MISSISSIPPI DEPARTMENT OF EDUCATION
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MISSISSIPPI
EXEMPLAR
Units & Lessons
MATHEMATICS

Foundations of Algebra

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P.O. Box 771 | Jackson, MS | 39205-0771
Tel (601) 359-2586
www.mde.k12.ms.us
Twitter: @MissDeptEd

Acknowledgements

Mississippi Exemplar Units and Lessons Project Leads

The Mississippi Department of Education gratefully acknowledges the following individuals for their leadership in the development of the Mississippi Exemplar Units and Lessons.

Dr. Kim Benton
Chief Academic Officer

Devin Boone
Special Education Professional Development Coordinator

Barbara Bowen
ELA Professional Development Coordinator

Elise Brown
Math Professional Development Coordinator

Wendy Clemons
Office of Professional Development Executive Director

Dana Danis
Office of Secondary Education ELA Curriculum Specialist

Dr. Marla Davis
Office of Secondary Education Bureau Director

Joyce Greer
Office of Early Childhood Instructional Specialist

Kristi Higginbotham
Special Education Professional Development Coordinator

Dr. Felicia Jackson-Stewart
ELA Professional Development Coordinator

Ashley Kazery
ELA Professional Development Coordinator

Kristina Livingston
Professional Development Coordinator Director

Celeste Maugh
Math Professional Development Coordinator

Tanjanikia McKinney
Science Professional Development Coordinator

Jennifer Nance
Office of Secondary Education Office Director II

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Mississippi Exemplar Units and Lessons Developers and Contributors

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Kimberlee Alexander
Greenville Public School District

Teresa Amacker
Ocean Springs School District

Terwinda T. Banks
Canton Public School District

Ebony Bealer
Harrison County School District

Kate Boteler
Madison County School District

Lydia Boutwell
MDE Early Childhood Consultant

Jeannie Brock
Benton County School District

Elisa Bryant
Lafayette County School District

Melissa Buck
MDE Literacy Coach

Leigh Ann Cheeseman
MDE Literacy Coach

Cindy Christian
Rankin County School District

Nicole Cockrell
Madison County School District

Angela Davis
MDE Literacy Coach

Samantha Edwards
South Panola School District

Beverly Farr
DeSoto County School District

Lisa Hamrick
Pascagoula – Gautier School District

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Mississippi Exemplar Units and Lessons Developers and Contributors

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Roxanne Harper
Brookhaven School District

Jessica Holyfield
Rankin County School District

Melanie Irby
Pearl Public School District

Lisa Lairy
West Point Consolidated School District

Shirley Massey
MDE Literacy Coach

Catrice Mitchell
Hinds County School District

Brenda Nelson
Gulfport School District

Cyndi Parker
Harrison County School District

Allison Ruhl
Madison County School District

Rebecca Russell
Rankin County School District

Kelly Smith
MDE Literacy Coach

Leigh Ann Smith
Lauderdale County School District

Nicole Smith
Jones County School District

Lori Stringer
MDE Literacy Coach

Katie Szabo
Lafayette County School District

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Mississippi Exemplar Units and Lessons Developers and Contributors

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Lydia Boutwell
MDE Early Childhood Consultant

Courtney D. Brown
Jackson Public School District

Ashley Boyd
DeSoto County School District

Toni Canizaro
Clinton Public School District

Tracy Catchings
Vicksburg-Warren School District

Susan Craddieth
Columbus Municipal School District

Alesheia Cunningham
DeSoto County School District

Savannah Evans
Lamar County School District

Fanchon Freeman
Clarksdale Municipal School District

Beth Fulmer
Math Curriculum Consultant

Jennifer Gaston
Coffeeville School District

Kathleen Hamilton
Marshal County Schools

Rachael Hayes-Magee
Biloxi Public School District

Caroline Heblich
DeSoto County School District

Susan Jarvis
Ocean Springs School District

Veronica Jefferies
Vicksburg-Warren School District

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Jeyakumar Jeyaraj
East Jasper Consolidated School District

Melissa Lowe
Lauderdale County School District

Lucy Ann Martin
Jackson Public School District

Lynda Mathieu
George County School District

Bonnie Maready
DeSoto County School District

Kimberly B. McKinney
West Point Consolidated School District

Hertensia V. Mixon
DeSoto County School District

Shalaan Oliver-Hendricks
Columbus Municipal School District

Amy Shelly
Special Education Professional Development Coordinator

TaShara Smith-Shoemaker
Hattiesburg Public School District

Mariella Simons
MDE Consultant

Ashleigh Syverson
Harrison County School District

David H. Taylor II
Laurel School District

Jennifer C. Wilson
Rankin County School District

Introduction

Mission Statement

The Mississippi Department of Education (MDE) is dedicated to student success, including the improvement of student achievement in English Language Arts (ELA) and mathematics in order to produce citizens who are capable of making complex decisions, solving complex problems, and communicating fluently in a global society. The Mississippi College- and Career-Readiness Standards (MS CCRS) provide a consistent, clear understanding of what students are expected to know and be able to do by the end of each grade level or course. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that students need for success in college and careers and to compete in the global economy. The goal of the MDE is to provide educators with the training and resources to understand and implement the MS CCRS effectively.

Purpose

In efforts to facilitate implementation and promote understanding of the MS CCRS for ELA and mathematics, the W. K. Kellogg Foundation generously awarded the MDE a grant to secure a cadre of effective educators to develop the MS CCRS Exemplar Units for teachers. Specifically, a group of highly-effective Mississippi educators developed exemplar instructional units and lessons aligned to the MS CCRS for ELA and mathematics. The MS CCRS Exemplar Units address difficult-to-teach standards as determined by teachers and are designed to serve as exemplar models for instructional units, lessons, and resources. The MS CCRS Exemplar Units have been vetted through nationally renowned vendors to ensure exemplar quality.

Design Overview

The MS CCRS Exemplar Units for ELA and mathematics address grade-level specific standards for Pre-Kindergarten-8th grade, as well as for Algebra, English I, and English II. The overall unit plan is described in the first section of the ELA and math units. This section includes the unit title, a suggested time frame, the grade level MS CCRS addressed and assessed, a unit overview with essential questions and a summary of lesson tasks, and the culminating/performance task description and rubric.

Though the math and ELA overall unit plan designs are very similar, some design aspects differ in order to accommodate the respective requirements of each content area. For mathematics, the first section also provides a segment designated for the Standards for Mathematical Practices (SMPs) addressed in the unit. For ELA, the first section also includes a text set with links to texts (if in the public domain) and a fresh/cold-read task.

The second section of each unit includes lesson plans. Within the lesson plans, provided are lesson-specific MS CCRS, suggested time frames, learning targets, guiding questions, required resources and materials, vocabulary terms and instructional strategies, teacher directions, instructional supports for students, enrichment activities, student handouts, assessments (formative, summative, pre-, and self-), and additional resources to aid in the implementation of the lessons.

Implementation

The intention of the MS CCRS Exemplar Units for ELA and mathematics is to provide educators with resources to understand and implement the MS CCRS effectively. The implementation of the MS CCRS Exemplar Units for ELA and mathematics is voluntary. Additionally, the MDE will provide ongoing support for implementation of the MS CCRS Exemplar Units with initial regional trainings followed by site-specific support through our regional service delivery model. For regional and site-specific training, please contact the MDE Office of Professional Development.

Grade Level	Unit Title	Duration
9	Linear Functions	11 days

Mississippi College- and Career-Readiness Standards for Mathematics	Standards for Mathematical Practice
<u>Foundations of Algebra Content Standards</u> **Focus:** **FOA.15** Determine the rate of change of a linear function from a description of a relationship or from two *(x, y)* values, including reading these from a table or from a graph. (8.F.4) Use the rate of change to determine if two lines are parallel, perpendicular, or neither. **FOA.16** Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. (8.F.4) **FOA.18** Given two points, a graph, a table of values, a mapping, or a real-world context determine the linear function that models this information. Fluently convert between the point-slope, slope-intercept, and standard form of a line. **Additional:** **FOA.17** Create and graph the equation of a linear function given the rate of change and y-intercept. Compare and contrast up to three linear functions written in various forms (i.e., point-slope, slope-intercept, standard form). **FOA.19** Create and identify the parent function for linear and quadratic functions in the Coordinate Plane.	**SMP.1** Make sense of problems and persevere in solving them. **SMP.2** Reason abstractly and quantitatively. **SMP.3** Construct viable arguments and critique the reasoning of others. **SMP.4** Model with mathematics. **SMP.5** Use appropriate tools strategically. **SMP.6** Attend to precision. **SMP.7** Look for and make use of structure. **SMP.8** Look for and express regularity in repeated reasoning.

FOA.20 Compare the properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.* (Limited to linear and quadratic functions only.) (8.F.2)	

Unit Overview

The focus of this unit is an understanding of linear functions represented algebraically, graphically, in tables, and in real-world context. This includes work on understanding how linear functions show change based on the slope and the y-intercept. Within this unit, students will understand that linear functions represent situations where one quantity influences another, and through a deeper conceptual understanding, they will translate situations into linear functions and can compare two linear functions in any representation.

Essential Questions:

- How can multiple representations of linear functions be used to make predictions?
- Does change in one thing always affect something else?

Lesson Tasks

Lesson 1: Patterns of Change
Students will be introduced to the idea of patterns and change those patterns through storytelling and Three-Act Math. Students will predict and describe change in graphs and situations.
Lesson 2: Change in Graphs
Students will continue considering change and relate change to linear functions as a way of demonstrating change. Students will graph lines by ordered pairs using group work and guided notes. Students will apply skills in a Gallery Walk.
Lesson 3: What's Changing the Line?
Students will compare the parent linear function to other linear functions to make connections between how slope and y-intercept change the graph of a line.
Lesson 4: Slope Situation
Students will apply their understanding of slope to create graphs to represent situations.

Lesson 5: Calculating Slope
Students will use the slope formula to calculate the slope when given two points and find slope triangles when finding the slope of a line from a graph.

Lesson 6: Making a Change
Students will focus on finding the slope from a table, graph, and situation through playing I Have, Who Has and participating in a Gallery Walk.

Lesson 7: Where Do I Start?
Students will use Reciprocal Teaching to review previous lessons. Students will focus on the y-intercept in real-world context and the meaning of an initial value in a situation.

Lesson 8: Summarizing the Situation
Students will review their understanding of linear functions through an Index Card Carousel and a game of Jeopardy.

Lesson 9: Money Talks
Students will compare real-world situations to determine the impact of the slope and initial value in making predictions and decisions in their daily life.

Lesson 10: Slope Art Performance Task
Students will summarize their understanding using the Elevator Talk strategy and demonstrate their understanding of slope, y-intercept, and writing equations in slope-intercept form in the Slope Art Performance Task.

Performance/Culminating Task

Slope Art
In the Slope Art performance task, students will create a picture using line segments. They will then use two points on each segment to calculate the slope, y-intercept, and the linear equation in slope-intercept form. Students will answer reflective questions about their picture, lines with the same slope, characteristics on a graph, and how lines with different slopes compare. The task asks students to create a real-world situation about the segment of their choice to reinforce an understanding of rate of change and initial value. To finish their art work, students will then add details and color their picture to create a work of art.

Standard(s) Assessed: FOA.15, FOA.16, FOA.18

Rubric for Performance/Culminating Task

	4	3	2	1
Student has included 16 line segments following the criteria: • **5 positive slope** • **5 negative slope** • **3 zero slope** • **3 undefined slope**	All 16 line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope	The 12-14 line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope	The 8-11 line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope	The 7 or fewer line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope
Student correctly found the slope and y-intercept of the line segments.	Correctly calculated the slope and y-intercept for all 16 lines and included work.	Correctly calculated the slope and y-intercept for 12-14 segments and included work.	Correctly calculated the slope and y-intercept for 8-11 segments and included work.	Correctly calculated the slope and y-intercept for 7 or fewer segments and included work. OR Did not include work for any problems.
Student wrote linear equations in slope-intercept form.	Correctly wrote a linear equation in slope-intercept form for all 16 segments.	Correctly wrote a linear equation in slope-intercept form for 12-14 segments.	Correctly wrote a linear equation in slope-intercept form for 8-11 segments.	Correctly wrote a linear equation in slope-intercept form for 7 or fewer segments.
Comparing Functions	Responds correctly to both questions and justifies reasoning.	Responds correctly to both questions, but does not justify reasoning.	Responds correctly to one question and justifies reasoning.	Does not respond correctly to either question. OR Responds correctly to one without justifying reasoning.
Real-World Connections	Writes a practical real-world situation with the correct rate of change and initial value.	Writes a real-world situation with the correct rate of change and initial value, but it is not practical.	Writes a real-world situation with only one correct value.	Writes a real-world situation that does not include the correct rate of change and initial value OR Does not attempt to write a situation.

Lesson 1: Patterns of Change

Focus Standard(s): FOA.15, FOA.16

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.4, SMP.5, SMP.6, SMP.7

Estimated Time: 55 minutes

Resources and Materials:

- Handout 1.1: Tell a Story
- Handout 1.2: Three-Act Math Task Recording Sheet
- Handout 1.3: Everyday Changes
- Handout 1.4: Change and Functions
- 25 Billion Apps: http://threeacts.mrmeyer.com/25billionapps/

Lesson Target(s):

- Students will evaluate given inputs to find the outputs of a function in a table
- Students will identify the rate of change occurring in real-world scenarios.

Guiding Question(s):

- How are patterns used to predict change?
- How can you use a given input to find the output of a function presented in a table?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Change • Ordered Pairs	☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Create pictures/symbols to represent words ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: This lesson serves as an introduction to functions. Students will be introduced to academic vocabulary and will use it when discussing patterns of change. Students will identify changes occurring in a video and in word problems and will be encouraged to determine the reasonableness of their solutions. Using their understanding of change, students will determine output values when given an input.

Anticipatory Set/Introduction to the Lesson: Tell a Story
Note: Cut the pictures out from **Handout 1.1: Tell a Story** prior to class. Students will work in teams for this activity (SMP.1, SMP.2).

Assign one picture from **Handout 1.1: Tell a Story** to each team. Explain to the class that the focus of this unit will be on how change is an important tool used in mathematics and in the real world. Ask students to apply prior knowledge to tell a story about the change taking place in their picture. Allow students time to work with their team to create a story. The story must include specific units and use academic vocabulary reinforcing the concept of slope learned in previous courses. Encourage groups to include a table or a graph to strengthen their story.

For students who are EL, have disabilities, or perform well below grade level:

- Provide students with pictures depicting a positive slope and the units they could apply to their story.

Extensions for students with high interest or working above grade level:

- Assign teams a picture depicting an undefined slope or a nonlinear function.

Activity 1: Three-Act Math Task Activity
Note: The idea behind a Three-Act Math Task is to develop deep-thinking, open-ended exploration, and engaging questions in a short time.

Distribute **Handout 1.2: Three-Act Math Task Recording Sheet.** Explain to students that they are going to watch a short video clip, and using that information, try to predict the rate of change to win the $10,000 (SMP.1, SMP.4). For Act 1, play the 25 Billion Apps clip as many times as needed for students to give the best answer possible. Once students have all filled out Act 1 Questions, elicit guesses and record them on the board.

Begin Act 2 by asking students what information would be useful to know (SMP.2). Allow time for students to discuss and share what tools they believe they need and how it will help them make their prediction (SMP.5).

Display Act 3 and ask students who came close to share how they made their prediction (SMP.7).

For students who are EL, have disabilities, or perform well below grade level:

- For students who are struggling to find responses too high or too low, discuss what the word "unreasonable" means.
- Provide examples that would be too high and too low and ask them to explain why those numbers are too high or too low.

Extensions for students with high interest or working above grade level:

- Use the questions found in the Sequel section of the Three-Act Math Task: 25 Billion Apps.

Activity 2: Change is Life Activity
Distribute **Handout 1.3: Everyday Changes** and circulate to help students accurately describe the change (SMP.6).
Note: Some students may need help being specific. For example, a student might say "It got hotter" when it would be more accurate to say "The temperature is increasing."

After approximately 10 minutes have passed, facilitate whole group discussion using mathematical terminology (SMP.6).

- ✓ Ask the following prompting questions to lead a whole group discussion.

Prompting Questions:

- What are some changes you identified?
- Was there any change that could not be measured?
- What are the types of change we discussed today?

Collect **Handout 1.3: Everyday Changes**

For students who are EL, have disabilities, or perform well below grade level:

- Allow students to work with a partner and then check their responses with another pair.
- Have students create a table for the scenarios to help identify a pattern (SMP.7).

Extensions for students with high interest or working above grade level:

- Students who are ready for a further challenge may be asked to give the change in terms of a specific unit rate.
- Challenge students to convert the rate of change to different units of measurement.

Reflection and Closing:

Instruct students to get out the Three-Act Math Task Recording Sheet and have them use the back side to write down their exit ticket answer.

✓ **Exit Ticket:** *What is one example of how one change in an element within a situation affects another element?*

Collect exit tickets and pass out **Handout 1.4: Change and Functions** for homework**.**

Reflect on how well the students were able to answer the following questions by examining evidence of student learning.

- How do patterns of change help us make recommendations?
- How can you determine what types of information help find unknown real-world solutions?
- How do you identify change in a word problem?
- How do you use a given input value to determine the output of a linear function?

Homework

Students will complete the homework sheet.

Handout 1.1: Tell a Story

Cut out the pictures and distribute one picture to each group.

Handout 1.2: Three-Act Math Task Recording Sheet

Name: _____ Date: _____

Three-Act Math Task Recording Sheet

Act One

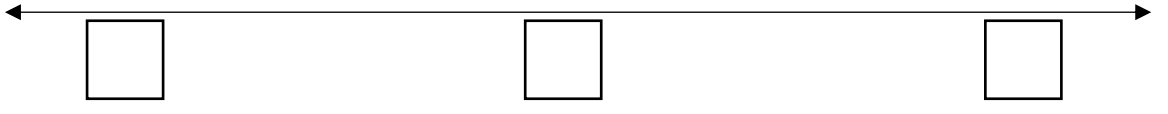
1. What question are you trying to answer?

2. What is your best guess? _____

3. Write an estimate that you feel sure is too low. _____

   Write an estimate that you feel sure is too high. _____

Mark your best guess, your "too low" estimate, and your "too high" estimate.



Act Two

1. Write down any question you think might help us find the answer.

   OR

2. Write down the information you would need to find the answer.

Act Three

1. What was the answer to the question? _____

2. What else could we investigate about this situation?

Handout 1.3: Everyday Changes

Name: _____ Date: _____

Write down the type of change that is occurring in each problem.

1. A candle starts out 15” tall. After 4 hours, it is 10 inches tall.

2. The temperature is 78^0 at 6 a.m. and 90^0 at noon.

3. The gas tank has 14.5 gallons at 4 p.m. and 11 gallons at 6 p.m.

4. I have $50 on Monday and $30 on Tuesday.

5. I weigh 152 on May 1 and 155 on June 1.

6. The plant is 12” tall on Friday and 13” tall on the following Wednesday.

7. I started the book on Sunday and was on page 52 on Tuesday.

8. I drive from my house to New Orleans, 100 miles away, and use 4 gallons of gasoline.

Handout 1.4: Change and Functions

Name: _____ Date: _____

Part A. Write down the type of change that is occurring in each problem.

1. A skydiver starts out at 13,000 feet. After a minute, she is at 9,500 feet.

2. One ounce of the water leaks out of the bottle every 4 hours.

3. Chris started out on question #3 and did 5 questions in 10 minutes.

4. A puppy weighs 20 ounces at birth and 60 ounces at 4 months.

Part B. Create a function table. Substitute the value of x to find y.

5. $y = 2x$ 6. $y = 3x + 5$ 7. $y = - x + 7$

Lesson 2: Change in Graphs

Focus Standard(s): FOA.15, FOA.16

Standards for Mathematical Practice: SMP.2, SMP.4, SMP.6, SMP.7, SMP.8

Estimated Time: 55 minutes

Resources and Materials:

- Anchor Chart Paper
- Scissors
- Tape
- Handout 2.1: Words to Graphs
- Handout 2.2: Graphing Linear Functions by Ordered Pairs
- Handout 2.3: Gallery Walk Task Cards
- Handout 2.4: Gallery Walk Reflection Sheet

Lesson Target(s):

- Students will understand that the slope of the line describes the change the line undergoes.
- Students will evaluate a linear function for a given input value.
- Students will graph a linear function by ordered pairs.

Guiding Question(s):

- How can you graph a line by using ordered pairs that make the function true?
- How do changes in linear functions define the direction and rate of change in the lines they produce?

Vocabulary

Academic Vocabulary:	Instructional Strategies for Academic Vocabulary:
• Ordered pairs • Rate of change • Slope • y-intercept	☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Create pictures/symbols to represent words ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will create graphs to represent real-world situations. Students will graph two ordered pairs and use the line to demonstrate the change between the two points.

Anticipatory Set/Introduction to the Lesson: Words to Graphs
Display the situation on **Handout 2.1: Words to Graphs** and allow the students time to create a graph to represent the scenario.

For students who are EL, have disabilities, or perform well below grade level:

- Provide a model of the coordinate plane and the labels on the x and y-axis.

Extensions for students with high interest or working above grade level:

- Ask students to identify the days when Jaylin has the greatest rate of change and how we know.
- Have students explain slope in the context of the problem.

Invite a student to sketch or display a graph to go with the situation. Section off the graph based on the rate of change. Facilitate a whole group discussion. Instruct students to Turn and Talk to explain what the rate of change tells us about each section. Continue the discussion by sharing ideas about how a graph could be used to help us make predictions.

Activity 1: Show Me the Change Activity
Remind students that the focus of the unit is change. Ask students to share different types of changes they saw in the previous lesson. After discussing the types of change, ask students to consider what change looks like (SMP.4).

Have students work in pairs or in groups. Give students approximately 5 minutes to plan a way to represent change without using words. Ways of showing change could include acting out change, drawing change, or displaying change in a mathematical way without using words. At the end of 5 minutes, the students take turns to show their change. Use student examples to make connections to change that can be shown mathematically.

For students who are EL, have disabilities, or perform well below grade level:

- Discuss types of change with student and then assist them in planning ways to demonstrate it without speaking.

Extensions for students with high interest or working above grade level:

- Students who are gifted artistically should be given the opportunity to make Anchor Charts of change to display in the classroom.

Activity 2: Graphing Linear Functions Guided Notes
Distribute **Handout 2.2: Graphing Linear Functions by Ordered Pairs**. Instruct students to follow along and fill in the appropriate sections.
Note: As students complete the notes, make sure to give additional examples needed for clarification.

Activity 3: Making Connections in Representations Gallery Walk
Note: Prior to this activity, hang 6 pieces of anchor chart paper and label the pages A-F. This activity will be done as a Red-Light-Green-Light, where students have must have work checked before moving on to the next task.

Distribute **Handout 2.3: Gallery Walk Task Cards**, scissors, and tape to groups of 3-4 students. Instruct students to fill in ordered pairs to satisfy the equation.

- ✓ Check ordered pairs for each team before allowing them to move on to graphing.

Have students graph the ordered pairs they selected on the coordinate plane provided. Encourage students to use a ruler and draw a straight line going through the points (SMP.6).

- ✓ Check graphs for each team before allowing them to cut and tape on to the anchor chart paper.

Once all graphs are correct, have teams cut along the dotted lines and tape each card to the corresponding poster. Provide each student with **Handout 2.4: Gallery Walk Reflection Sheet**.

Assign each team a different poster to begin their Reflection Sheet. Students will respond to the prompts, paying special attention to the common traits of each graph and equation (SMP.2, SMP.7). The reflection that students are asked to do can be very useful in building deep understanding of the slope and initial value of a linear function.

For students who are EL, have disabilities, or perform well below grade level:

- Have students identify common traits in two graphs and equations at a time.

Extensions for students with high interest or working above grade level:

- Have students write a conjecture about slope and y-intercept and the impact on parallel and intersecting lines.

Reflection and Closing:

- ✓ Facilitate a whole group discussion on the students' observations during the Gallery Walk. Clarify the slope and y-intercept and how they define the graphs of the lines that model them. Ask students to begin constructing more efficient ways that would be more effective for graphing to replace creating a table of values (SMP.8).

Reflect on how well the students were able to answer the following essential questions by examining evidence of student learning:

- How can change be displayed in real-world situations and in graphs of linear functions?
- How can you graph a line by using ordered pairs that make the function true?
- How do changes in linear functions define the direction and rate of change in the lines they produce?

Homework

Students will write two linear equations with similar characteristics to $y = 4x - 1$.
One equation must have the same rate of change and one must have the same y-intercept.

Handout 2.1: Words to Graph

Name: _____ Date: _____

Create a graph to accompany the following situation.

Jaylin keeps track of the hours she plays Legend of Zelda on her Nintendo Switch. This month, she played for an hour each night from Monday through Thursday and three hours on both Friday and Saturday. Jaylin did not play on Sunday. Create a graph to represent the number of hours Jaylin played Zelda over a 2-week period.

Handout 2.2: Graphing Linear Functions by Ordered Pairs

Name: _____ Date: _____

Graphing Linear Functions by Ordered Pairs

1. A coordinate plane is made of 2 _____ that run into each other perpendicularly.

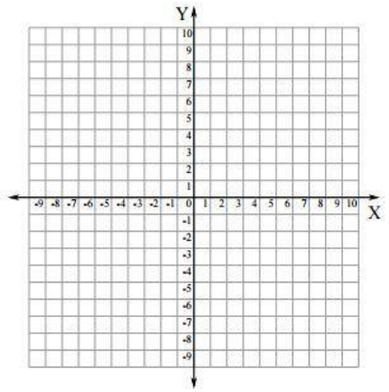
2. Any point on the coordinate plane is named with a(n) _____. In an ordered pair, the first number always gives the _____and the second number always gives the _____ value.

3. One way to graph is to make ordered pairs based on your linear function. To make an ordered pair, you can choose any number for the _____ value of the ordered pair as long as your ordered pair will show up on the graph. Then you substitute your _____ value into the equation to find your y-value. Repeat this to make at least 4 ordered pairs.

Make 4 ordered pairs for each function and then plot your points and connect them to make the line.

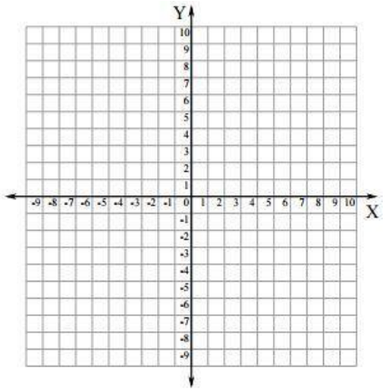
4. ***y = 2x – 4***

(,) (,) (,) (,)



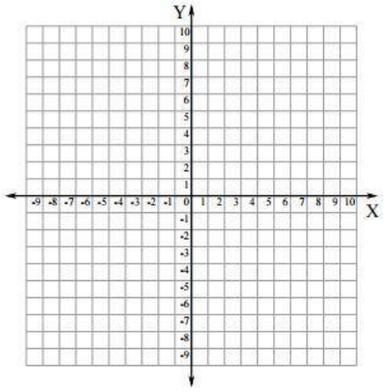
5. ***y = x + 2***

(,) (,) (,) (,)



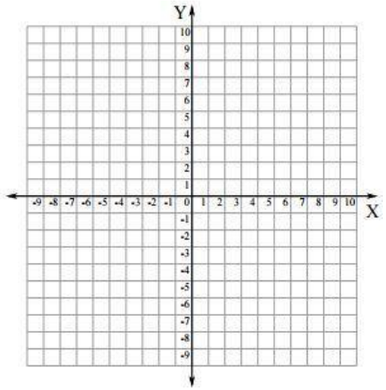
6. ***y = - x + 3***

(,) (,) (,) (,)

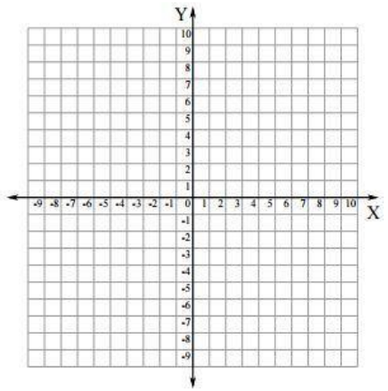


7. ***y =*** 1/2 ***x***

(,) (,) (,) (,)



Extra grid for next class



Graphing Linear Functions by Ordered Pairs KEY

1. A coordinate plane is made of 2 NUMBER LINES that run into each other perpendicularly.

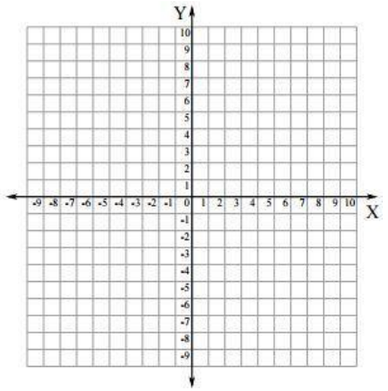
2. Any point on the coordinate plane is named with a(n) ORDERED PAIR. In an ordered pair, the first number always gives the x-value and the second number always gives the y- value.

3. One way to graph is to make ordered pairs based on your linear function. To make an ordered pair, you can choose any number for the x- value of the ordered pair as long as your ordered pair will show up on the graph. Then you substitute your x- value into the equation to find your y-value. Repeat this to make at least 4 ordered pairs. The points will create a line since they all follow the same PATTERN .

Make 4 ordered pairs for each function and then plot your points and connect them to make the line.

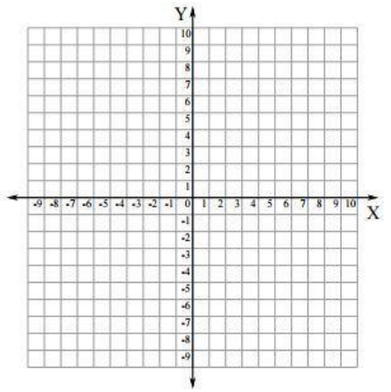
4. ***y = 2x – 4***

(,)(.)(,)(,)



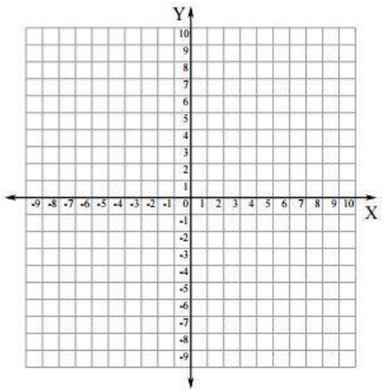
5. ***y = x + 2***

(,)(.)(,)(,)



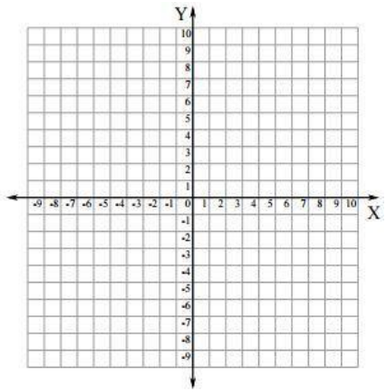
6. ***y = - x + 3***

(,)(.)(,)(,)



7. ***y =*** 1/2 ***x***

(,) (.) (,) (,)



Handout 2.3: Gallery Walk Task Cards

GROUP 1

For each one, make the ordered pairs by substituting the given x-values to find y. Once that is completed, ask your teacher to check the pairs. Then, graph your points on the coordinate plane. Make a nice long line that goes through them all.

A

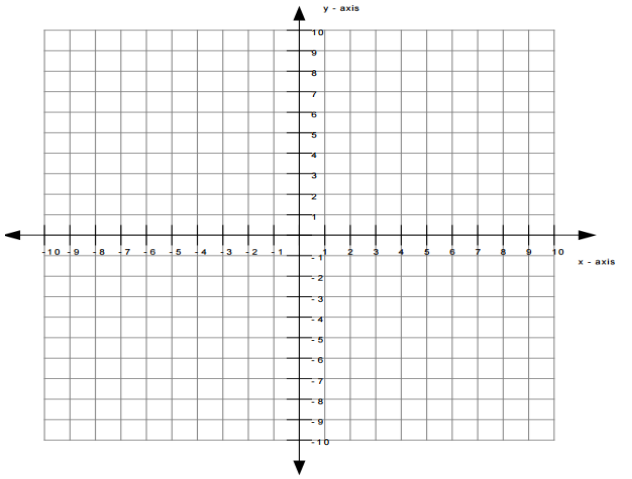
Equation: ***y = x + 5***

(-1, _____)

(2, _____)

(0, _____)

(3, _____)



B

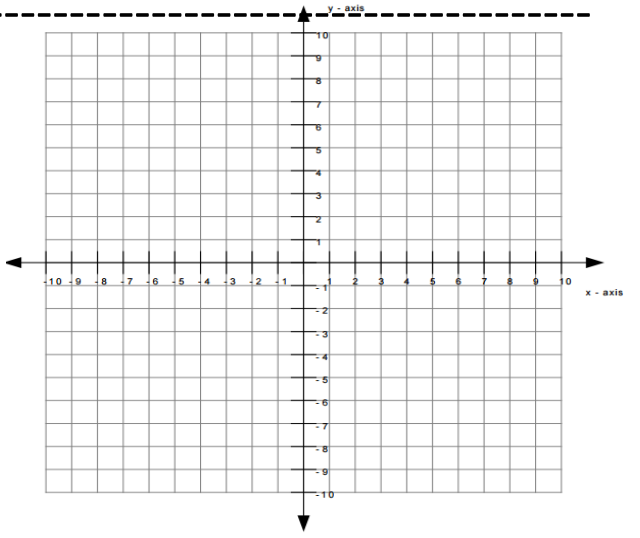
Equation: ***y = -2x + 6***

(1, _____)

(2, _____)

(0, _____)

(3, _____)



C

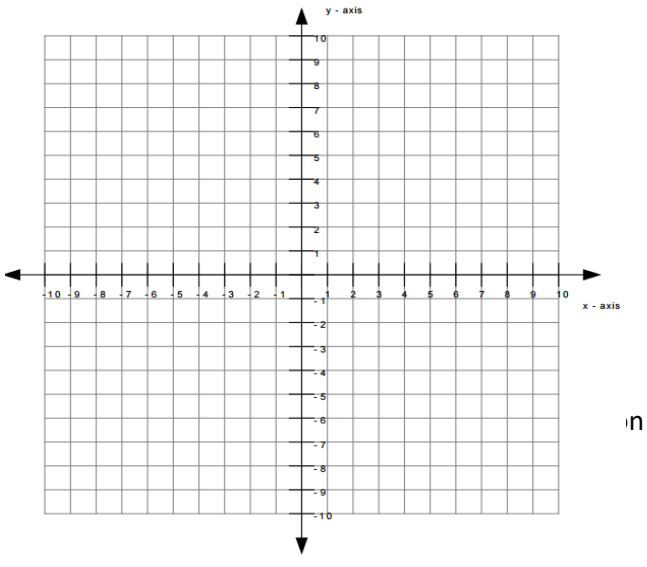
Equation: ***y = 1x + 3***

(-1, _____)

(2, _____)

(0, _____)

(3, _____)



Equation: ***y = -2x – 3***

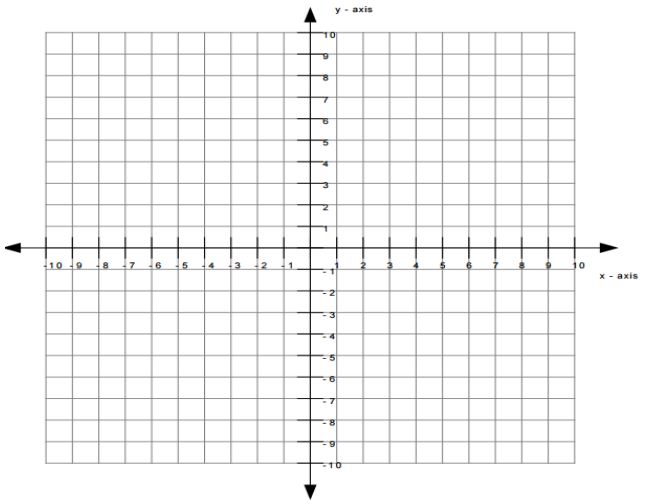
(-1, _____)

D

(-2, _____)

(0, _____)

(1, _____)



Equation: ***y = -x***

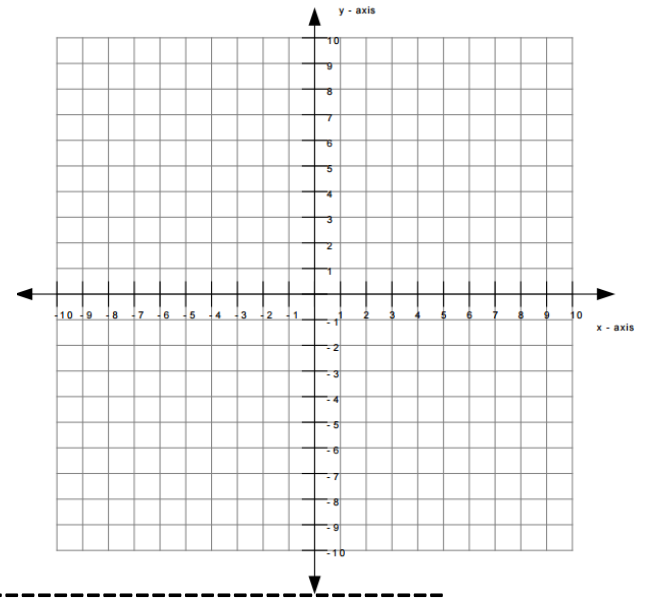
(1, _____)

E

(-2, _____)

(-3, _____)

(3, _____)



Equation: ***y = 2x***

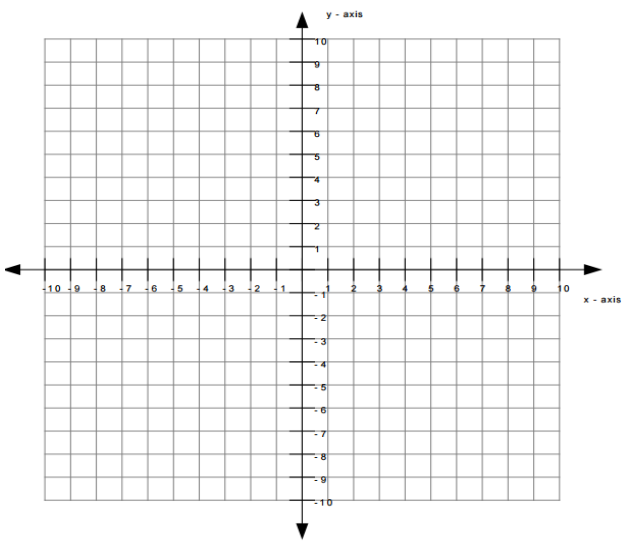
(-1, _____)

F

(2, _____)

(0, _____)

(-3, _____)



GROUP 2

For each one, make the ordered pairs by substituting the given x-values to find y. Once that is completed, ask your teacher to check the pairs. Then, graph your points on the coordinate plane. Make a nice long line that goes through them all.

Equation: ***y = -2x + 5***

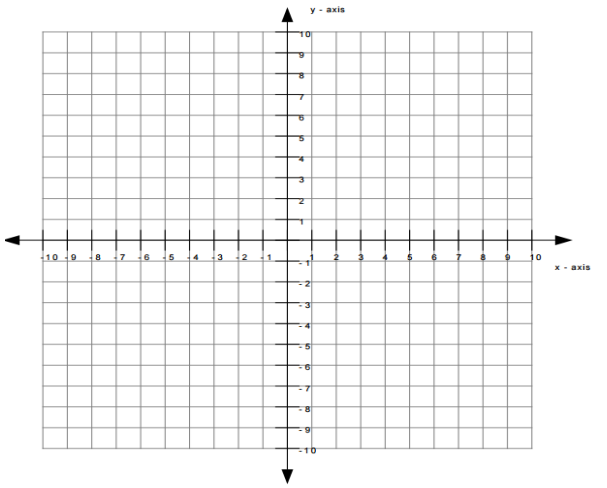
A

(-1, _____)

(2, _____)

(0, _____)

(3, _____)



Equation: ***y = -2x + 3***

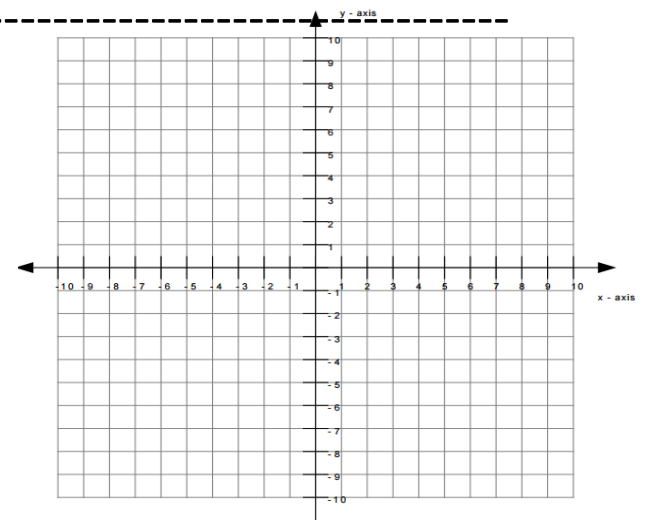
B

(-1, _____)

(-2, _____)

(0, _____)

(3, _____)



Equation: ***y = 1x - 7***

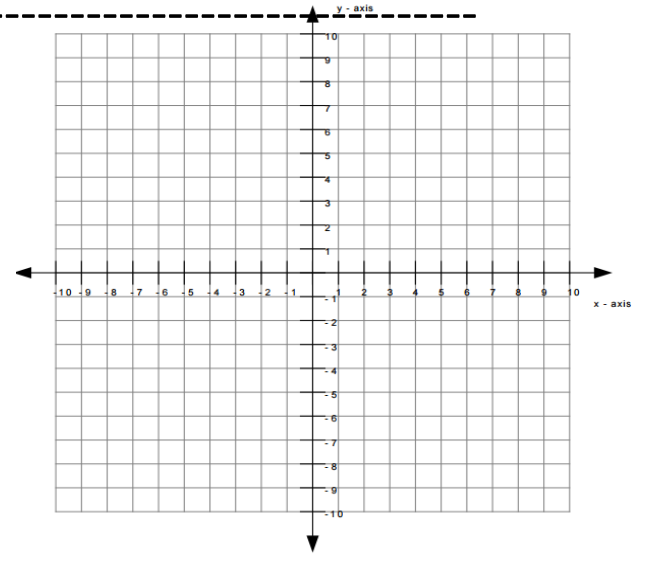
C

(3, _____)

(2, _____)

(0, _____)

(-1, _____)



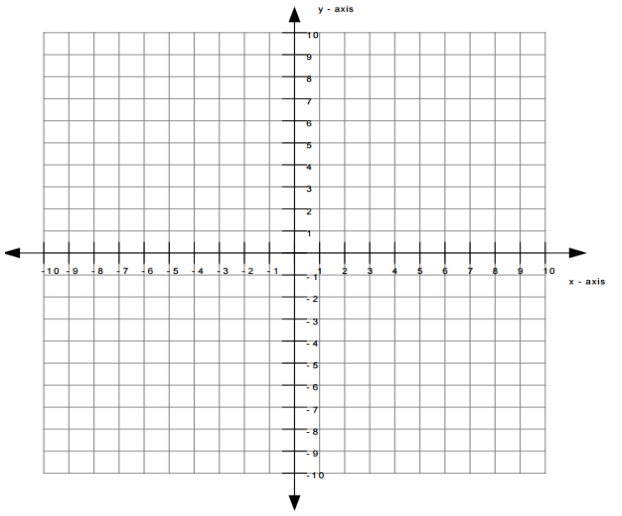
Equation: ***y = x - 3***

(-1, _____)

D (-2, _____)

(3, _____)

(4, _____)



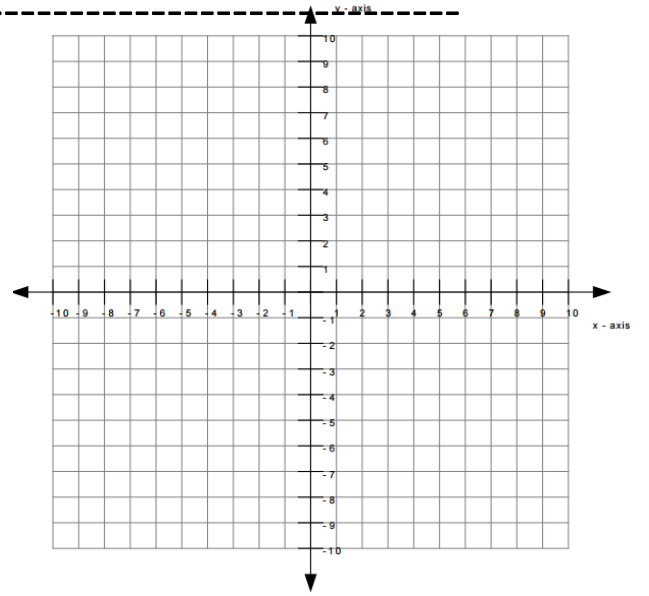
Equation: ***y = -x + 1***

(1, _____)

E (-2, _____)

(-3, _____)

(0, _____)



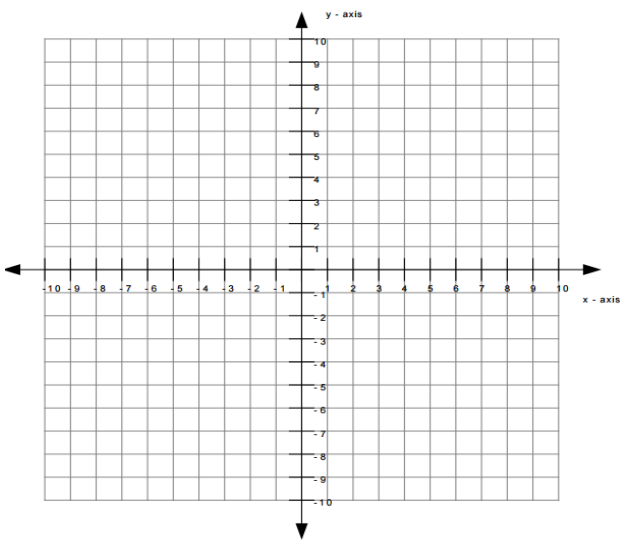
Equation: ***y = 2x + 1***

(-1, _____)

F (2, _____)

(0, _____)

(-3, _____)



GROUP 3

For each one, make the ordered pairs by substituting the given x-values to find y. Once that is completed, ask your teacher to check the pairs. Then, graph your points on the coordinate plane. Make a nice long line that goes through them all.

Equation: ***y = -1x + 5***

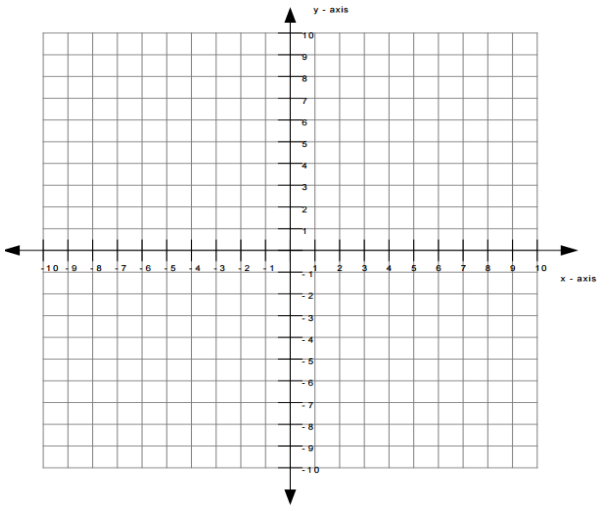
A

(-1, _____)

(2, _____)

(-2, _____)

(3, _____)



Equation: ***y = -2x - 1***

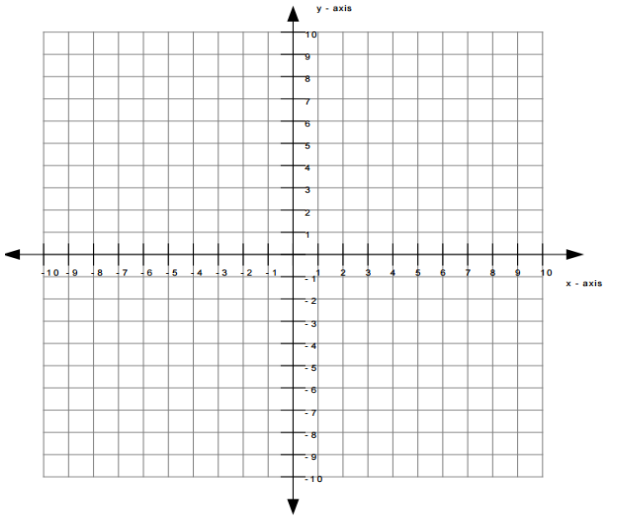
B

(-3, _____)

(2, _____)

(0, _____)

(1, _____)



Equation: ***y = x + 4***

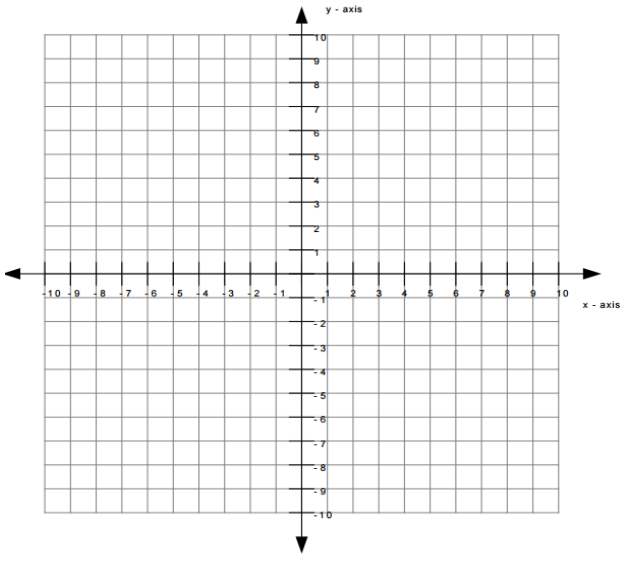
C

(-1, _____)

(2, _____)

(0, _____)

(-3, _____)



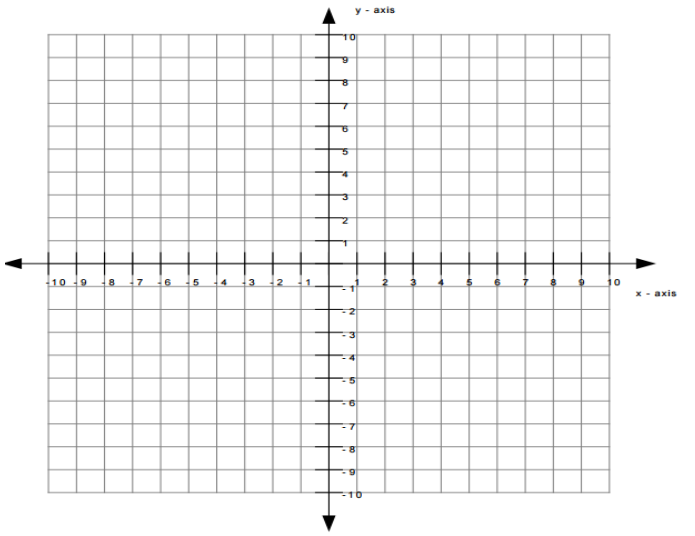
Equation: ***y = 2x - 3***

(-1, _____)

D (2, _____)

(3, _____)

(4, _____)



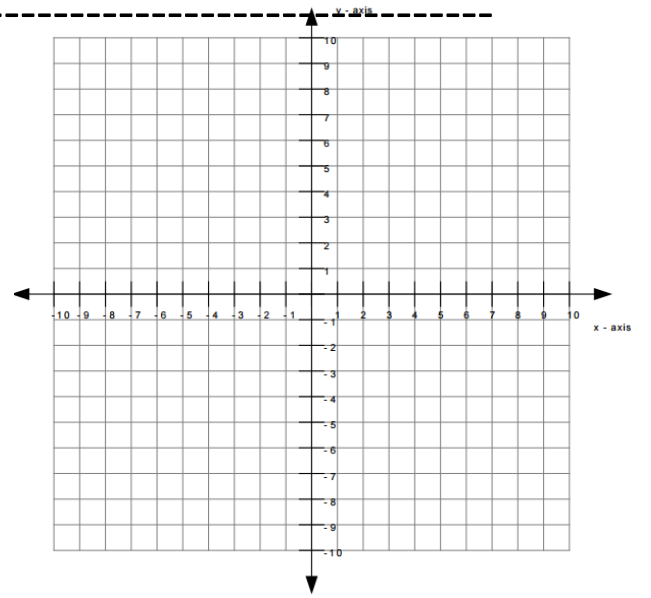
Equation: ***y = -x + 5***

(1, _____)

E (-2, _____)

(0, _____)

(6, _____)



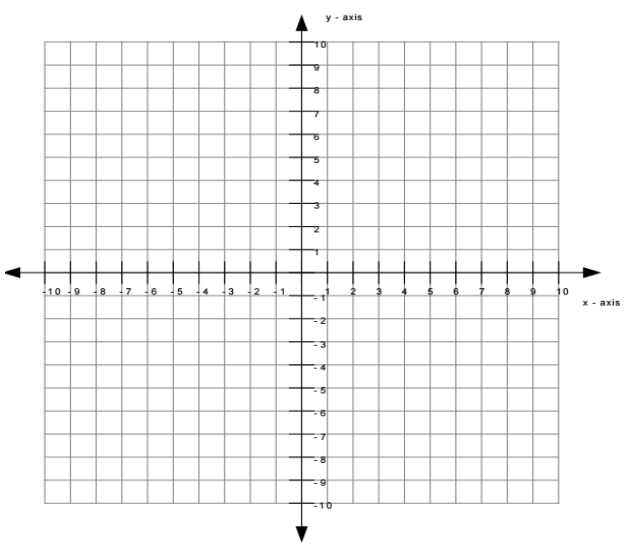
Equation: ***y = 2x + 2***

(-1, _____)

F (2, _____)

(0, _____)

(3, _____)



GROUP 4

For each one, make the ordered pairs by substituting the given x-values to find y. Once that is completed, ask your teacher to check the pairs. Then, graph your points on the coordinate plane. Make a nice long line that goes through them all.

Equation: ***y = 2x + 5***

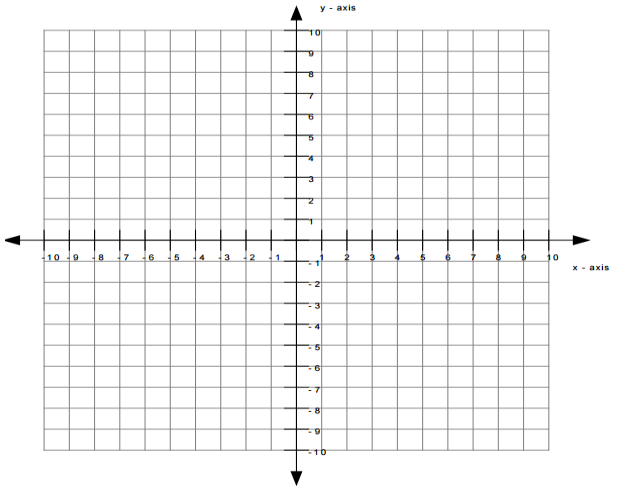
A

(-1, _____)

(-2, _____)

(0, _____)

(1, _____)



Equation: ***y = -2x***

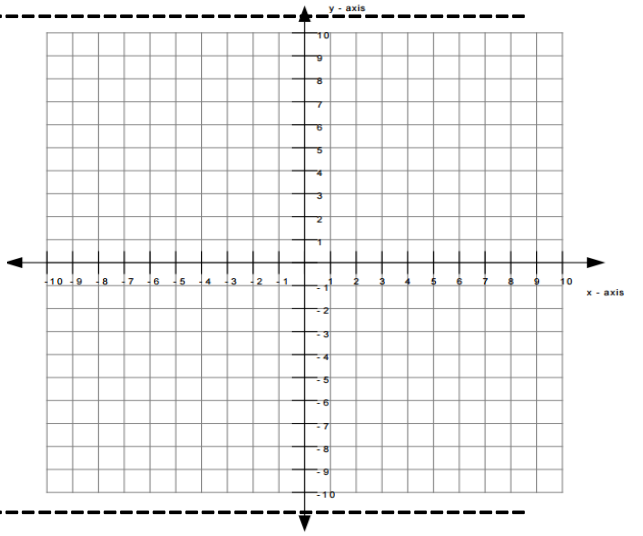
B

(1, _____)

(-2, _____)

(-3, _____)

(3, _____)



Equation: ***y = 1x + 2***

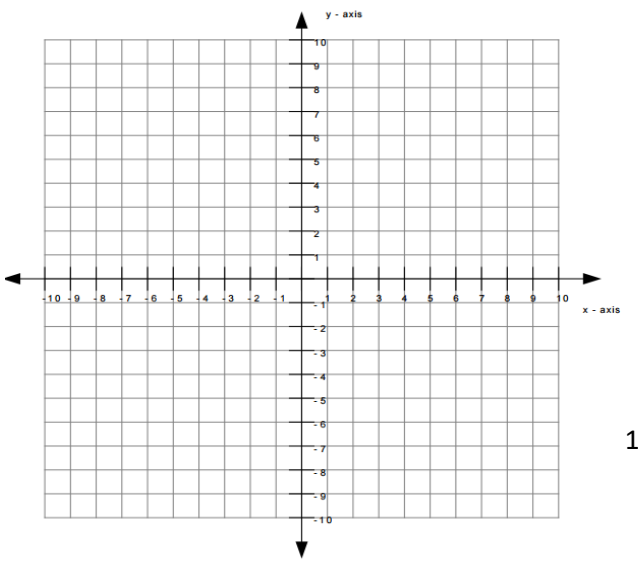
C

(-1, _____)

(2, _____)

(0, _____)

(3, _____)



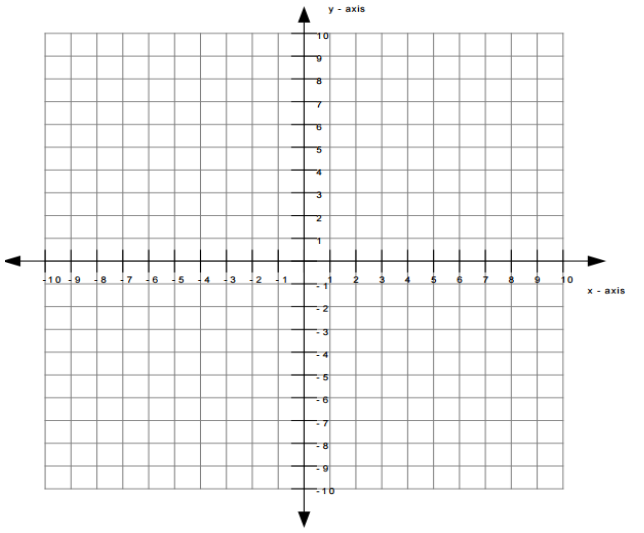
Equation: ***y = 2x - 3***

(-1, _____)

D (2, _____)

(0, _____)

(3, _____)



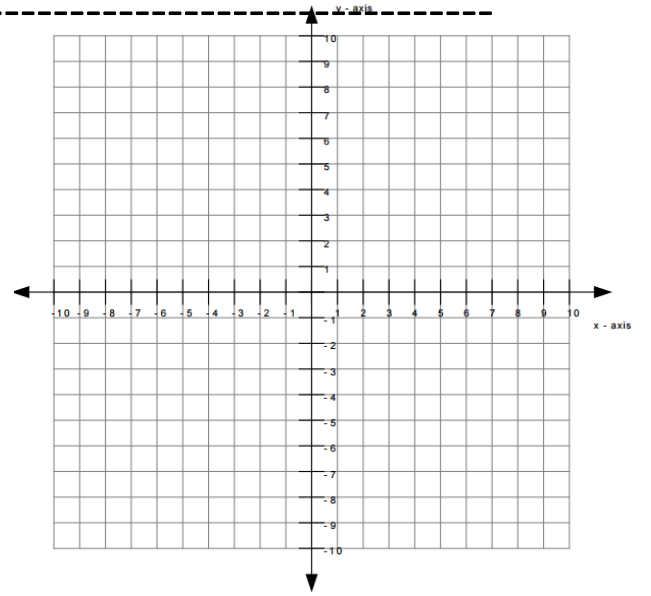
Equation: ***y = -1x - 4***

(1, _____)

E (-2, _____)

(-3, _____)

(0, _____)



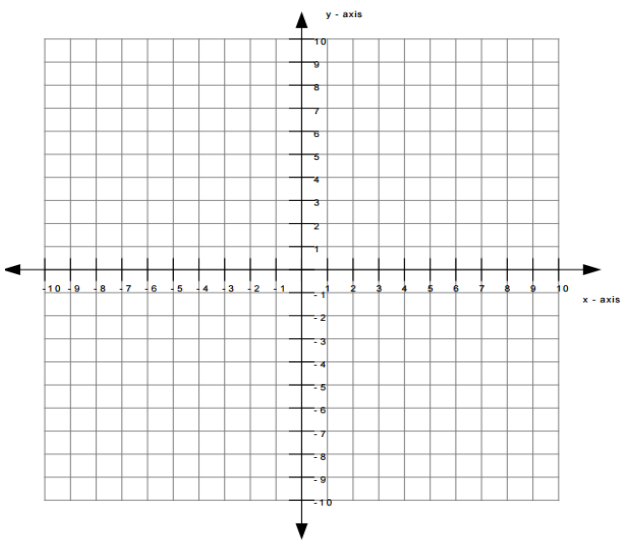
Equation: ***y = 2x - 1***

(-1, _____)

F (2, _____)

(0, _____)

(3, _____)



GROUP 5

For each one, make the ordered pairs by substituting the given x-values to find y. Once that is completed, ask your teacher to check the pairs. Then, graph your points on the coordinate plane. Make a nice long line that goes through them all.

Equation: ***y = -1x + 5***

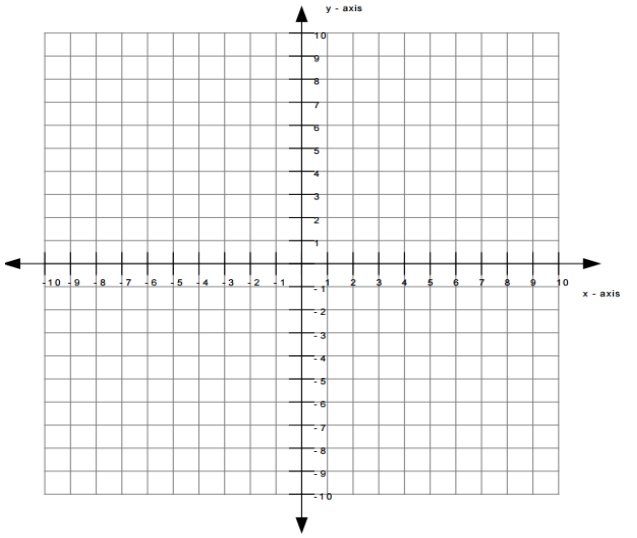
A

(1, _____)

(2, _____)

(0, _____)

(3, _____)



Equation: ***y = -2x + 2***

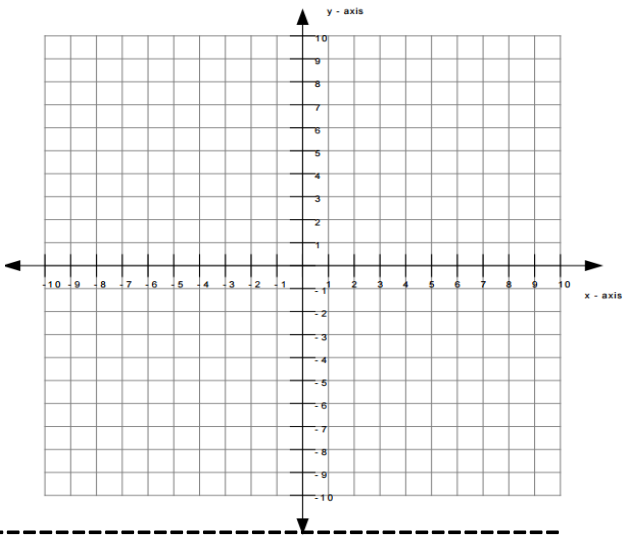
B

(-1, _____)

(-3, _____)

(0, _____)

(3, _____)



Equation: ***y = x***

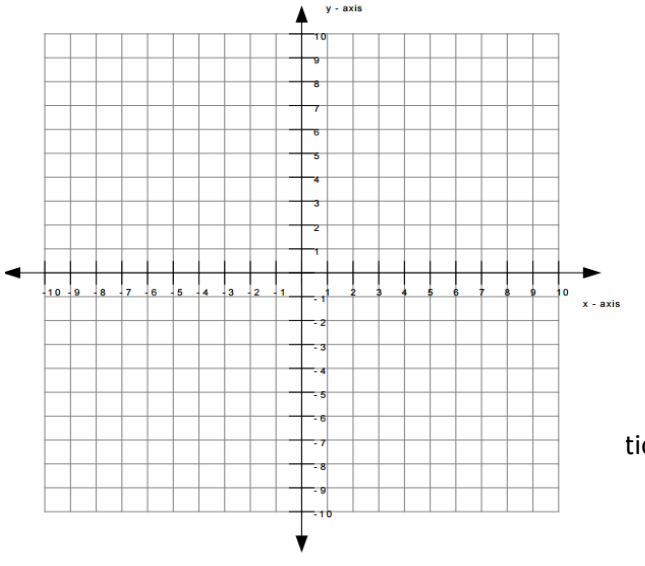
C

(-1, _____)

(2, _____)

(0, _____)

(3, _____)



Equation: ***y = -1x - 3***

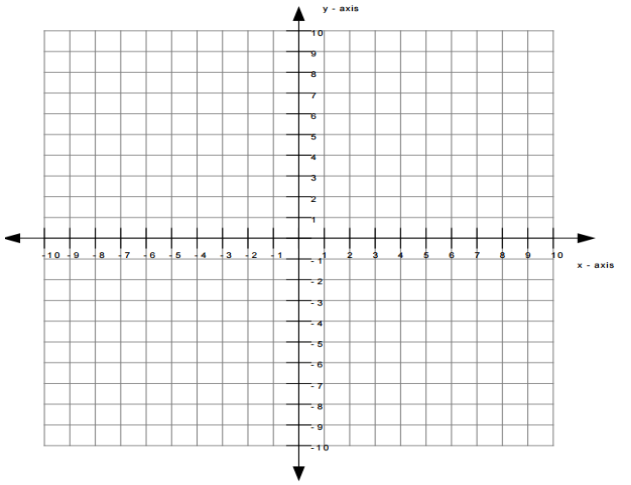
(-1, _____)

D

(-2, _____)

(0, _____)

(1, _____)



Equation: ***y = -1x - 2***

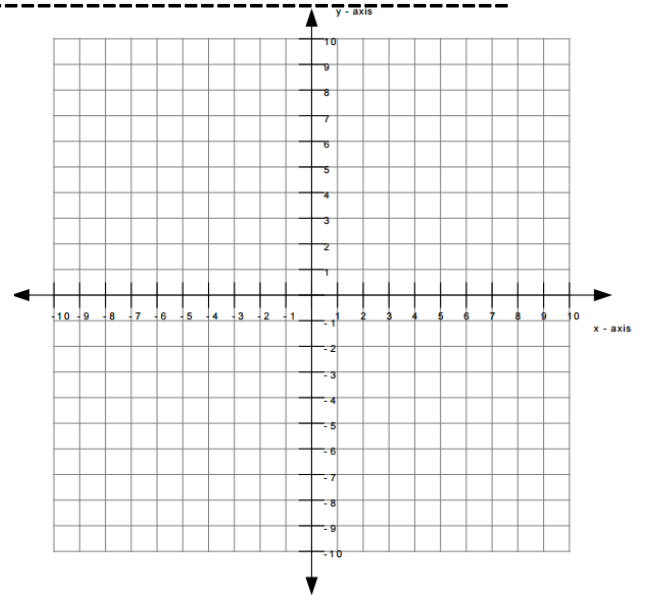
(0, _____)

E

(-2, _____)

(-3, _____)

(3, _____)



Equation: ***y = 2x - 3***

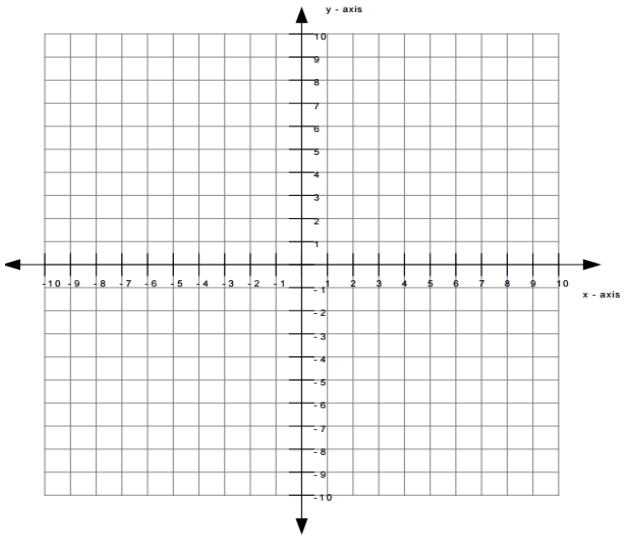
(-1, _____)

F

(2, _____)

(4, _____)

(5, _____)



Handout 2.4: Gallery Walk Reflection Sheet

Name: _____ Date: _____

1. Fill in the chart based on your observations.

Gallery Sheet:	How are all the **graphs** alike?	How are all the **equations** alike?	What do you think that tells you about graphing a line like $y = 3x + 4$?
A			
B			
C			
D			
E			
F			

2. Look at the graphs on Sheets B and E. How are they alike? _____ How are they different? _____

3. Look at the graphs on Sheets C and F. How are they alike? _____ How are they different? _____

4. What would you predict would be true about the graph y = 3x + 4?

Lesson 3: What's Changing This Line?

Focus Standard(s): FOA.15, FOA.16

Additional Standard(s): FOA.17, FOA.19

Standards for Mathematical Practice: SMP.2, SMP.3, SMP.7, SMP.8

Estimated Time: 55 minutes

Resources and Materials:

- Anchor Chart Paper
- Copy Paper
- Dry Erase Markers
- Glue
- Mini-White Boards
- Handout 3.1: Changing the Constant
- Handout 3.2: Changing the Coefficient
- Handout 3.3: What Changes Card Sort

Lesson Target(s):

- Students will graph linear functions in slope-intercept form.
- Students will compare linear functions.

Guiding Question(s):

- How does a change in the coefficient of x affect the graph of a linear function?
- How does a change in the constant affect the graph of a linear functions?

Vocabulary	
Academic Vocabulary: • Rate of Change • Slope • y-intercept	**Instructional Strategies for Academic Vocabulary:** ☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will compare linear functions to make connections between an equation and a graph.

Anticipatory Set/Introduction to the Lesson: Homework Pair-Share

- ✓ Have students Pair-Share the two equations they created for homework. Ask students to identify common characteristics their equations have and discuss what the lines would look like if all four were graphed on one coordinate plane.

Circulate and actively monitor discussions listening for students who correctly discuss and identify the slope and y-intercept (SMP.3, SMP.8).

For students who are EL, have disabilities, or perform well below grade level:

- Provide students with graph paper and rulers to test theories of what the graph would look like.
- Encourage students who have not yet made connections to use a table to organize ordered pairs.

Extensions for students with high interest or working above grade level:

- Ask students to create a situation their rules may apply to.
- Have students explain in words the relationship between the slope and y-intercept to the graph.

Activity 1: Changing the Constant

Note: Prior to activity, cut out cards from **Handout 3.1: Changing the Constant**.

Pass out mini-white boards and dry erase markers.

- ✓ Instruct students to graph the equations y = x.

Once students have graphed the parent linear function y = x, pass out a card from **Handout 3.1: Changing the Constant**. Instruct students to graph the new equation on the same graph.

- ✓ Have students show their graphs.
- ✓ Facilitate a whole group discussion about what changed in the equation and the graph. Ask students to explain why this is important to understand. Instruct students to Turn and Talk to explain how this will help them graph (SMP.3 and SMP.8).

Activity 2: Changing the Coefficient

Note: Prior to activity, cut out cards from **Handout 3.2: Changing the Coefficient**.

Instruct students to erase their boards.

- ✓ Have students graph the equations y = x.

Once students have graphed the parent linear function y = x, pass out a card from **Handout 3.2: Changing the Coefficient**. Instruct students to graph the new equation on the same graph.

- ✓ Have students show their graphs.
- ✓ Facilitate a whole group discussion about what changed in the equation and the graph. Ask students to explain why this is important to understand. Instruct students to Turn and Talk with a different partner to explain how this will help them graph (SMP.3, SMP.7, SMP.8).

Extensions for students with high interest or working above grade level:

- Make cards with rational slopes for students who have successfully master graphing using slope - intercept form in previous math courses.

Activity 3: Slope-Intercept Anchor Chart

Create an anchor chart to display the findings of the day. Model the use of academic vocabulary: slope, y-intercept, steepness, constant, coefficient, rate of change when creating the anchor chart.

For students who are EL, have disabilities, or perform well below grade level:

- Students can create a foldable to match the anchor chart for use throughout the remainder of the unit.

Activity 4: What Changes Card Sort

Note: Prior to activity, cut out cards from **Handout 3.3: What Changes Card Sort** so each team receives one set of cards.

Pass out a card set from **Handout 3.3 What Changes Card Sort**, glue, and a sheet of copy paper to each team. Have teams work together to sort cards in two groups: steepness change and initial value change (SMP.7).

- ✓ Once cards are sorted, have teams write a summary at the bottom of their paper to explain the role of the constant and the coefficient in a linear equation.

Reflection and Closing:

- ✓ **Exit Ticket:** Have students write a rule for a line with a negative slope and a y-intercept that is greater than 2 (SMP.2).

Homework

Ask students to draw a representation of a slope of zero and provide proof of how they arrived at their conclusion.

Handout 3.1: Changing the Constant

y=x+1	y=x+4	y=x+1	y=x+4
y=x-1	y=x-4	y=x-1	y=x-4
y=x+2	y=x+5	y=x+2	y=x+5
y=x-2	y=x-5	y=x-2	y=x-5
y=x+3	y=x+6	y=x+3	y=x+6
y=x-3	y=x-6	y=x-3	y=x-6

Handout 3.2: Changing the Coefficient

y=-1x	y=4x	y=-1x	y=4x
y=-1x	y=-4x	y=-1x	y=-4x
y=2x	y=5x	y=2x	y=5x
y=-2x	y=-5x	y=-2x	y=-5x
y=3x	y=6x	y=3x	y=6x
y=-3x	y=-6x	y=-3x	y=-6x

Handout 3.3: What Changes Card Sort

y=-1x	y=4x	y=x+1	y=x+4
y=-x	y=-4x	y=x-1	y=x-4
y=2x	y=5x	y=x+2	y=x+5
y=-2x	y=-5x	y=x-2	y=x-5
y=3x	y=6x	y=x+3	y=x+6
y=-3x	y=-6x	y=x-3	y=x-6

Lesson 4: Slope Situations

Focus Standard(s): FOA.15, FOA.16, FOA.17

Standards for Mathematical Practice: SMP.2, SMP.3, SMP.4, SMP.6

Estimated Time: 55 minutes

Resources and Materials:

- Handout 4.1: Graphing Stories
- Handout 4.2: Slope is Life Notes
- Graphing Stories Video - http://graphingstories.com/

Lesson Target(s):

- Student will describe linear functions based on their initial values and slopes
- Student will sketch functions based on real-world change.
- Student will make the connection between mathematical slope and the graphs of their linear functions

Guiding Question(s):

- Does change in one thing always affect another?
- How can graphs be used to represent changes in the real world?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Rate of change • Slope • Steepness • y-intercept	☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Create pictures/symbols to represent words ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will recognize slope and slope changes in real-world contexts. Students will understand that slope is an exact rate of change. Students will find the slope from ordered pairs.

Anticipatory Set/Introduction to the Lesson: Zero Slope

Allow students time to share the graph they created to represent a line with a slope of zero.

- ✓ Actively monitor conversations and make observations of the graphs created. Ask students to justify to one another why the line would be horizontal and not vertical using the steepness as a focus in the discussion. Play the "skeptic" to determine which students can truly explain what a slope of zero means in a mathematical and real-world context (SMP.3).

Activity 1: Using Graphs to Represent Situations

Display the following scenario:

"*A student gets into his car, leaving from a point 5 miles from his home and quickly speeds away towards his home.*"

Provide Quiet-Think-Time to allow students to construct an idea of ways they might represent this situation. Instruct students to work in teams to produce a representation they will share with the class (SMP.2 and SMP.4).

- ✓ Allow students approximately 5 minutes to work on this in groups of 2-4. At the end of the time, have students share their representations.

For students who are EL, have disabilities, or perform well below grade level:

- Students can represent the graph on the coordinate plane, with a sketch, or a video clip they created.

Activity 2: Graphing Stories Activity
Ask students to consider if, in real life, the rate or direction, ever change during a real-world situation. Explain to students that they are going to sketch graphs of changing real-world situations.

Distribute **Handout 4.1: Graphing Stories**. Explain to the students they will watch a video. Before they watch the video, have students label the y-axis as shown. Next, show a Graphing Stories Video of your choice and create a graph for the scenario. The video will play at half speed to allow time to correct errors and check values (SMP.6). **Handout 4.1: Graphing Stories** contains four graphs, so you may repeat this process as many times as time permits. Finally, the video will reveal the solution with the graph superimposed on the video as it happens so students can compare their graph to the solution.

- ✓ Check graphs for each scenario shown to verify student understanding of rates as they apply to the real-world (SMP.4).

For students who are EL, have disabilities, or perform well below grade level:

- Pause video before rates change to allow time to graph each segment of change.

Extensions for students with high interest or working above grade level:

- Students could create their own video situations and graphs and show them in future classes.

Activity 3: Slope is Life Guided Notes

Distribute **Handout 4.2: Slope is Life Notes** and go through them with the students, eliciting what students think to fill in the blanks.

- ✓ Provide examples for students to practice finding slope on the back of their notes.

Reflection and Closing:

- ✓ Facilitate a whole group discussion of how mathematical slopes and real-world slopes are related and when, if ever, they differ. For example, real-world situations are often limited to Quadrant 1 and are less likely to be truly straight lines.

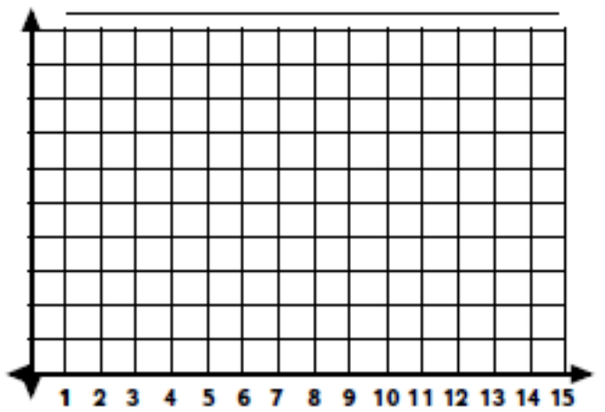
Homework

Have students write their name using only lines. Instruct students to label each line segment of each letter as positive, negative, zero, or undefined slopes.

Handout 4.1: Graphing Stories

Name: _____ Date: _____

1.



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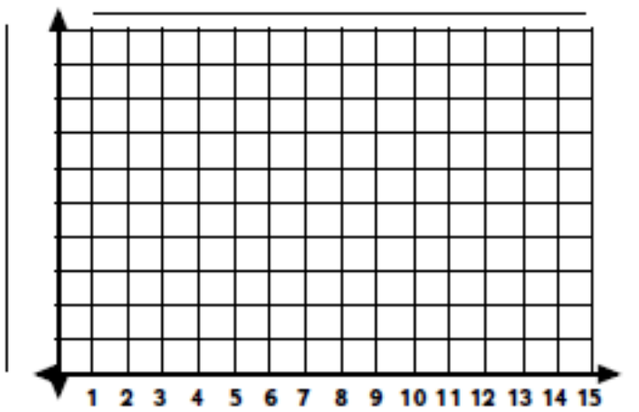
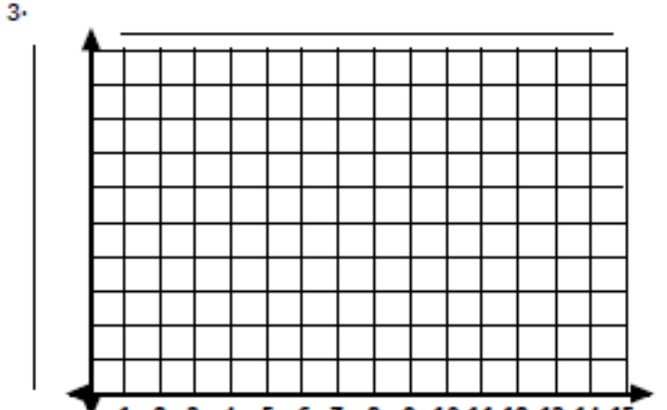
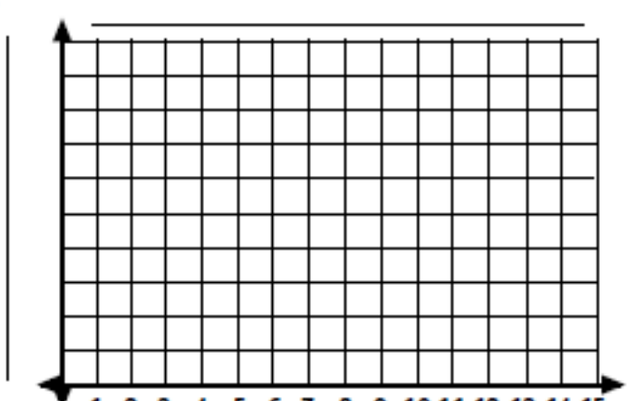


3.



4.



Handout 4.2: Slope is Life Notes

Name: _____ Date: _____

I. Slope is a mathematical way of showing _____ and can usually be written as a _____.

II. Slope reflects life because life has a lot of _____ . Slope can also be thought of as _____ .

Ex:

III. Slope is about _____ and _____

A. Slopes are positive or negative. Slope is _____ when y increases as x increases or y decreases when x decreases. These lines go up to the _____ on the coordinate plane. Lines with negative slopes go up to the _____.

B. Slopes have exact rates of _____ . It is written as a fraction with _____ over _____ . The slope tells exactly how many points y changes compared to how many points _____changes.

IV. Slope can be found by:

A. Looking at the graph and comparing any _____ ordered pairs to find their change.

B. Taking two ordered pairs from a table or graph to find their change with the slope formula: $$m = \frac{y_2 - y_1}{x_2 - x_1}$$

1. Pay close attention to your _____!

2. Be consistent. The y-value you start with must be above the x-value that you start with.

C. Is found in situations by taking the information and informally finding the change OR by making it into 2 ordered pairs and using the slope formula.

KEY

I. Slope is a mathematical way of showing change and can usually be written as a fractional ratio.

II. Slope reflects life because life has a lot of change. Slope can also be thought of as unit rate

Ex: miles per hour, growth per month, elevation after hours of descent

III. Slope is about direction and exact rate of change.

A. Slopes are positive or negative. Slope is positive when y increases as x increases or y decreases when x decreases. These lines go up to the right on the coordinate plane. Lines with negative slopes go up to the left.

B. Slopes have exact rates of change. It is written as a fraction with change in y over change in x. The slope tells exactly how many points y changes compared to how many points the x changes.

IV. Slope can be found by:

A. Looking at the graph and comparing any 2 ordered pairs to find their change.

B. Taking two ordered pairs from a table or graph to find their change with the slope formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

1. Pay close attention to your SIGNS!

2. Be consistent. The y-value you start with must be above the x-value that you start with.

C. Is found in situations by taking the information and informally finding the change OR by making it into 2 ordered pairs and using the slope formula.

Lesson 5: Calculating Slope

Focus Standard(s): FOA.15, FOA.16

Additional Standard(s): FOA.17

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP.7, SMP.8

Estimated Time: 55 minutes

Resources and Materials:

- Anchor Chart Paper
- Handout 5.1: Calculating Slope
- Handout 5.2: Real-World Slope
- Handout 5.3: Homework

Lesson Target(s):

- Students will identify representations of linear functions.
- Students will use two points on tables and graphs to find the rate of change of a linear function.

Guiding Question(s):

- How can linear functions be represented?
- What are the different methods for finding the slope of a line?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Linear • Ordered pairs • Rate of change • Slope	☐ Introduce words with student-friendly definitions and pictures ☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will calculate and interpret the meaning of the slope. Students will use the slope formula or rise over run method to calculate rate of change.

Anticipatory Set/Introduction to the Lesson: Representations Anchor Chart
Explain to students that we can use representations other than graphs to find change. Create an Anchor Chart to display the different ways to represent linear functions. Elicit students to draw on prior knowledge of using tables, graphs, equations, real-world situations, and models to share ideas. On the Anchor Chart, provide an example of each using the same rule to help students make connections (SMP.7).

Activity 1: Slope of Tables and Graphs

- ✓ Instruct students to graph the line $y = 2x + 4$ using the x-values 0, 1, 2, and 3.

Actively monitor students as they graph the equation. Look for students who are already organizing information in a table or graphing using the slope and y-intercept.

- ✓ Instruct students to now create a table to organize the ordered pairs they found for the graph.

Ask students to verbally explain how they see change in each representation. Verify students find the rate of change is 2 in both representations. Have students Turn and Talk about which representation they feel is easier to work with and why.

Activity 2: Calculating Slope
Explain and model how to calculate the slope using graphs and tables representing linear functions. Begin by working with the representation most students felt was easier in the previous activity.

Display the slope formula and explain how to evaluate using two ordered pairs.

$$slope = \frac{y_2 - y_1}{x_2 - x_1} \qquad \frac{Rise}{Run} = \frac{change\ in\ y}{change\ in\ x}$$

Model how to find the slope using two points from the table in Activity 1.

- ✓ Students identify two points from the table.
- ✓ Students write and apply the slope formula to calculate the slope of graphs and tables using two points.
- ✓ Students interpret their results and determine whether the results make sense by comparing the rise over run to the calculated slope.

Have students verify the slope by using two different points on the graph (SMP.8).

For students who are EL, have disabilities, or perform well below grade level:

- Allow students to use highlighters to identify x and y values in ordered pairs and their corresponding location in the formula.

Extensions for students with high interest or working above grade level:

- Have students write an explanation of why the points selected do not change the slope of a line.

- ✓ Allow students time to practice using the slope formula. Distribute and complete **Handout 5.1: Calculating Slope** as a Pairs Check**.**

Activity 3: Finding Slope Within a Situation

Distribute **Handout 5.2: Real-World Slope** and ask for a volunteer reader.

"Jakarri was told that the number of blooms on a cactus was related to the number of days the sun shined on that cactus within a month. Data was gathered, and he discovered that if a cactus received 1 day of sun within a month, there were 6 blooms on that cactus. A cactus absorbing 3 days of sun within a month had 20 blooms. Jakarri wants to determine at what rate will blooms appear on a cactus as it relates to the days of sun within a month."

- ✓ Instruct students to identify the independent (x) and dependent (y) variables in the situation (SMP.2).

- ✓ Allow time for teams to determine if they would use the slope formula, a table or both to determine the slope of the situation (SMP.1, SMP.4, SMP.8).

Conduct a Whip Around, Sit Down to share and record student responses.

Note: "Whip Around, Sit Down" - All students/teams stand up. Start the Whip Around process by sharing information from the real-world problem with the class one team at a time. If a student/team hears a response that's on their sheet, they check it off. Once all the students'/team's responses have been said by classmates and they are checked off the list, students/teams sit down. The Whip Around only continues with those students who remain standing.

- ✓ Students/teams share one fact or discovery from the situation at a time.

Instruct teams to finish showing their work on their individual papers and make sure the solution is clear and precise.

Ask a student volunteer to display their team's work and interpret their results in the context of the situation at the document camera and explain the steps.

- ✓ Students evaluate their progress and change the method used if necessary, and determine if the results make sense. Critique the reasoning of peers by responding to the arguments of their peers and determine if the statements make sense or are flawed (SMP.3).

For students who are EL, have disabilities, or perform well below grade level:

- Ask students to determine which variable affects the other and explain that the "boss" is the independent variable (x).

Reflection and Closing:

- ✓ **Exit Ticket:** Construct a table and a graph with a slope of -4 and prove the slope using the slope formula.

Homework

Complete **Handout 5.3: Homework**.

Handout 5.1: Calculating Slope

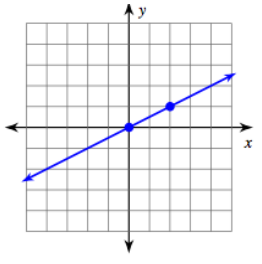
Name: _____ Date: _____

Calculating Slope for Multiple Representations

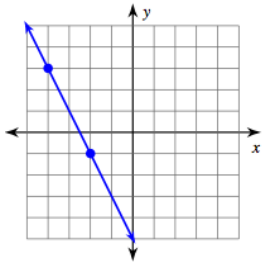
$$\frac{Rise}{Run} = \frac{change\ in\ y}{change\ in\ x}$$

Calculate the slope using the slope formula or “Rise over Run.”

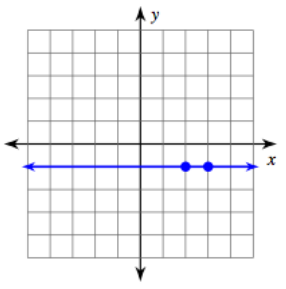
1.



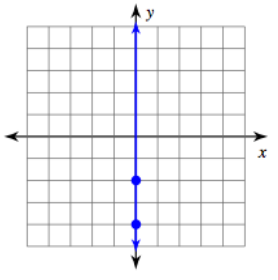
2.



3.



4.



5.

X	Y
-2	-9
0	-1
1	3
2	7

6.

X	Y
-1	5
0	3
1	1
2	-1

7.

X	-5	-3	0	1
Y	-3	-1	2	3

8.

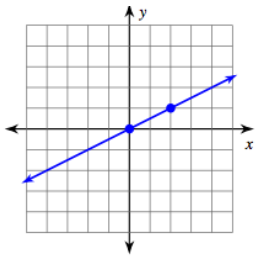
X	-6	-6	-6	-6
Y	-1	-3	0	3

Key

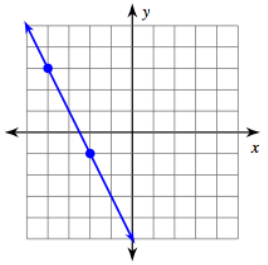
Calculating Slope for Multiple Representations

$$\frac{Rise}{Run} = \frac{change\ in\ y}{change\ in\ x}$$

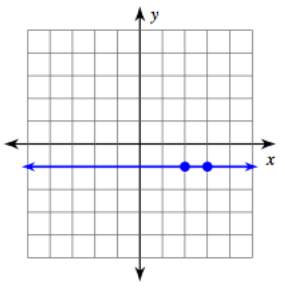
Calculate the slope using the slope formula or "Rise over Run."

1. 

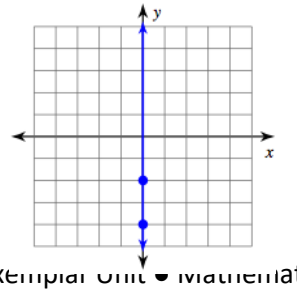
m = ½

2. 

m = -2

3. 

m = 0

4. 

Undefined

5.

X	Y
-2	-9
0	-1
1	3
2	7

m = 4

6.

X	Y
-1	5
0	3
1	1
2	-1

m = -2

7.

X	-5	-3	0	1
Y	-3	-1	2	3

m = 1

8.

X	-6	-6	-6	-6
Y	-1	-3	0	3

Undefined

Handout 5.2: Real-World Slope

Name: _____ Date: _____

Cactus Blooms

Jakarri was told that the number of blooms on a cactus was related to the number of days the sun shone on that cactus within a month. Data was gathered, and he discovered that if a cactus received 1 day of sun within a month, there were 6 blooms on that cactus. A cactus absorbing 3 days of sun within a month had 20 blooms. Jakarri wants to determine at what rate will blooms appear on a cactus as it relates to the days of sun within a month.

_____

_____

_____

_____

Students will read the situation, brainstorm, and complete the following:

1. Identify the two points

2. Calculate the slope

3. Make a table with at least 5 points

KEY

Cactus Blooms

Jakarri was told that the number of blooms on a cactus was related to the number of days the sun shone on that cactus within a month. Data was gathered, and he discovered that if a cactus received 1 day of sun within a month, there were 6 blooms on that cactus. A cactus absorbing 3 days of sun within a month had 20 blooms. Jakarri wants to determine at what rate will blooms appear on a cactus as it relates to the days of sun within a month.

One day of sun yields six blooms

Three days of sun yields 20 blooms

Rate of change = $\frac{y_2 - y_1}{x_2 - x_1}$

Students will read the situation, brainstorm their notes and complete the following:

1. Identify the two points

(1, 6) and (3, 20)

2. Calculate the slope

$\frac{20-6}{3-1} = \frac{14}{2}$ = 7 blooms per month

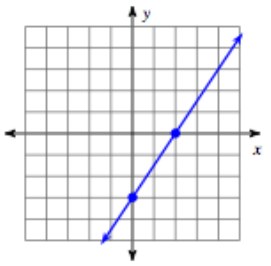
3. Make a table with at least 5 points

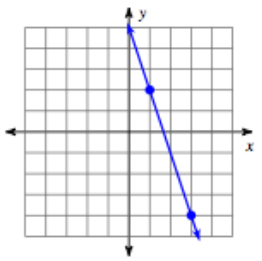
x	y
1	6
2	13
3	20
4	27
5	34

Handout 5.3: Homework

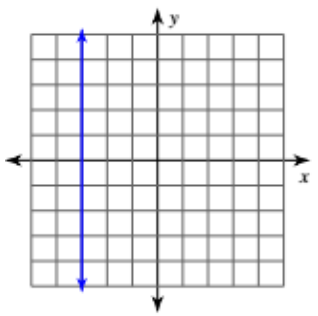
Name: _____ Date: _____

Use the best method to calculate the slope of graph or set of points.

1. 

2. 

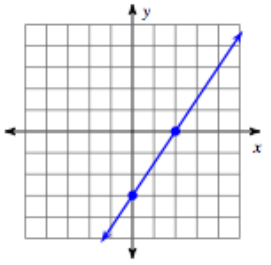
3. (17, -13), (17 8)

4. 

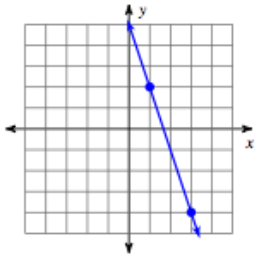
5. (9, 3), (19, -17)

Key

Use the best method to calculate the slope of graph or set of points.

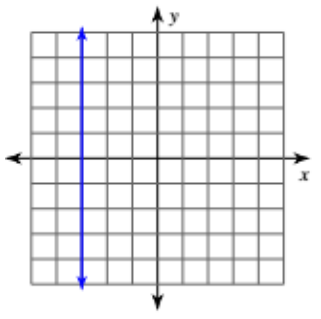
1. 

m = 3/2

2. 

m = -3

3. (17, -13), (17, 8) undefined

4. 

undefined

5. (9, 3), (19, -17) m= -2

Lesson 6: Making a Change

Focus Standard(s): FOA.15, FOA16

Additional Standard(s): FOA.17, FOA.19

Standards for Mathematical Practice: SMP.3, SMP.6, SMP.7

Estimated Time: 55 minutes

Resources and Materials:

- Anchor Chart Paper
- Scissors
- Tape
- Handout 6.1: I Have, Who Has
- Handout 6.2: Identity m and b
- Handout 6.3: Slope as Rate of Change Gallery Walk

Lesson Target(s):

- Students will find the slope of a line using two points in a table, graph, or situation.

Guiding Question(s):

- What is the best method for calculating slope when given a graph?
- What is the best method for calculating slope when given a table?
- What is the best method for calculating slope when given a situation?

Vocabulary

Academic Vocabulary:

- Horizontal line
- Negative slope
- Positive slope
- Undefined slope
- Vertical line
- Zero slope

Instructional Strategies for Academic Vocabulary:

☐ Model how to use the words in discussion
☐ Discuss the meaning of word in a mathematical context
☐ Create pictures/symbols to represent words
☐ Write/discuss using the words
☐ Act out the words or attach movements to the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will use multiple methods to create an equation of a linear function. Students will make a table and a graph. Students will use the slope formula. Students will use slope-intercept form of an equation to identify the slope.

Anticipatory Set/Introduction to the Lesson: I Have, Who Has?
Note: Prior to the lesson, cut out **Handout 6.1: I Have, Who Has?**
Distribute cards to students. All cards must be used, so some students may receive two cards. Have students write down the slope of the problem in the "I Have" part of their card. Circulate and check solutions before you start the activity to avoid interruptions during the quick pace of the activity (SMP.6).

Begin the game with the student who has the first card reading aloud, "I have the first card. Who has a slope of 3?" The student whose slope came out to be 3 will go next. That student will read, "I have a slope of 3. Who has a slope of -1/4?" When a student is finished with a card, he/she flips it over. The game is over when all cards in the activity have been used.
Note: Students can see patterns in finding the slope of a graph such as using the rise over run method instead of the slope formula. Students are also able to shift how they see and use relevant data (SMP.7).

- ✓ Ask the following prompting questions to lead a whole group discussion.

Prompting Questions:

- Were there any problems identifying the y-intercept in the table or graphs with the game?
- Do you think it would be easier to find the slope from a table or a graph?
- Did anyone solve for slope using the formula we learned yesterday?

Note: Cards can be collected and shuffled to play another round of I Have, Who Has before the next activity if needed.

For students who are EL, have disabilities, or perform well below grade level:

- Preselect easier cards for struggling students.

Extensions for students with high interest or working above grade level:

- Challenge students to create their own "I Have, Who Has" game cards.

Activity 2: Identify m and b
Distribute **Handout 6.2: Identify m and b** and review identifying the slope and y-intercept with the whole class. Address possible misconceptions, such as student may think the y-coordinate for the y-intercept must be zero and moving along the x-axis first for the slope.

Activity 3: Slope as Rate of Change Gallery Walk

Note: Prior to lesson, hang 5 pieces of anchor chart paper around the room labeled with the equations shown on **Handout 6.3: Slope as Rate of Change Gallery Walk.**

Place students in teams of 4-5. Have teams use Numbered Heads to determine group situation (A, B, C, or D). Distribute **Handout 6.3: Slope as Rate of Change Gallery Walk**, scissors, and tape to each team.

Note: There are 4 different groups of situations (A, B, C, and D) and some teams may work on the same situations since this is designed for 16 - 20 students.

- ✓ Explain to students that you expect them to complete their task, show work, and get the other team members to sign your work before taping their work to the appropriate Gallery Walk situation (SMP.3).

When all teams have taped all their work, instruct teams to stop at each poster and record their thoughts on each situation using the following mathematical terminology (SMP.6).

- positive slope
- negative slope
- zero slope
- undefined slope
- y-intercept
- horizontal line
- vertical line

Note: Be sure to encourage students to use the appropriate grade level and subject vocabulary while constructing statements or arguments.

For students who are EL, have disabilities, or perform well below grade level:

- Provide fewer words for students to focus on using in description on graphs.

Extensions for students with high interest or working above grade level:

- Challenge teams to write a description using at least 4 words per situation.

Reflection and Closing:

- ✓ **3-2-1 Exit Ticket:** Have students write down 3 representations they have worked with so far, 2 ways to find slope, and 1 other way to describe the y-intercept.

Reflect on the level of accuracy of the student responses to the following questions:

- How do you find the slope when given two points?
- How do you find the y-intercept using a table and a graph?

Homework

Display or write on the board for students to copy into notebook:
Given the points (2, 16), (5,10), and (7,6), use the best methods to determine the slope, identify the y-intercept, and write the linear equation in slope-intercept form.

Handout 6.1: I Have, Who Has

I HAVE:

X	Y
0	4
1	7
2	10
3	13
4	16

WHO HAS:

a slope of $-\frac{1}{4}$

I HAVE:

the first card

WHO HAS:

a slope of ***3***

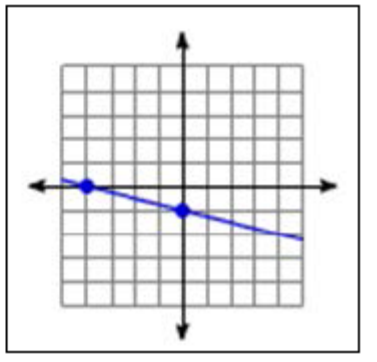
I HAVE:

X	Y
1	5
4	7
7	9
10	11
13	13

WHO HAS:

a slope of $\frac{2}{5}$

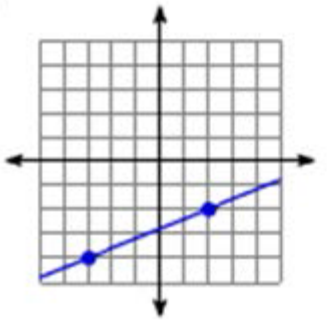
I HAVE:



WHO HAS:

a slope of $\frac{2}{3}$

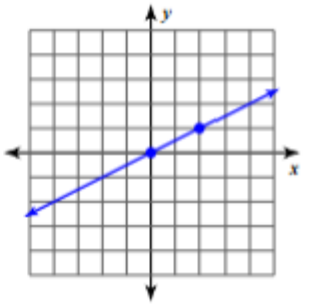
I HAVE:



WHO HAS:

a slope of **-1**

I HAVE:



WHO HAS:

a slope of - *2*

I HAVE:

X	Y
5	9
7	7
8	6
11	3
12	2

WHO HAS:

a slope of $-\frac{4}{5}$

I HAVE:

X	Y
-4	4
-5	10
-6	16
-7	22
-8	28

WHO HAS:

a slope of $\frac{1}{2}$

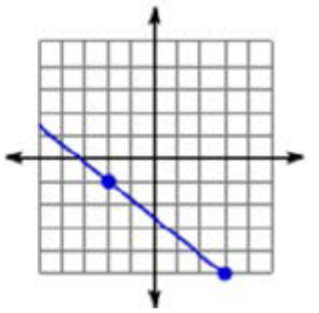
I HAVE:

X	Y
0	7
1	12
2	17
3	22
4	27

WHO HAS:

a slope of $-\frac{5}{4}$

I HAVE:



WHO HAS:

a slope of ***- 6***

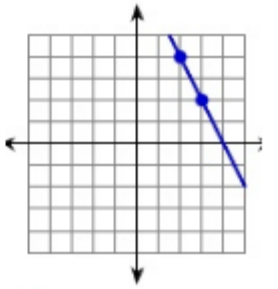
I HAVE:

X	Y
0	1
8	2
16	3
24	4
32	5

WHO HAS:

a slope of ***4***

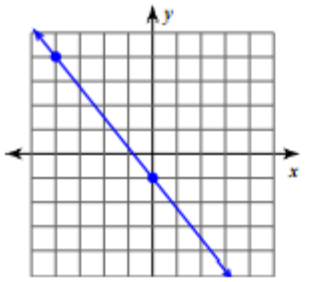
I HAVE:



WHO HAS:

a slope of ***5***

I HAVE:



WHO HAS:

a slope of $\frac{1}{8}$

I HAVE:

X	Y
-1	0
3	24
4	30
7	48
8	54

WHO HAS:

a slope of $\frac{2}{8}$ *OR* $\frac{1}{4}$

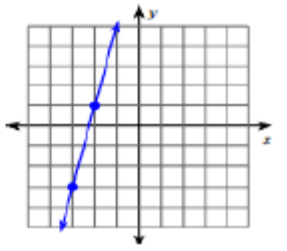
I HAVE:

X	Y
-7	-1
-2	2
8	8
13	11
23	17

WHO HAS:

a slope of $-\frac{6}{4}$ *OR* $-\frac{3}{2}$

I HAVE:



WHO HAS:

a slope of ***6***

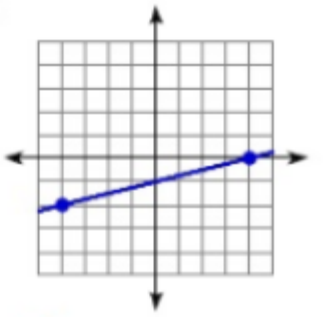
I HAVE:

X	Y
1	3
2	13
3	23
4	33
6	53

WHO HAS:

a slope of 2

I HAVE:



WHO HAS:

a slope of $\frac{3}{5}$

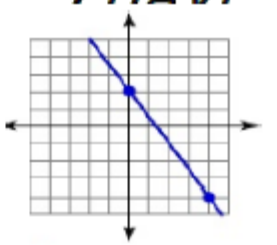
I HAVE:

X	Y
-2	25
-1	19
0	13
2	1

WHO HAS:

a slope of $-\frac{3}{10}$

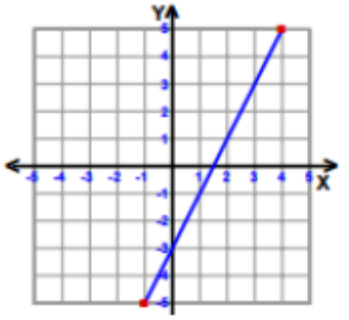
I HAVE:



WHO HAS:

a slope of 10

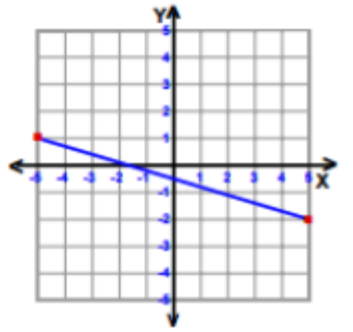
I HAVE:



WHO HAS:

a slope of - 6

I HAVE:



WHO HAS:

a slope of $\frac{7}{2}$

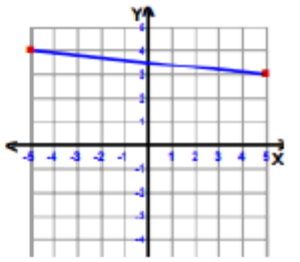
I HAVE:

X	Y
-9	0
-7	7
-3	21
1	35
3	42

WHO HAS:

a slope of $-\frac{1}{10}$

I HAVE:



WHO HAS:

a slope of $\frac{4}{3}$

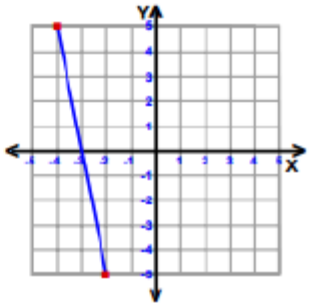
I HAVE:

X	Y
-7	-10
-1	-2
2	2
5	6
11	14

WHO HAS:

a slope of - 5

I HAVE:



WHO HAS:

a slope of 0

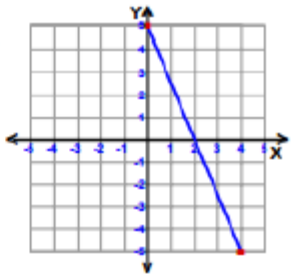
I HAVE:

X	Y
-6	2
-3	2
0	2
12	2
15	2

WHO HAS:

a slope of $-\frac{5}{2}$

I HAVE:



WHO HAS:

a slope of 7

Handout 6.2: Identify the m and b

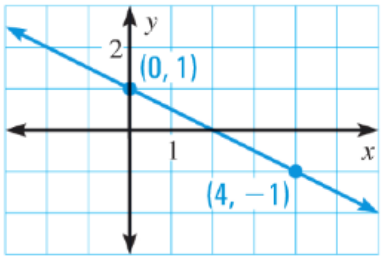
Name: _____ Date: _____

Identify the initial value (y-intercept or "b") within a table or graph

SLOPE-INTERCEPT FORM $y = mx + b$

m is identified as the _____ and b is identified as the _____

1. **Identify the slope and y-intercept from a graph.**



Slope: _____

Y-Intercept: _____

2. **Identify the slope and y-intercept from a graph.**

x	y
-5	-16
-2	-7
0	-1
3	8
5	14

Slope: _____

Y-intercept: _____

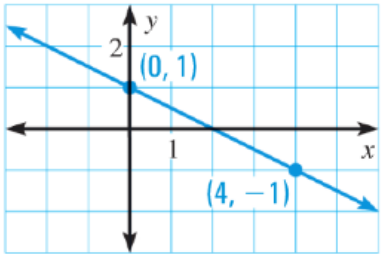
KEY

Identify the initial value (y-intercept or "b") within a table or graph

SLOPE-INTERCEPT FORM $y = mx + b$

m is identified as the ___SLOPE_____ and b is identified as the____y-intercept__.

1. **Identify the slope and y-intercept from a graph.**



Slope: $m = -1/2$

Y-Intercept: $b = 1$

2. **Identify the slope and y-intercept from a graph.**

x	y
-5	-16
-2	-7
0	-1
3	8
5	14

Slope: 3

Y-intercept: **-1**

Handout 6.3: Slope as Change Gallery Walk

Name: _____ Date: _____

DIRECTIONS

1. Before class, put up Gallery Sheets.

2. Break kids into teams of 3. There are 4 different groups of situations (A, B, C, and D) so some of your teams will be doing the same situations since this is designed for 12 students. If you have 24 or fewer students, you can make two sets of each group's papers. If you have more than 24, you can make three sets of each group's papers, as needed.

3. Give sheets out to each team.

4. You should probably have students show you their answers before they cut them up to make sure they have done them correctly.

5. When they are finished, students will need scissors to cut (or they can crease and carefully tear) on dotted lines. Then they will need tape to put graphs on Gallery Sheets.

6. When they are finished, discuss the graphs. Talk about what situations made positive slopes, negative slopes, zero slopes, and y-intercepts. See if students can come up with other situations that would have the same result.

KEY

Group	***y = 20x***	***y = 50x + 75***	***y = -2x + 30***	***y = 10***	***y = 10x + 50***
A	1	2	3	4	5
B	1	4	3	2	5
C	1	5	4	3	2
D	1	2	3	5	4

Slope as Rate of Change

Group A

DIRECTIONS:

1. Fill in the ordered pair table based on the situation given.

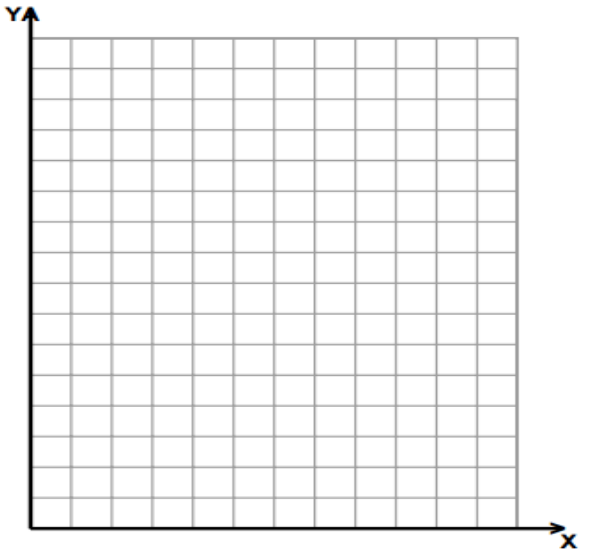
2. Plot the ordered pairs on the grid. Connect to make a line.

3. Cut (or crease and carefully tear) along the dotted lines

4. Put your graph on the Gallery Page that has the equation that matches your graph.

1.He is biking from home at a rate of 20 miles per hour

Hours Traveled	*Miles From Home*
0	**0**
1	
2	
3	



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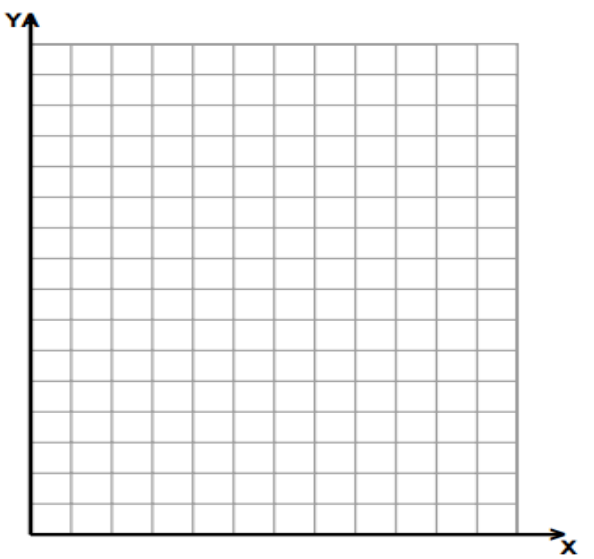
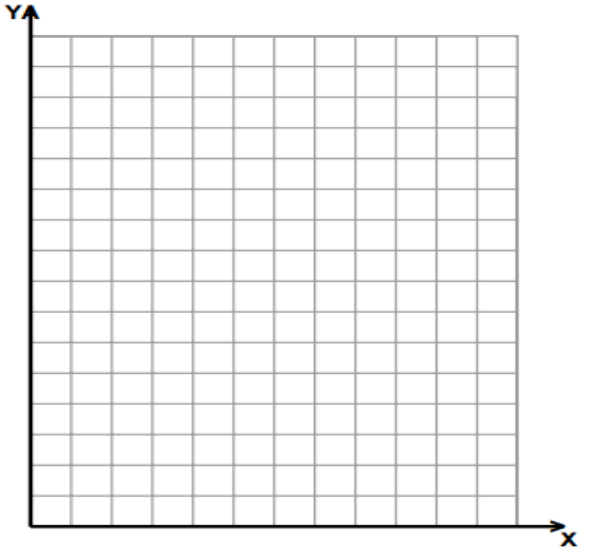
2. He is spending $50 per month on his car insurance, and he spent $75 in sign-up fees to begin.

Months of Insurance	*Total Spent on Insurance*
0	**75**
1	
2	
3	



3. The temperature started at 30° at 6 a.m. and dropped 2 degrees every hour.

Hours Since 6 a.m.	*Temperature*
0	**30**
1	
2	
3	



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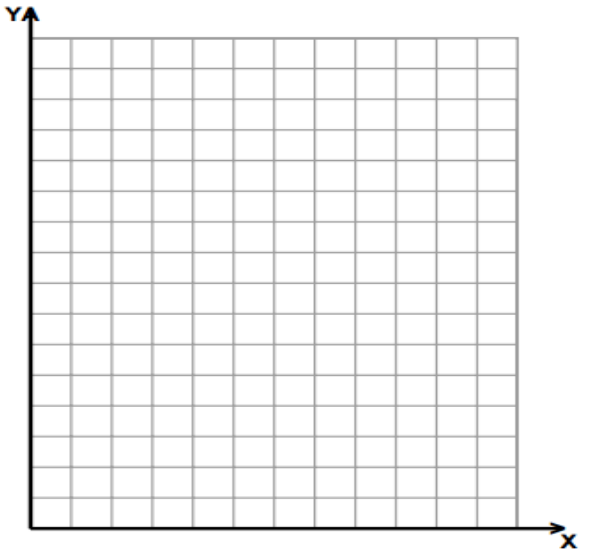
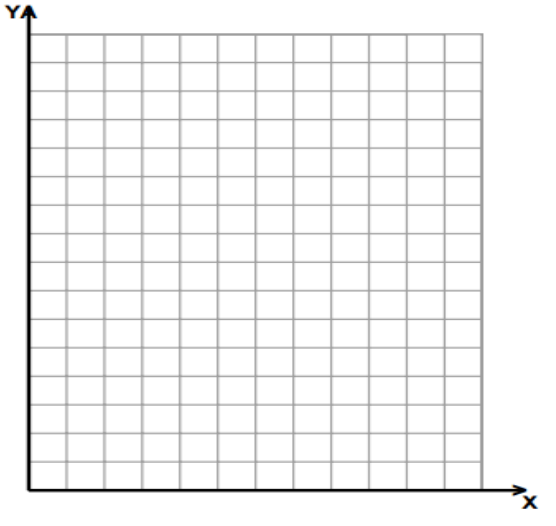
4. At noon, Grant had driven 10 miles from his home. Then, he rested for 3 minutes

Minutes Past Noon	*Distance From Home*
0	**10 miles**
1	
2	
3	



5.She started with $50 and she is saving $10 per week

Weeks Saving	*Total Saved*
0	**50**
1	
2	
3	



Slope as Rate of Change

Group B

DIRECTIONS:

1. Fill in the ordered pair table based on the situation given.

2. Plot the ordered pairs on the grid. Connect to make a line.

3. Cut (or crease and carefully tear) along the dotted lines

4. Put your graph on the Gallery Page that has the equation that matches your graph.

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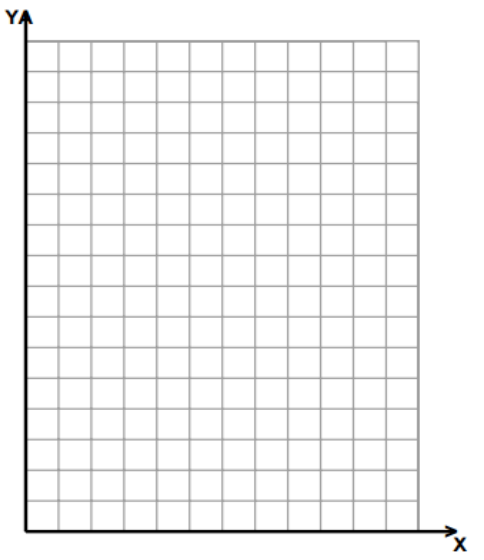
1. A sprinter burns 20 calories per minute

Minutes of Sprinting	*Calories Burned*
0	
1	
2	
3	



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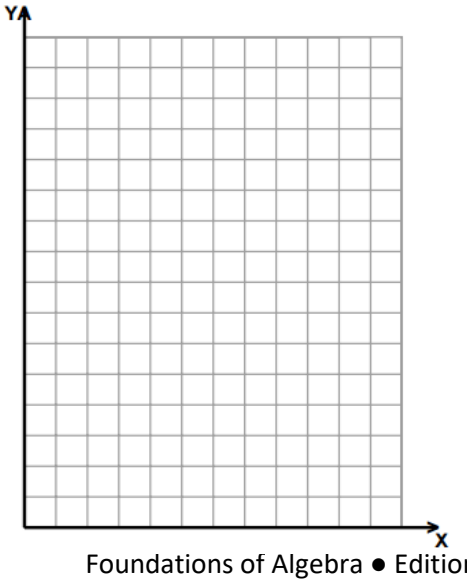
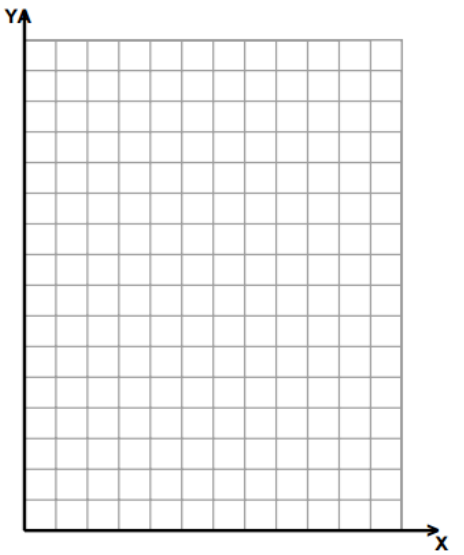
2. Alison earned $10 before the first day of her Spring Break but nothing for the next 3 days.

Days of Spring Break	*Total Money Earned*
0	**10**
1	
2	
3	



3. I started with $30 and spent $2 for every ride I rode.

Rides Ridden	*Total Amount of Money I Have*
0	
1	
2	
3	



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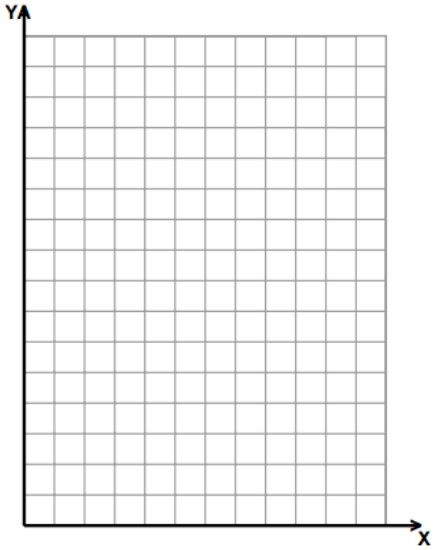
4. It costs $50 per hour and a $75 sign-up fee for the service to call and talk to my aunt in Lima, Peru.

Hours of Phone Call	*Total Spent*
0	
1	
2	
3	



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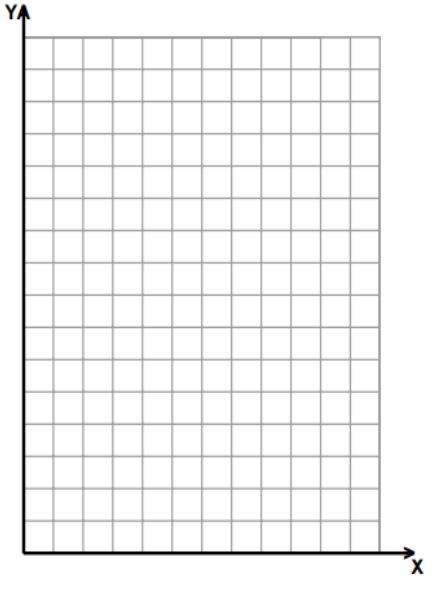
5. I make $10 per day dog-sitting, and I had $50 to begin with.

Days Dog-Sitting	*Total $ I Have*
0	**50**
1	
2	
3	



Slope as Rate of Change

Group C

DIRECTIONS:

1. Fill in the ordered pair table based on the situation given.

2. Plot the ordered pairs on the grid. Connect to make a line.

3. Cut (or crease and carefully tear) along the dotted lines

4. Put your graph on the Gallery Page that has the equation that matches your graph.

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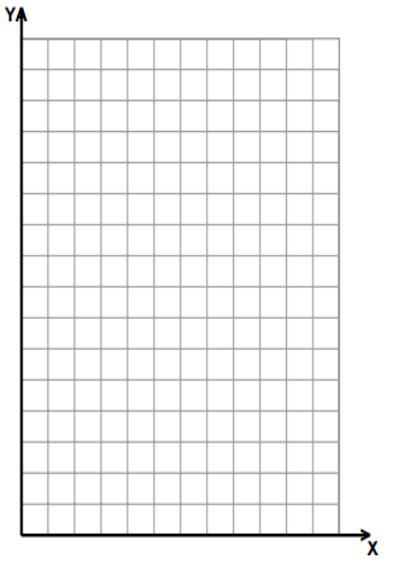
1. I am running 20 miles per week.

Weeks of Running	*Total Miles Run*
0	
1	
2	
3	



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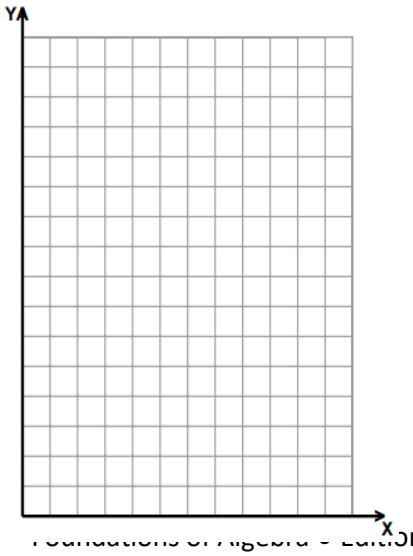
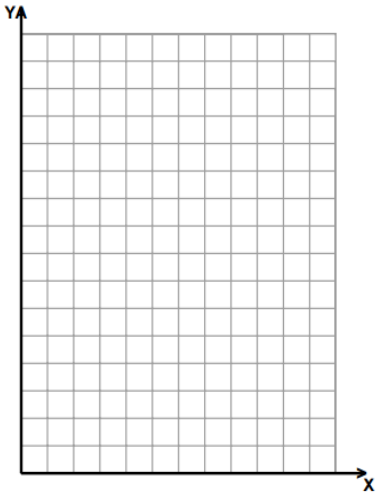
2. I make $10 per day dog-sitting, and I had $50 to begin with.

Days Dog-Sitting	*Total $ I Have*
0	**50**
1	
2	
3	



3. Jed started the vacation with $10 and didn't earn or spend any money for the next 3 days.

Days of Vacation	*Total $ Jed Has*
0	**10**
1	
2	
3	



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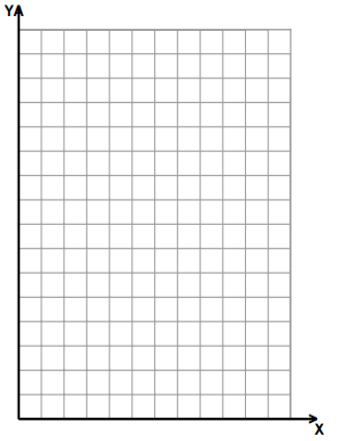
4. She began walking at an elevation of 30 feet above sea level. As she walked, the elevation decreased 2 feet every hour.

Hours of Walking	*Elevation*
0	**30**
1	
2	
3	



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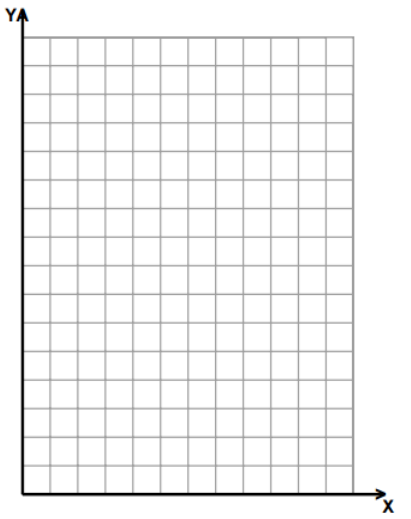
5. He is spending $50 per month on his car insurance, and he spent $75 in sign-up fees to begin.

Months of Insurance	*Total Spent on Insurance*
0	**75**
1	
2	
3	



Slope as Rate of Change

Group D

DIRECTIONS:

1. Fill in the ordered pair table based on the situation given.

2. Plot the ordered pairs on the grid. Connect to make a line.

3. Cut (or crease and carefully tear) along the dotted lines

4. Put your graph on the Gallery Page that has the equation that matches your graph.

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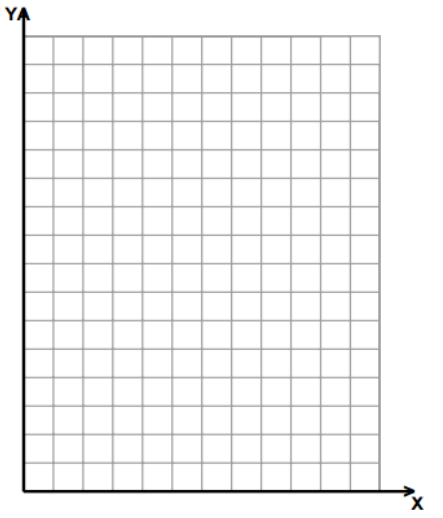
1. It costs $20 per person to get in to the festival

People Entering Festival	*Total $ Spent*
0	**0**
1	
2	
3	



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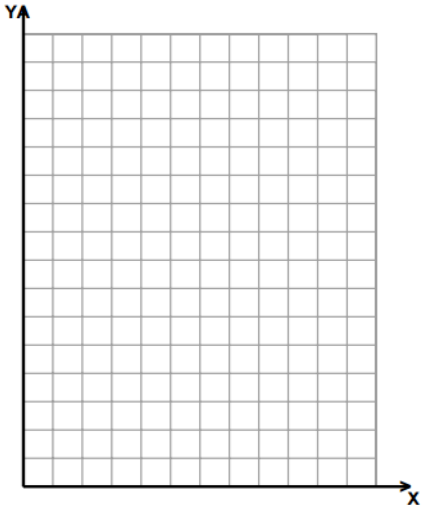
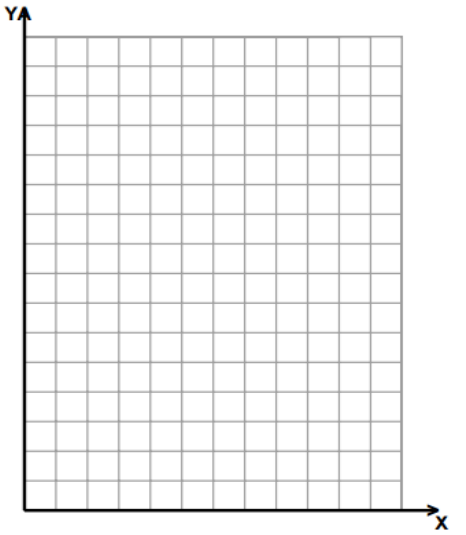
2. It costs $50 per hour and a $75 sign-up fee for the service to call and talk to my aunt in Lima, Peru.

Hours of Phone Call	*Total Spent*
0	
1	
2	
3	



3. The peak of the roof is 30 feet from the ground and drops 2 feet down every yard away from the peak.

Yards from Peak	*Feet Above Ground*
0	**30**
1	
2	
3	



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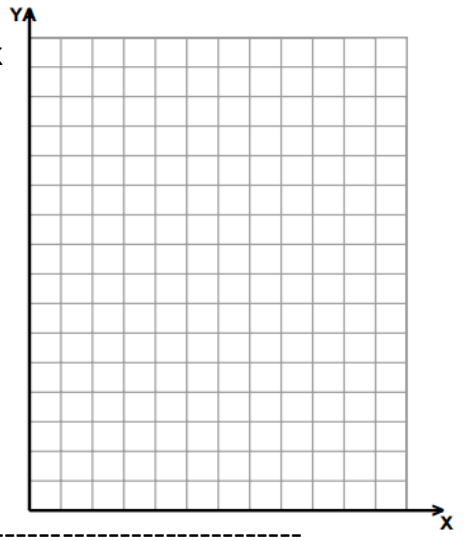
4. She started with $50, and she is saving $10 per week

Weeks of Saving	*Total $ Saved*
0	**50**
1	
2	
3	



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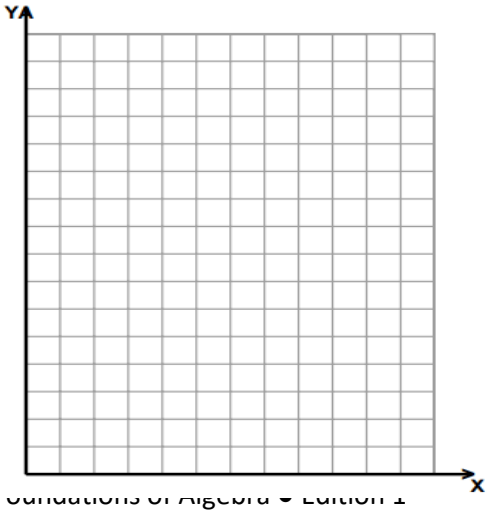
5. At 1 pm, Gareth had driven 10 miles. Then, he stopped for 3 hours to visit a friend.

Hours After 1 pm	*Total Miles traveled*
0	**10**
1	
2	
3	



Lesson 7: Where Do I Start?

Focus Standard(s):FOA.15, FOA.16

Additional Standard(s): FOA.17, FOA.20

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.4

Estimated Time: 55 minutes

Resources and Materials:

- Document Camera

Lesson Target(s):

- Given two points or a table that represents linear functions, the students will find the y-intercept using the slope-intercept form of an equation.

Guiding Question(s):

- How can the slope-intercept form of an equation be used to determine the y-intercept?
- How can you find the y-intercept when working with forms other than slope-intercept form?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Coefficient • Constant • Linear function • Ordered pairs • Rate of change • Slope	☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes:
Students will continue to use multiple representations to write linear equations. Students will deepen their understandings of slope and y-intercept and use this understanding to write linear functions in slope-intercept form.

Anticipatory Set/Introduction to the Lesson: Reciprocal Teaching
Instruct students to Stand Up-Hand Up-Pair Up. Have students pretend their partner was absent the day before. Student A will explain how to find the slope of a linear function using the formula for slope, a table, and a graph. Student B will ask clarifying questions after Student A explains. Then, students will switch roles. Student B will explain to Student A how to determine the type of change in a linear function. Student A will ask clarifying questions after Student B explains.

Activity 1: Finding y-intercepts Direct Instruction
Display slope-intercept form: $y=mx+b$. Identify and briefly explain the ***x***, ***y***, ***m***, and ***b.*** Explain that in slope-intercept form of an equation, we can easily use the slope of the line and y-intercept to express the linear function, but in some representations, the y-intercept is not given. Ask students to brainstorm ways they have learned to find the slope using the different representations. Allow time to consider if they can think of how a y-intercept may be identified in those forms if it is not shown in the representation.

Display the table shown below.

3	8
5	14

- ✓ Have students find the slope using the slope formula.

Lesson $m = \frac{14-8}{5-3} = \frac{6}{2} = 3$

Model for students how to use a point from the table, (5, 14), to substitute into the slope-intercept form of an equation. Have students complete the equation as it is filled in. Use *y = mx + b* and **substitute *m* with 3, *x* with 5, and *y* with 14.**

14=3(5) + b

- ✓ Allow time for students to solve the equation for the y-intercept.

Model for students how to replace their values, *m* = 3 and *b* = -1, back into slope-intercept form.

y = 3x -1

For students who are EL, have disabilities, or perform well below grade level:

- Provide students with highlighters to find corresponding values when evaluating functions.
- Extend the table or graph to find the starting point and slope.

Note: Provide additional examples for students as needed.

Activity 3: Electrical Situation – Is It Functioning Properly?

Note: Prior to the activity, label each corner as A, B, C, and D. Reinforce that the y-intercept may be seen as the following:

- y-intercept: the point where the line crosses the y-axis on a graph.
- y-intercept: the point that has an x value of zero in a table.
- y-intercept: the initial value or starting point in a situation.

Inform students that some companies charge customers an initial fee as well as a unit charge for certain services.

Display the situation below on the board or document camera (SMP.1, SMP.2, SMP.4).

"An electrician's initial service fee can be represented by (0, 30). The bill after 2 hours can be represented by (2 ,150). What equation represents this situation?"

A. y = 30x + 150
B. y = 60x - 30
C. y = 150x - 30
D. y = 60x + 30

✓ Have students identify the initial value or y-intercept within the situation and use the method of their choice to determine the rate of change. Allow students time to read the situation quietly and move to a corner with the letter that represents their answer.

Instruct the students to reveal their answer using the "Four Corners" Teaching Strategy as explained below.

- Can't share their answer with anyone or write their answer on paper.
- Quietly walk to the corner with the letter that best represents their answer choice for the situation.
- Use 1-2 minutes to discuss why they chose their answer.
- Teams should each decide on a speaker to defend their answer choice.

Bring the whole class together while they are still in their corners.

✓ Each team to defends their choice.

Reveal the correct answer and address questions and concerns from individual students. Instruct students to go back to their seats.

For students who are EL, have disabilities, or perform well below grade level:

- Encourage students to focus only on the slope at first to narrow down their selection.

Extensions for students with high interest or working above grade level:

- Students may use the two points to make a graph, identify the slope and y-intercept, and write the equation.

Activity 4: Electrical Situation – The Initial Problem
Display the situation below on the board or document camera (SMP.1, SMP.2, SMP.4).

"An electrician charges a service fee of $30 to come to your home and consider the problem. With your consent, he will work on the situation charging $60 for each hour it takes to repair the problem. What value represents the initial value or y-intercept in this situation?"

A. $90
B. $30
C. $60
D. Not enough information

- ✓ Students show their thinking using the "Four Corners" Teaching Strategy.

Activity 5: Electrical Situation – The Problem is Growing
Display the situation below on the board or document camera (SMP.1, SMP.2, SMP.4).

"An electrician charges a service fee of $30 to come to your home and look into the problem. With your consent, he will work on the situation charging $60 for each hour it takes to repair the problem. What value represents the slope in this situation?"

A. $30
B. $60
C. $90
D. Not enough information

- ✓ Students show their thinking using the "Four Corners" Teaching Strategy.

Reflection and Closing:

Ask students to brainstorm different services that may have an initial fee and a unit price to consider when purchasing.

- ✓ Have students exchange situations and write linear functions for the situation received.

Homework

- ✓ Have students copy and respond to the following situation by creating a table, graph, and linear equation.

Madison has $50 in her PayPal account. She sells shoes for $10 per pair. Write a linear equation to represent the amount of money in her account based on the number of shoes she sells.

Lesson 8: Summarizing Situations

Focus Standard(s): FOA.15, FOA.16, FOA.18

Standards for Mathematical Practice: SMP.2, SMP.3, SMP.4, SMP.7

Estimated Time: 55 minutes

Resources and Materials:

- Sticky Notes
- Handout 8.1: Index Card Carousel
- Handout 8.2: Jeopardy

Lesson Target(s):

- Students will find the initial value from a table, graph or situation.
- Students will find the slope from a table, graph, or situation.

Guiding Question(s):

- How do tables, graphs, and situations give you the same information in different ways?
- Is it easier to work with one representation over another?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Initial value • Linear function • Ordered pairs • Rate of change • Slope • y-intercept	☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will find slope of a linear function using the slope formula or rise over run method and the initial value of a linear function by identifying the y-intercept.

Anticipatory Set/Introduction to the Lesson: Index Card Carousel

Note: Prior to the lesson, cut out the cards on **Handout 8.1: Index Card Carousel**.

Group students in teams to begin the Carousel. The activity will review material covered throughout the unit, such as:

- finding slope (from values, from a graph, from a situation);
- finding initial value (from values, from a graph, from a situation);
- writing a linear equation with slope and y-intercept.

Distribute a card to each team. Allow the team time to work together and agree on their answer. Have teams write their response on a sticky note and stick it to the back of the card. Instruct all teams to pass their card clockwise to the next group. Continue this process until each team has responded to every card (SMP.2, SMP.4).

✓ Collect all cards and do a quick check for understanding using the responses. Facilitate a whole group discussion on the responses on the cards needing reinforcement (SMP.3).

Activity 1: Self Reflection

List the topics of review on the board and ask students to first write them down and then, score themselves from 1 (I don't feel at all confident with this) to 5 (I feel very confident with this) for each topic.

The topics include:

- finding slope
  - from values,
  - from a graph,
  - from a situation;
- finding initial value
  - from values,
  - from a graph,
  - from a situation;
- writing a linear equation with slope and y-intercept.

Read the list and allow time for students to ask clarifying questions for the areas they do not feel confident. Provide additional examples for areas of weakness.

For students who are EL, have disabilities, or perform well below grade level:

- Provide examples of each topic for students to properly assess themselves.
- Ask specific questions about each topic. Use formative assessments in the unit to guide discussion.

Activity 2: Jeopardy

Note: The Jeopardy game can be modified based on the amount of time available.

Distribute the first page of **Handout 8.2: Jeopardy**. Read the game directions to the class. Give clarification where necessary.

Jeopardy Directions:

1. Sort the class into equal teams. Number them so they know who is #1, #2, etc. on each team. You may want to rearrange the teams so that, for example, all the #2s are about equal in ability. If you can't make teams with the same numbers of students, make sure the students on the unequal team keep track of whose turn it is (you will probably have to help them with this as the game progresses).

2. Project the Jeopardy Board with the projector. The purpose of the board is for you to cross off questions as they are asked, to keep score, and to have room to write graphs or questions if the students need to see them written down.

3. Start by explaining the rules:

a. They will compete against the other people in the same position on the team (all the #2s, etc.).

b. They do not get points if you have not called on them.

c. When it is their turn and they have an answer, they should say "Buzz" and wait for you to call on them.

d. Whoever gets a question correct, the next person on their team gets to pick the next category and amount.

e. If everyone whose turn it was misses the question, other people can be called on to answer. Everyone should do every question.

f. They should start with easy ones (lower point value). There are no hidden "Double Jeopardy" questions, but the game will have a "Final Jeopardy" question.

g. Poor sportsmanship (against other teams or your own teammates) is the only way to lose points.

4. The game begins by the first person trying to guess a number you have chosen between 1 and 20. Whoever is closest will choose the first category and amount. For the first question, all the #1s compete.

5. Continue until the last question is marked out.

6. At that point, total all the points and ask each team to decide:

a. Which teammate will play Final Jeopardy.

b. How much the team will wager.

7. Collect their wagers before Final Jeopardy.

8. Write (or read) the Final Jeopardy Question. No talking. When the player from each team has his/her answer, they should hand it to you (with the Team # on it). When all players have handed in answers, start with the team with the least points and, based on whether they were correct, change their score. Continue until all are done and you have a final winner.

9. If the game is taking too long, skip right to Final Jeopardy. If the Final Jeopardy question seems too hard, use one you think at least 2 of your players could do.

For students who are EL, have disabilities, or perform well below grade level:

- Allow students to use Anchor Charts, Guided Notes, or example problems to help them work through the Jeopardy problems.

Activity 3: Modeling

✓ Model the following situation using a graph, an equation, a table of values, or an illustration:

"The online book club charges a sign-up fee of $25 and then each book costs $4."

✓ Pair-Share the model with a partner. Each student models the situation with a graph, equation, table, or illustration.

Extensions for students with high interest or working above grade level:

- Encourage students to model the situation as many ways possible, including multiple forms of the linear equation.

Have students critique their partner's models to check for different methods to correctly model the situation (SMP3, SMP4, SMP7).

Reflection and Closing:

Have students write notes to Jeopardy teammates describing what they learned from them during class discussions today.

Reflect on the level of accuracy of the student responses to the following questions:

- How do slope and y-intercept describe linear functions?
- How do you know which method you should use when finding slope or y-intercept?

Homework

Simile Me: Have students complete the following sentence: Working with linear functions is like _____ because _____.

Handout 8.1: Index Card Carousel

Write an equation of a line through the given points:

(8, -1) and (9, 0)

Write an equation of a line through the given points:

(2, 7) and (-3, 1)

Write an equation to represent the following situation:

Samantha drinks 2oz. of water out of a 32oz. bottle every 4 minutes.

Write an equation to represent the following situation:

Amos is draining his pool. The pool initially had 13,500 gallons of water in it, and it is draining at a rate of 1400 gallons every 2 hours.

Write an equation to represent the following situation:

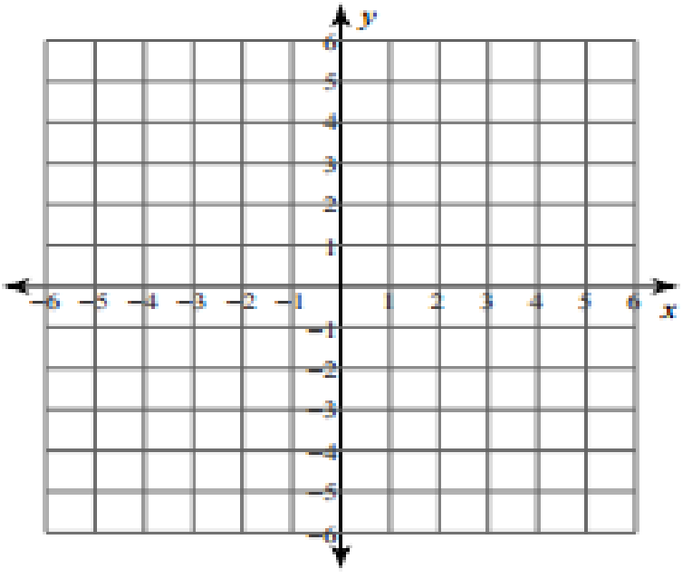
Ariana is taking a taxi from the airport to her hotel. The taxi has a service charge of $5.00 and then charges $1.80 per mile.

Write an equation to represent the following situation:

Ladarius is moving into his first apartment. The complex is asking for a $200 safety deposit and rent is $985 per month.

Handout 8.2: Jeopardy

Y-Intercept	*Coordinate Plane*	*Slope*	*Mixed Review*
100	100	100	100
200	200	200	200
300	300	300	300
400	400	400	400
500	500	500	500



SCORECARD

Y-Intercept	*Coordinate Plane*	*Slope*	*Mixed Review*
100 What is the y-intercept in $y = \frac{3}{4}x + 5$	**100** How many quadrants make up the Coordinate Plane?	**100** What happens to line when the slope gets bigger?	**100** Give an example of a real-world problem that would only use the first quadrant.
200 If a person saves $40 a week for 3 weeks and starts with $50, what is the initial value?	**200** Write an equation for a linear function going through the origin with a slope of -2.	**200** If a line goes up to the left, what do you know about the slope?	**200** What do you call the slope of a completely vertical line?
300 What is the y-intercept of the line passing through (6,7) and (0,9)?	**300** Write an equation for a horizontal line with a y-intercept of 3.	**300** Describe the graph of y = 2/3 x - 5	**300** What is the slope of the line passing through (5, 7) & (-1,0)?
400 What is the equation of a line with an initial value of 0 and a slope of 3?	**400** What is the equation of the line with a y-intercept of 8 and a slope of ½?	**400** Put these lines in order from least steep to most steep: y = 1/3 x + 4, y = 5x -7, y = -2x, y = 8	**400** Which two sets of ordered pairs are found on the graph of 2x - 3y = 18? (0,18) (3,4) (9,0) (12, 2)
500 What is the y-intercept of the line passing through (3, 7) and (4, 9)?	**500** What type of change would a linear function have if it had an initial value of (0,4) and went through (3, -2)?	**500** What would the equation of the line be that passes through (4, 7) and (2, 8)?	**500** If a line passes through (5, 8) and (6, 8), what is the **slope**?

Y-Intercept	*Coordinate Plane*	*Slope*	*Mixed Review*
100 What is the y-intercept in $y = \frac{3}{4} x + 5$ **5**	**100** How many quadrants make up the Coordinate Plane? **4**	**100** What happens to line when the slope gets bigger? **it gets steeper**	**100** Give an example of a real-world problem that would only use the first quadrant.
200 If a person saves $40 a week for 3 weeks and starts with $50, what is the initial value? **50**	**200** Write an equation for a linear function going through the origin with a slope of -2. **y = -2x**	**200** If a line goes up to the left, what do you know about the slope? **it is negative**	**200** What do you call the slope of a completely vertical line? **no slope or undefined**
300 What is the y-intercept of the line passing through (6,7) and (0,9)? **9**	**300** Write an equation for a horizontal line with a y-intercept of 3. **y = 3**	**300** Describe the graph of y = 2/3 x - 5 **it starts at -5 and goes up to the right at a rate of over 3 and up 2**	**300** What is the slope of the line passing through (5, 7) & (-1,0)? **7/6**
400 What is the equation of a line with an initial value of 0 and a slope of 3? **y = 3x**	**400** What is the equation of the line with a y-intercept of 8 and a slope of ½? **y = ½ x + 8**	**400** Put these lines in order from least steep to most steep: y = 1/3 x + 4, y = 5x -7, y = -2x, y = 8 **y = 8, y = 1/3 x + 4 , y = -2x, y = 5x -7**	**400** Which two sets of ordered pairs are found on the graph of 2x - 3y = 18? (0,18) (3,4) **(9,0) (12, 2)**
500 What is the y-intercept of the line passing through (3, 7) and (4, 9)? **1**	**500** What type of change would a linear function have if it went had an initial value of (0,4) and went through (3, -2)? **negative**	**500** What would the equation of the line be that passes through (4, 7) and (2, 8)? **y = -1/2x + 9**	**500** If a line passes through (5, 8) and (6, 8), what is the slope? **0**

Final Jeopardy:

A new candle is 12” tall. If the candle is 10” tall after 3 hours, what is the equation of the line that names this linear function?

KEY

Final Jeopardy:

A new candle is 12” tall. If the candle is 10” tall after 3 hours, what is the equation of the line that names this linear function?

$y = -\frac{2}{3}x + 12$ or $y - 12 = \frac{2}{3}(x - 0)$ or $2x + 3y = 36$

Lesson 9: Money Talks

Focus Standard(s): FOA.16

Additional Standard(s): FOA.17, FOA.20

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP.6, SMP.7

Estimated Time: 55 minutes

Resources and Materials:

- Dry Erase Markers (2 colors per student)
- Highlighters
- Mini-White Boards
- Sticky Notes
- Handout 9.1: Money, Money, Money

Lesson Target(s):

- Student will find rate of change and initial value for a linear function from multiple representations.
- Students will use real-world situations to comparing and evaluating linear functions.

Guiding Question(s):

- How can you compare two real-world functions?
- When comparing two functions, how can you decide which is greater at a certain point?

Vocabulary

Academic Vocabulary:	Instructional Strategies for Academic Vocabulary:
• Initial value • Linear function • Slope • y-intercept	☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will continue to develop their understanding of linear functions through the comparison of functions in a real-world context.

Anticipatory Set/Introduction to the Lesson: Elevator or Stairs?
Ask students if they have ever been in a situation where they had to choose between two options; for example, which checkout line at the store to select or whether to take the elevator or stairs?

Explain to students that understanding functions will help them make better decisions in the real-world when comparing options (SMP.4). Brainstorm a list of services they may want to compare; for example, they could brainstorm about company costs for before deciding (*i.e. cell phone service, Uber vs. Lyft, Lawn Care, Baby Sitting)*.

Tell students that since we have learned about linear functions, we can now use that information to compare functions to help make better decisions.

Activity 1: Who Makes More Money?
Ask students to consider this situation:

"Alex earns $30 a week doing odd jobs for his grandmother during the summer. If he already had $80 saved and saves all the money his grandmother pays him, how much will he have saved after 6 weeks?"

Instruct students to work independently to find the initial value and the rate of change. Then, use those values to write a linear function in slope-intercept form.

- ✓ Have students write response on mini-white board using the first color marker.

Ask students to consider the linear function reflected in this situation using the second marker color:

"Sheila earns $40 a week edging lawns during the summer. If she already had $25 saved and saves all the money she earns edging lawns, how much will she have saved after 6 weeks?"

Instruct students to work independently to find the initial value and the rate of change. Then, use those values to write a linear function in slope-intercept form.

- ✓ Have students write response on mini-white board.

Ask students who will have more money at the end of 6 weeks and at the end of 3 weeks.

- ✓ Discuss answers with students (SMP.3 and SMP.7).

For students who are EL, have disabilities, or perform well below grade level:

- Provide sentence stems and highlighters for students to practice putting the slope and y-intercept into slope-intercept form.
- Encourage students to reference Anchor Charts and Guided Notes.

Extensions for students with high interest or working above grade level:

- Students can be asked to create their own situations given a linear function.

Activity 3: Money, Money, Money Activity

Create a two column table on the board. Label the left column "Daria" and the right, "Kent".

Distribute **Handout 9.1: Money, Money, Money** (SMP.1, SMP.2, SMP.4). Allow students to work with a partner and each pair will be given a sticky note on which to write their names.

- ✓ Have students work on **Handout 9.1: Money, Money, Money**. When they are done, they should put their sticky notes under the heading that they think is the answer to question 3.

Once teams have placed sticky notes to "vote," the students take turns explaining their reasoning using academic vocabulary (SMP.3 and SMP.6).

Listen and facilitate discussion for students to help one another clarify misconceptions.

- ✓ Have students repeat the process with questions 4- 6 with similar "voting" and explanations.

For students who are EL, have disabilities, or perform well below grade level:

- Work directly with pairs who incorrectly answered the first problem to address misconceptions.

Extensions for students with high interest or working above grade level:

- Students will answer Extension on **Handout 9.1: Money, Money, Money** and explain how the slope has a greater impact on the linear function than the y-intercept.

Reflection and Closing:

- ✓ **Exit Ticket: So What?**

Have students answer the following prompts:

- What takeaways from the lesson will be important to know three years from now?
- Why?

Homework

No homework.

Handout 9.1: Money, Money, Money

Name: _____ Date: _____

1. Daria makes $40 per week and starts out with $70.

Write the linear function in slope-intercept form that models this situation

_____

2. Kent starts out with $30 and makes $50 per week.

Write the linear function in slope-intercept form that models this situation

_____

3. Daria and Kent want to see who has the most money after 2 weeks. How much does each person have? Daria has _____ and Kent has _____. Explain how you know this.

Extension: Who will make more money over time? How do you know?

4. Kate makes $20 per week and starts out with $50.

Write the linear function in slope-intercept form that models this situation

_____

5. Carlos starts out with $180 and spends $50 per week.

Write the linear function in slope-intercept form that models this situation

_____

6. Kate and Carlos want to see who has the most money after 2 weeks. How much does each person have? Kate has _____ and Carlos has _____. Explain how you know this.

Extension: Who will make more money over time? How do you know?

KEY

Name: _____ Date: _____

1. Daria makes $40 per week and starts out with $70.

Write the linear function in slope-intercept form that models this situation

y = 40x + 70

2. Kent starts out with $30 and makes $50 per week.

Write the linear function in slope-intercept form that models this situation

y = 50x + 30

3. Daria and Kent want to see who has the most money after 2 weeks. How much does each person have? Daria has $150 and Kent has $130. Explain how you know this.

Extension: Who will make more money over time? How do you know? Kent (Slope)

4. Kate makes $20 per week and starts out with $50.

Write the linear function in slope-intercept form that models this situation

y = 20x + 50

5. Carlos starts out with $180 and spends $50 per week.

Write the linear function in slope-intercept form that models this situation

y = -50x + 180

6. Kate and Carlos want to see who has the most money after 2 weeks. How much does each person have? Kate has $90 and Carlos has $80. Explain how you know this.

Extension: Who will make more money over time? How do you know? Kate (Slope)

Lesson 10: Slope Art

Focus Standard(s): FOA.15, FOA.16

Additional Standard(s): FOA.17, FOA.20

Standards for Mathematical Practice: SMP.2, SMP.3, SMP.4, SMP.5, SMP.7, SMP.8

Estimated Time: 120 minutes

Resources and Materials:

- Document Camera
- Graph Paper
- Markers or Colored Pencils
- Handout 10.1: Slope Art Performance Task
- Handout 10.2: Performance Task Rubric
- https://www.desmos.com/

Lesson Target(s):

- Students will find rate of change and initial value for a linear function.
- Students will compare two functions at a given point.

Guiding Question(s):

- How can you interpret a situation to find information needed to write a linear function?
- How can you compare two functions at a given point?

Vocabulary	
Academic Vocabulary: • Initial value • Linear function • Ordered pairs • Rate of change • Slope • y-intercept	**Instructional Strategies for Academic Vocabulary:** ☐ Model how to use the words in discussion ☐ Discuss the meaning of word in a mathematical context ☐ Create pictures/symbols to represent words ☐ Write/discuss using the words

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will identify slope and y-intercept and complete a Performance Task requiring the application of these skills to compare linear functions at a given point.

Anticipatory Set/Introduction to the Lesson: Elevator Talk
Note: An Elevator Task asks students to summarize a concept or topic into a 30-60 second talk. Basically, if someone got on an elevator with you and asked what slope is for example, you have until the elevator gets to your floor to explain it (SMP.3).

Have students pair up using Proximity Partners. Have the student on the left be partner A. Their topic will be **slope**. Have the student on the right be partner B. Their topic will be **y-intercept**.

Set a timer for 30 seconds. Allow partner A to begin by sharing their pitch to their partner. Partner B should listen and ask questions as needed. Reverse roles and repeat with Partner B sharing their pitch.

Ask students to share with the class something their partner said that clarified slope or y-intercept for them.

Review unit concepts, including finding the initial value and rate of change from a real-world situation and from a graph.

Activity 1: Performance Task

- ✓ Have students create and color a picture using graph paper and line segments (SMP.5).

The picture must include the following:

- 5 line segments with a positive slope
- 5 line segments with a negative slope
- 3 lines with a zero slope
- 3 lines with an undefined slope.

Instruct students to label each line in the drawing with a number from #1-#16.
Note: Picture may include other lines that are not straight; however, the 30 segments must be labeled and easy to find.

On **Handout 10.1: Slope Art Performance Task**, students will record all work, which will include the following:

- 2 points found on the line segment,
- the slope and y-intercept of the two points (SMP.8),
- the equation of the line segment in slope-intercept form (SMP.2 and SMP.7), and
- reflection questions to compare linear functions and write a real-world situation (SMP.4).

Distribute **Handout 10.2: Performance Task Rubric** and discuss expectations with the class before they begin working.
Have students complete the Performance Task by adding details to their picture and coloring.

For students who are EL, have disabilities, or perform well below grade level:

- Students may work in Desmos to test lines before graphing them.
- Have students complete the Performance Task with a partner.

Extensions for students with high interest or working above grade level:

- Students can write a story to accompany their picture.

Reflection and Closing:

✓ **Exit Ticket:** On paper, small groups sketch and write what they learned throughout the unit. Then team representatives line up and, one at a time, slide their work under the document camera while quickly summarizing what was learned. All teams must share the summary created.

Reflect on the level of accuracy of the student responses to the following questions:

- How do linear functions reflect change and predict change?
- How can you determine slope and initial value of a function?

Homework

No Homework.

Handout 10.1: Slope Art Performance Task

Name: _____ Date: _____

Line #	Point #1	Point #2	Slope of Line	Slope (m)	y-intercept (b)	Equation of Line y = mx + b
			Positive			
			Positive			
			Positive			
			Positive			
			Positive			
			Negative			
			Negative			
			Negative			
			Negative			

Line #	Point #1	Point #2	Slope of Line	Slope (m)	y-intercept (b)	Equation of Line y = mx + b
			Negative			
			Zero			
			Zero			
			Zero			
			Undefined			
			Undefined			
			Undefined			

Comparing Lines:

a. Compare two lines with positive slopes. Which would have a greater y-value when x is 4? How do you know?
b. Find two lines that have the same slope. What does this look like in the graph? Why?

Real-World Connection:

a. Select a line from your graph. Write a real-world situation for the line.

Handout 10.2: Rubric for Performance Task

	4	3	2	1
Student has included 16 line segments following the criteria: • **5 positive slope** • **5 negative slope** • **3 zero slope** • **3 undefined slope**	All 16 line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope	The 12-14 line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope	The 8-11 line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope	The 7 or fewer line segments include the following criteria: • 5 positive slope • 5 negative slope • 3 zero slope • 3 undefined slope
Student correctly found the slope and y-intercept of the line segments.	Correctly calculated the slope and y-intercept for all 16 lines and included work.	Correctly calculated the slope and y-intercept for 12-14 segments and included work.	Correctly calculated the slope and y-intercept for 8-11 segments and included work.	Correctly calculated the slope and y-intercept for 7 or fewer segments and included work. OR Did not include work for any problems.
Student wrote linear equations in slope-intercept form.	Correctly wrote a linear equation in slope-intercept form for all 16 segments.	Correctly wrote a linear equation in slope-intercept form for 12-14 segments.	Correctly wrote a linear equation in slope-intercept form for 8-11 segments.	Correctly wrote a linear equation in slope-intercept form for 7 or fewer segments.
Comparing Functions	Responds correctly to both questions and justifies reasoning.	Responds correctly to both questions, but does not justify reasoning.	Responds correctly to one question and justifies reasoning.	Does not respond correctly to either question. OR Responds correctly to one without justifying reasoning.
Real-World Connections	Writes a practical real-world situation with the correct rate of change and initial value.	Writes a real-world situation with the correct rate of change and initial value, but it is not practical.	Writes a real-world situation with only one correct value.	Writes a real-world situation that does not include the correct rate of change and initial value OR Does not attempt to write a situation.

For training or questions regarding this unit,
please contact:

exemplarunit@mdek12.org