MISSISSIPPI DEPARTMENT OF EDUCATION

Ensuring a bright future for every child

MISSISSIPPI

EXEMPLAR Units & Lessons

MATHEMATICS

Foundations of Algebra

Grant funded by:

W.K. KELLOGG FOUNDATION™

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	☐ Introduce words with student-friendly definitions and pictures ☐ Model how to use the words in discussion

• Slope	☐ 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

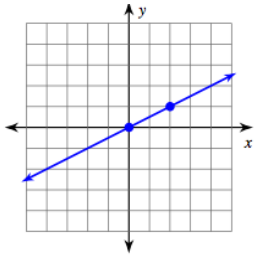
Name: _____ Date: _____

Calculating Slope for Multiple Representations

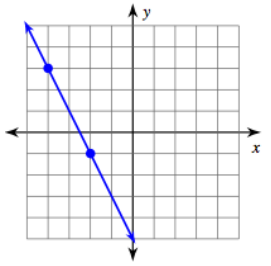
$$\frac{Rise}{Run} = \frac{change\ in\ y}{change\ in\ x}$$

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

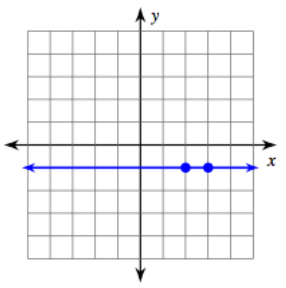
1.



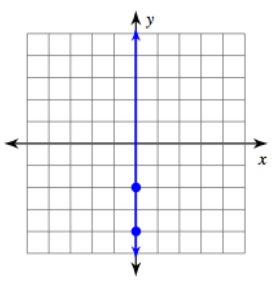
2.



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.

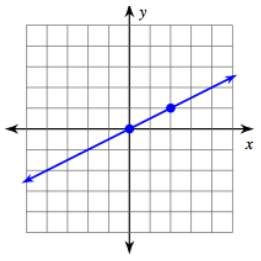
X	-6	-6	-6	-6
Y	-1	-3	0	3

Key

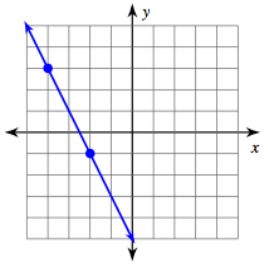
Calculating Slope for Multiple Representations

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

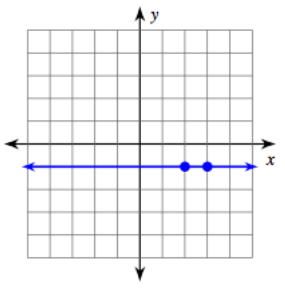
Calculate the slope using the slope formula or "Rise over Run."

1. 

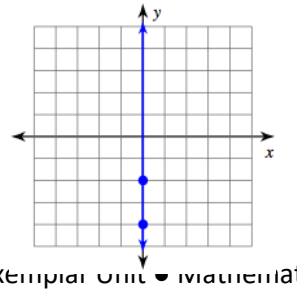
m = ½

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

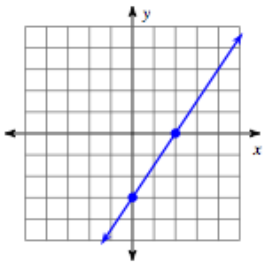
3. Make a table with at least 5 points

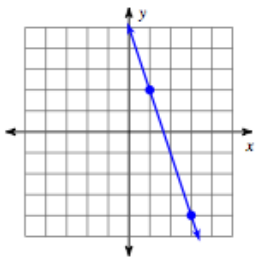
x	y
1	6
2	13
3	20
4	27
5	34

Handout 5.3: Homework

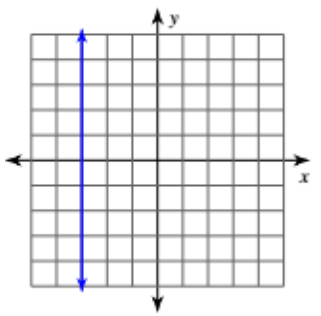
Name: _____ Date: _____

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

1. 

2. 

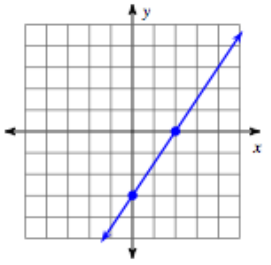
3. (17, -13), (17 8)

4. 

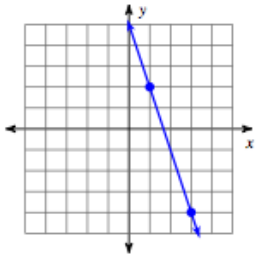
5. (9, 3), (19, -17)

Key

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

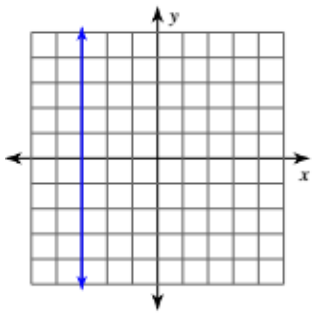
1. 

m = 3/2

2. 

m = -3

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

4. 

undefined

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

For training or questions regarding this unit,
please contact:

exemplarunit@mdek12.org