Lesson 2
Slope

Vocabulary Start-Up

The term *slope* is used to describe the steepness of a straight line. **Slope** is the ratio of the **rise**, or vertical change, to the **run** or horizontal change.

Complete the graphic organizer.

I think this word means...	How is this concept related to other math concepts?
slope	
Where have I heard this word in my life?	What makes this an important word for me to know?

Essential Question

WHY are graphs helpful?

Vocabulary

slope
rise
run

Common Core State Standards

Content Standards
Preparation for 8.EE.5

Mathematical Practices
1, 3, 4

Real-World Link

A ride at an amusement park rises 8 feet every horizontal change of 2 feet. How could you determine the slope of the ride?

Which Mathematical Practices did you use? Shade the circle(s) that applies.

1. Persevere with Problems
2. Reason Abstractly
3. Construct an Argument
4. Model with Mathematics
5. Use Math Tools
6. Attend to Precision
7. Make Use of Structure
8. Use Repeated Reasoning

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Work Zone

Find Slope Using a Graph or Table

Slope is a rate of change. It can be positive (slanting upward) or negative (slanting downward).

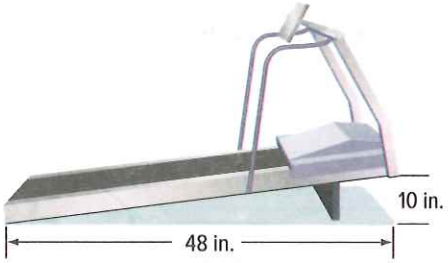
$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

← vertical change between any two points

← horizontal change between the same two points

Real World Example

1. Find the slope of the treadmill.



$\text{slope} = \frac{\text{rise}}{\text{run}}$ Definition of slope

$= \frac{10 \text{ in.}}{48 \text{ in.}}$ rise = 10 in., run = 48 in.

$= \frac{5}{24}$ Simplify.

The slope of the treadmill is $\frac{5}{24}$.

Show your work.

Got it? Do this problem to find out.

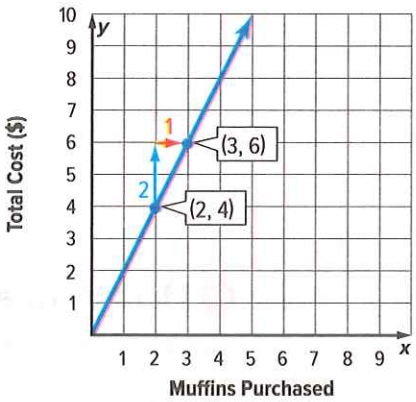
a. A hiking trail rises 6 feet for every horizontal change of 100 feet. What is the slope of the hiking trail?

a. _____

Examples

Tutor

2. The graph shows the cost of muffins at a bake sale. Find the slope of the line.



Choose two points on the line. The vertical change is 2 units and the horizontal change is 1 unit.

$\text{slope} = \frac{\text{rise}}{\text{run}}$ Definition of slope

$= \frac{2}{1}$ rise = 2, run = 1

The slope of the line is $\frac{2}{1}$ or 2.

Translating Rise and Run

up → positive
down → negative
right → positive
left → negative

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3. **The table shows the number of pages Garrett has left to read after a certain number of minutes. The points lie on a line. Find the slope of the line.**

Time (min), x	Pages left, y
1	12
3	9
5	6
7	3

Choose any two points from the table to find the changes in the x- and y-values.

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} \quad \text{Definition of slope}$$

$$= \frac{9-12}{3-1} \quad \text{Use the points (1, 12) and (3, 9).}$$

$$= \frac{-3}{2} \text{ or } -\frac{3}{2} \quad \text{Simplify.}$$

To check, choose two different points from the table and find the slope.

Check $$\text{slope} = \frac{\text{change in } y}{\text{change in } x}$$

$$= \frac{3-6}{7-5}$$

$$= \frac{-3}{2} \text{ or } -\frac{3}{2} \checkmark$$

Slope

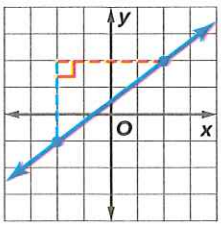
In linear relationships, no matter which two points you choose, the slope, or rate of change, of the line is always constant.

Got it? **Do these problems to find out.**

Show your work.

Find the slope of each line.

b.



c.

x	−6	−2	2	6
y	−2	−1	0	1

b. _____

c. _____

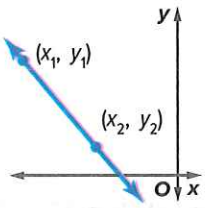
Slope Formula

Key Concept

Words The slope m of a line passing through points (x_1, y_1) and (x_2, y_2) is the ratio of the difference in the y-coordinates to the corresponding difference in the x-coordinates.

Symbols $m = \frac{y_2 - y_1}{x_2 - x_1}$, where $x_2 \neq x_1$

Model



It does not matter which point you define as (x_1, y_1) and (x_2, y_2). However the coordinates of both points must be used in the same order.

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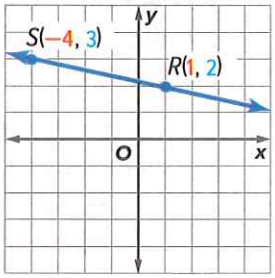
Using the Slope Formula

To check Example 4, let $(x_1, y_1) = (-4, 3)$ and $(x_2, y_2) = (1, 2)$. Then find the slope.

Example

Watch Tutor

4. **Find the slope of the line that passes through $R(1, 2)$, $S(-4, 3)$.**



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

$m = \frac{3 - 2}{-4 - 1}$ $(x_1, y_1) = (1, 2)$, $(x_2, y_2) = (-4, 3)$

$m = \frac{1}{-5}$ or $-\frac{1}{5}$ Simplify.

Show your work.

Got it? **Do these problems to find out.**

d. $A(2, 2)$, $B(5, 3)$ **e.** $J(-7, -4)$, $K(-3, -2)$

d. _____

e. _____

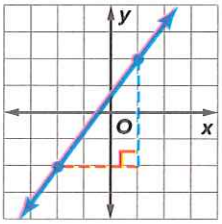
Guided Practice

Check

1. Find the slope of the storage shed's roof. (Example 1)

Find the slope of each line. (Examples 2 and 3)

2.



3.

x	0	1	2	3
y	1	3	5	7

Find the slope of the line that passes through each pair of points. (Example 4)

4. $A(-3, -2)$, $B(5, 4)$

5. $E(-6, 5)$, $F(3, -3)$

6. **Building on the Essential Question** In any linear relationship, explain why the slope is always the same.

Rate Yourself!

How well do you understand slope? Circle the image that applies.

Clear Somewhat Clear Not So Clear

For more help, go online to access a Personal Tutor. Tutor

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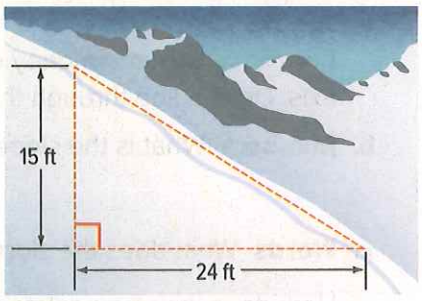
Name _____ My Homework _____

Independent Practice

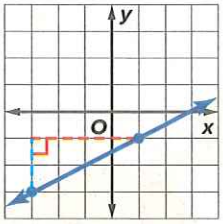
Go online for Step-by-Step Solutions eHelp

1 Find the slope of a ski run that descends 15 feet for every horizontal change of 24 feet. (Example 1)

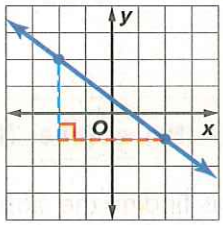


Find the slope of each line. (Example 2)

2.



3.



The points given in the table lie on a line. Find the slope of each line.
(Example 3)

4.

x	0	2	4	6
y	9	4	−1	−6

5.

x	0	1	2	3
y	3	5	7	9

Find the slope of the line that passes through each pair of points. (Example 4)

6. $A(0, 1)$, $B(2, 7)$ _____

7 $C(2, 5)$, $D(3, 1)$ _____

8. $E(1, 2)$, $F(4, 7)$ _____

9. MP **Justify Conclusions** Wheelchair ramps for access to public buildings are allowed a maximum of one inch of vertical increase for every one foot of horizontal distance. Would a ramp that is 10 feet long and 8 inches tall meet this guideline? Explain your reasoning to a classmate.

_____

_____

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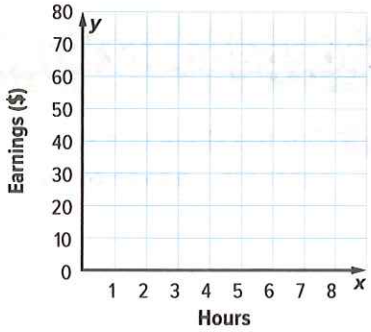
10. **Multiple Representations** For working 3 hours, Sofia earns $30.60. For working 5 hours, she earns $51. For working 6 hours, she earns $61.20.



a. **Graphs** Graph the information with hours on the horizontal axis and money earned on the vertical axis. Draw a line through the points.

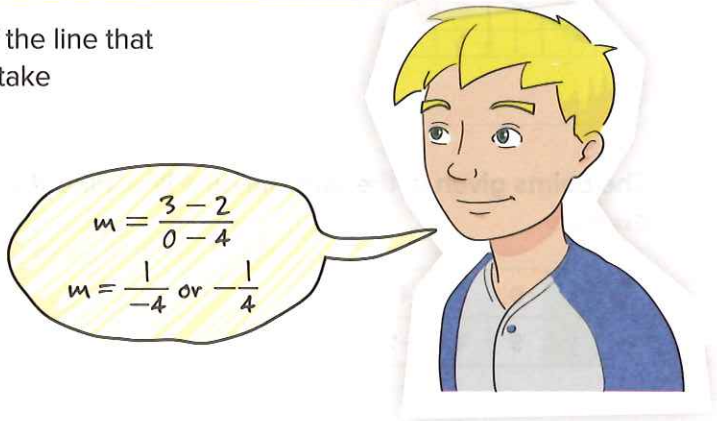
b. **Numbers** What is the slope of the line?

c. **Words** What does the slope of the line represent?

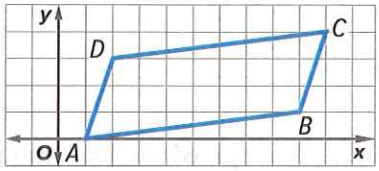
How does the slope relate to the unit rate?

H.O.T. Problems Higher Order Thinking

11. **Find the Error** Jacob is finding the slope of the line that passes through $X(0, 2)$ and $Y(4, 3)$. Circle his mistake and correct it.



12. **Persevere with Problems** Two lines that are parallel have the same slope. Determine whether quadrilateral *ABCD* is a parallelogram. Justify your reasoning.



13. **Model with Mathematics** Give three points that lie on a line with each of the following slopes.

a. 5

b. $\frac{1}{5}$

c. -5

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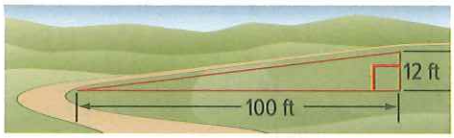
Extra Practice

14. Find the slope of a road that rises 12 feet for every horizontal change of 100 feet.

$\frac{3}{25}$



$\text{slope} = \frac{\text{rise}}{\text{run}}$ Definition of slope

Homework Help

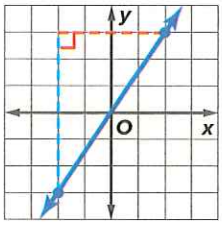
$= \frac{12 \text{ ft}}{100 \text{ ft}}$ rise = 12 ft, run = 100 ft

$= \frac{3}{25}$ Simplify.

15. Wyatt is flying a kite in the park. The kite is a horizontal distance of 24 feet from Wyatt's position and a vertical distance of 72 feet. Find the slope of the kite string. _____

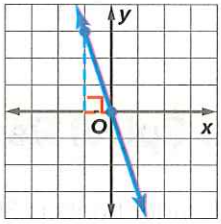
Find the slope of each line.

16.



_____

17.



_____

MP Use Math Tools **The points given in the table lie on a line. Find the slope of each line.**

18.

x	−3	3	9	15
y	−3	1	5	9

_____

19.

x	−2	−1	1	2
y	−4	−2	2	4

_____

Find the slope of the line that passes through each pair of points.

20. $M(-2, 3)$, $N(7, -4)$ _____

21. $G(-6, -1)$, $H(4, 1)$ _____

22. $J(-9, 3)$, $K(2, 1)$ _____

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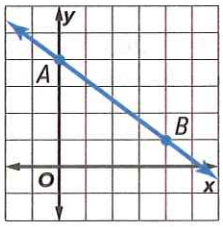
Power Up! Common Core Test Practice

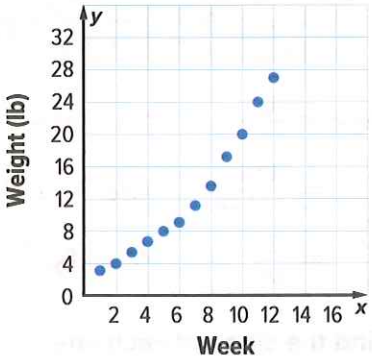
23. Line *AB* represents a steep hill.

The coordinates of point *A* are _____ and the coordinates of point *B* are _____. The slope of the hill is _____.



24. Lionel charted the growth of his puppy for several weeks and plotted the values on a graph. Draw a line that passes through the points (2, 4) and (10, 20).

What is the slope of the line? What does this slope represent?



Common Core Spiral Review

25. The wait time to ride the Thunder boats is 30 minutes when 180 people are in line. Write and solve a proportion to find the wait time when 240 people are in line. 7.RP.2, 7.RP.3

Solve each proportion. 7.RP.2, 7.RP.3

26. $\frac{5}{7} = \frac{a}{35}$

27. $\frac{12}{p} = \frac{36}{45}$

28. $\frac{3}{9} = \frac{21}{k}$

29. $\frac{n}{15} = \frac{17}{34}$

30. $\frac{-7}{10} = \frac{3.5}{j}$

31. $\frac{12}{18} = \frac{-40}{x}$

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