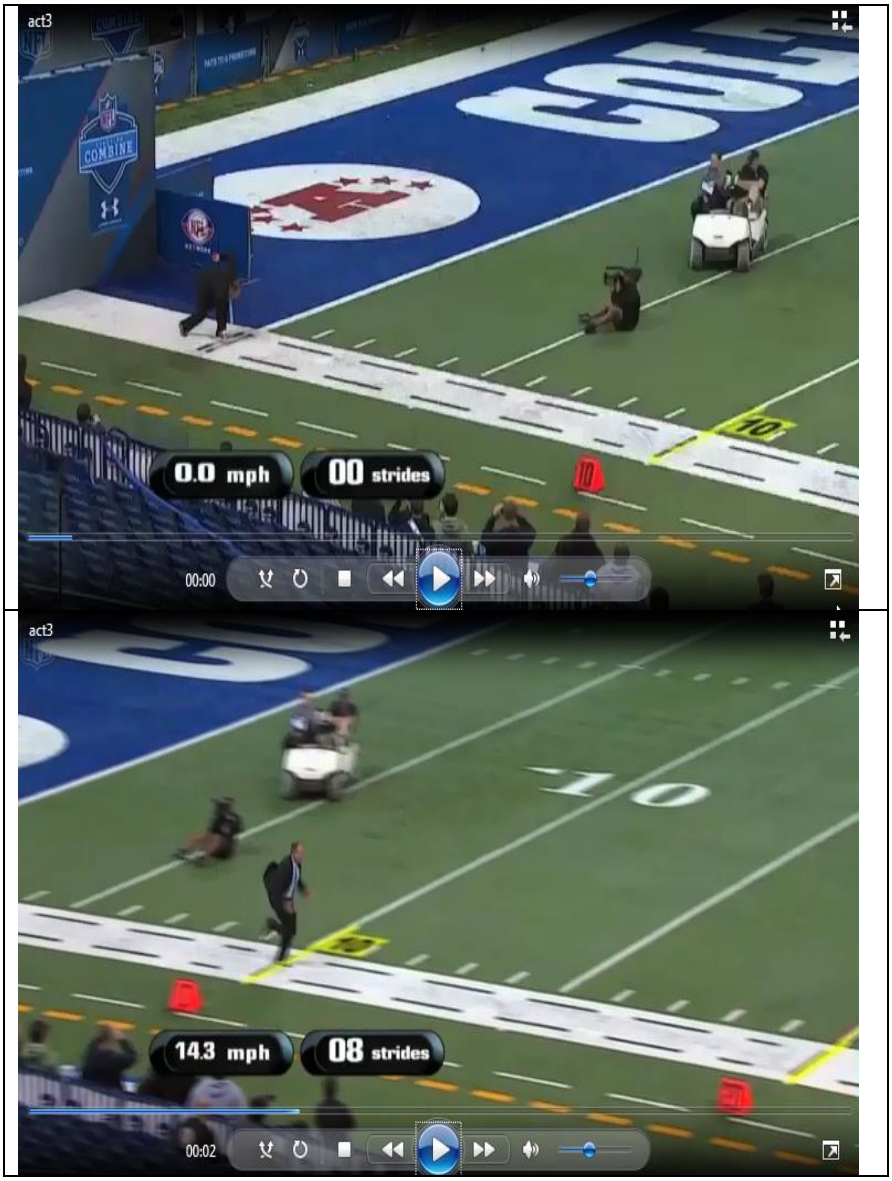
Intervention
Students can start by creating ordered pairs using the time and number of strides for every ten yards of the race. Then, discuss with students what they need to plan for as they construct the coordinate grid to show the story of Rich Eisen's run. Discuss the interval that they feel is most appropriate for the graph. After a plan is made, then students work to plot the ordered pairs.

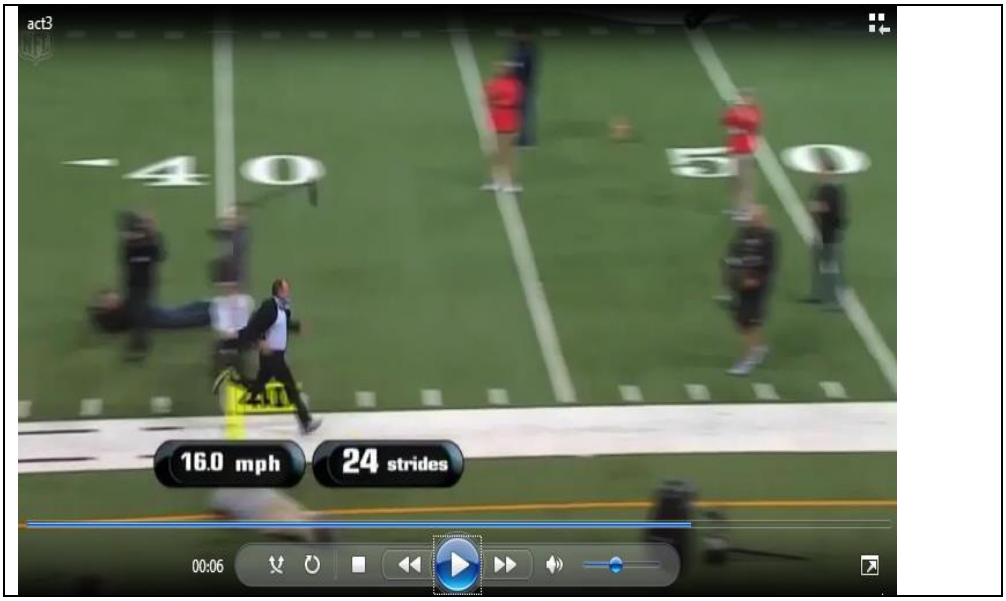
Intervention Table

TECHNOLOGY CONNECTIONS

- http://mathwire.com/games/gridlock2.pdf
  Gridlock is a game available on Mathwire.com that helps students practice forming ordered pairs and plotting them on a coordinate grid. After each game, students can tell a story about the data they plotted in each round.

Act 2 Images





Three Act Student Recording Sheet Name _____

ACT 1

What questions come to your mind?

Main Question: _____

What is your first estimate and why?

Record an estimate that is too low and an estimate that is too high.

On an empty number line, record all three estimates made above.

ACT 2

What information would you like to know or need to solve the MAIN question?

Record the given information (measurements, materials, etc…)
If possible, give a better estimation with this information: _____

Act 2 (con't)
Use this area for your work, tables, calculations, sketches, and final solution.

ACT 3

What was the result?

Scaffolding Task: Coordinate Grid Geoboards

Back to Task Table

Adapted from K-5 Math Teaching Resources
Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

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

MGSE5.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).

MGSE5.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

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

BACKGROUND KNOWLEDGE

Students haven't been taught about the coordinate grid in the past. This is their first time being exposed to the coordinate grid. It is important for students to know there are four quadrants in the grid but the students will only be working in quadrant one.

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.
- Students may have difficulty making shapes with rubber bands on the geoboard if they haven't used geoboards in the past.

ESSENTIAL QUESTIONS

- How can the coordinate system help you identify the location of shapes?
- How do coordinate grids help you organize information?

MATERIALS

- geoboards
- rubber bands
- coordinate grid paper
- rulers
- dry erase markers

GROUPING

Pairs

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this lesson students will review plotting points and labeling axis. Students will create shapes on the geoboard and have their partner plot the points on a coordinate grid. Students will compare the picture of the coordinate grid to the polygon on the geoboard.

Comments: Identifying points on a coordinate grid is important in understanding how the coordinate system works. The skills developed in this lesson can be applied cross-curricular to reading latitude and longitude on a map and to plotting data points. This task simply requires students to practice locating points on the plane. The entire standard set requires that students solve mathematical problems based on the relationship between the x and y coordinates.

TASK

- Partner students and have one person make a coordinate grid by using a dry erase marker to number the x and y axis on the geoboard.
- Have that same partner use a rubber band to create a polygon on the geoboard. Then state the coordinate of the vertices to the other partner.
- The other partner will plot the vertices on their coordinate grid and connect the points with line segments.
- The pair will then compare the picture of the polygon to the polygon on the geoboard and discuss any differences.
- Students will take turns to create and plot different polygons.
- Once students are finished creating polygons be sure to have them wipe off the numbers on the geoboard.

FORMATIVE ASSESSMENT QUESTIONS

- What polygon was created?
- What are the points for the vertices of the polygons?
- What were the differences/similarities between the geoboard polygon and the polygon on the picture of the polygon?
- 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 3-D shape on the geoboard.

Intervention

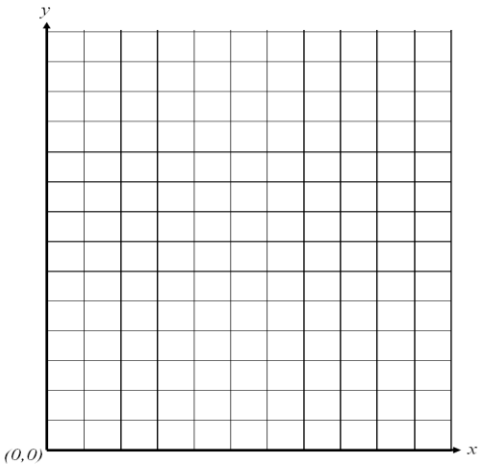
- Have students only work on the geoboard to name polygons and the ordered pairs.

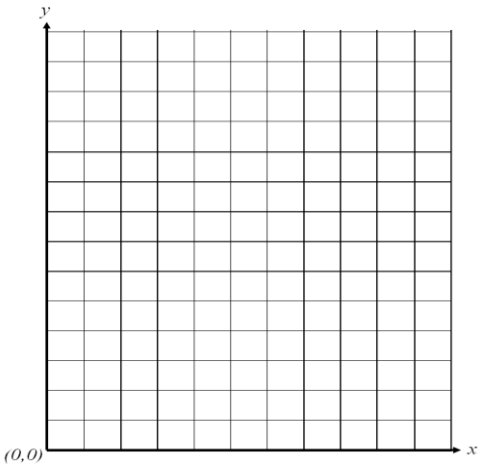
Intervention Table

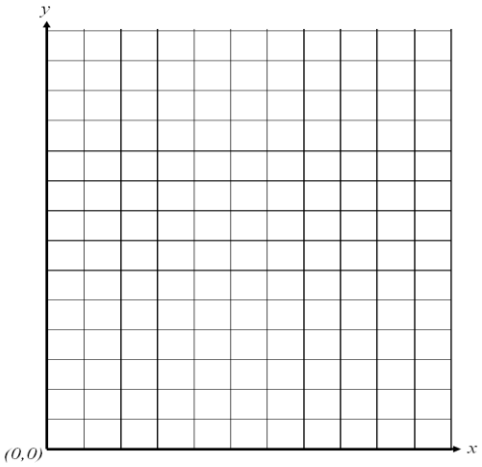
Name _____ Date _____

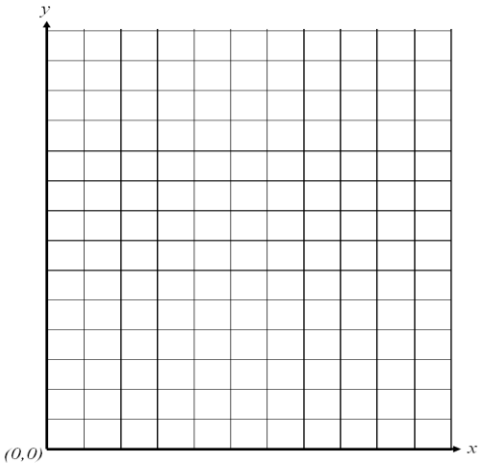
Coordinate Grid Geoboards

Directions: Use the coordinate grid to record polygons from the geoboard.









Compare the picture of the polygon and the actual polygon on the geoboard. Record the similarities/differences below.

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