5-2 Direct Variation

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Vocabulary

Review

1. Cross out the expression below that does NOT show a formula for *slope.*

   $\frac{\text{horizontal change}}{\text{vertical change}}$ ↔ $\frac{y_2 - y_1}{x_2 - x_1} = m$ $\frac{\text{rise}}{\text{run}}$ ↕ ↔

2. Underline the correct word in each sentence about *slope.*

   The *slope* of a horizontal line is undefined / zero .

   The *slope* of a vertical line is undefined / zero .

Vocabulary Builder

direct (adjective) **duh** REKT

Definition: **Direct** means straightforward in language or action.

Other Word Forms: directly (adverb), direction(s) (noun)

Math Usage: If the ratio of two variables is constant, then the variables form a **direct** variation.

What It Means: In a **direct** variation, one variable *directly* affects another by multiplying it by a constant value.

Both variables increase: The more expensive the car, the more sales tax you pay.

One variable increases, the other variable decreases: As a candle burns longer, its height gets smaller.

$y = kx$, where $k \neq 0$, is a **direct variation.**

In the above, k is called the *constant of variation.*

(2, 5)

$y = kx$

slope

constant of variation

Use Your Vocabulary

Choose the correct word from the list to complete each sentence.

directly direct directions

3. Renee gave the visitor _?_ to the museum. _____

4. The fans went _?_ to their seats. _____

5. There is a _?_ connection between the outside temperature and the number of people at the beach. _____

A function in the form $y = kx$, where $k \neq 0$, represents a **direct variation**. The **constant of variation** k is the coefficient of x.

To determine whether an equation represents a direct variation, solve it for y. If you can write the equation in the form $y = kx$, where $k \neq 0$, it represents a direct variation.

Problem 1 Identifying a Direct Variation

Got It? **Does $4x + 5y = 0$ represent a direct variation? If so, find the constant of variation.**

6. Circle the equation that shows direct variation.

$y = \frac{k}{x}$ $\quad$ $y = kx$ $\quad$ $yx = k$

7. Complete the steps to solve $4x + 5y = 0$ for y.

$4x + 5y = 0$ Write the original equation.

$4x - 4x + 5y = 0 - 4x$ Subtract $4x$ from each side.

$\frac{5y}{5} = \frac{-4x}{5}$

$y = \frac{-4}{5}x$ Divide each side by 5.

8. Does $4x + 5y = 0$ represent a direct variation? Explain.

Yes! Our simplification when we solve for y looks just like $y = kx$.

9. In the equation $4x + 5y = 0$, $\frac{-4}{5}$ is the constant of variation.

Problem 2 Writing a Direct Variation Equation

Got It? **Suppose y varies directly with x, and $y = 10$ when $x = -2$. What direct variation equation relates x and y? What is the value of y when $x = -15$?**

10. Complete the reasoning model below.

Think	Write
I start with the function form of direct variation.	$y = k \cdot x$
Then I substitute 10 for y and -2 for x.	$\frac{10}{-2} = \frac{k \cdot (-2)}{-2}$
Now I divide each side by -2 to solve for k.	$-5 = k$
Next, I write an equation by substituting -5 for k.	$y = -5x$
Finally, I determine the value of y when $x = -15$.	$y = -5 \cdot -15 = 75$

$y = 75$

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Problem 3 Graphing a Direct Variation

Got it? **Weight on the moon y varies directly with weight on Earth x. A person who weighs 100 lb on Earth weighs 16.6 lb on the moon. What is an equation that relates weight on Earth x and weight on the moon y? What is the graph of this equation?**

11. Find the value of k. Round k to the nearest hundredth if necessary.

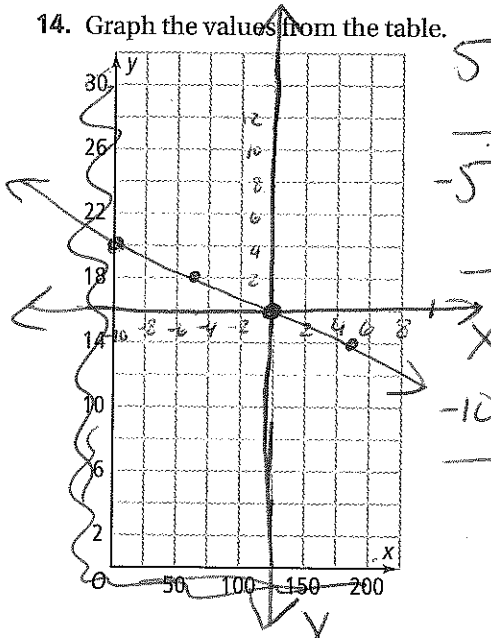
$$y = kx$$
$$= k \cdot$$
$$= k$$

12. To the nearest hundredth, $k =$. So, $y \approx$ $\cdot x$.

13. Make a table of values.

x	$y =$ x
0	$y =$ $\cdot 0 = 0$
25	$y =$ $\cdot 25 =$
50	$y =$ $\cdot 50 =$
100	$y =$ $\cdot 100 =$
125	$y =$ $\cdot 125 =$

14. Graph the values from the table.



$y = \frac{-2}{5}x$

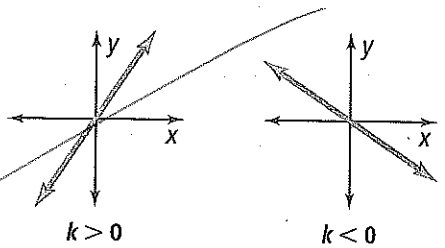
x	y
0	$\frac{-2}{5} \cdot 0 = 0$ 0
5	$\frac{-2}{5} \cdot \frac{5}{1} = \frac{-10}{5}$ -2
-5	$\frac{-2}{5} \cdot \frac{-5}{1} = \frac{10}{5}$ 2
-10	$\frac{-2}{5} \cdot \frac{-10}{1} = \frac{20}{5}$ 4

Take note

Concept Summary Graphs of Direct Variations

The graph of a direct variation equation $y = kx$ is a line with the following properties.

- The line passes through (0, 0).
- The slope of the line is k.



15. Substitute $x = 0$ and $y = 0$ in the equation $-2x + y = 3$.

$$-2x + y = 3$$
$$-2 \cdot \quad + \quad = 3$$
$$+ \quad = 3$$
$$\stackrel{?}{=} 3$$

16. Because the graph of $-2x + y = 3$ passes / does not pass through (0, 0), the equation is / is not a direct variation.

Problem 4 Writing a Direct Variation From a Table

Got It? For the data in the table at the right, does y vary directly with x? If it does, write an equation for the direct variation.

x	y
−3	2.25
1	−0.75
4	−3

18. Write each ordered pair as the ratio of the y-coordinate to the x-coordinate. Then write the ratio of y to x as a decimal.

$(-3, 2.25)$ $(1, -0.75)$ $(4, -3)$

_____ = _____ = _____ =

19. For the data in the table, does y vary directly with x? Yes / No

20. The equation for the direct variation shown is $y =$ _____ $\cdot x$.

Lesson Check • Do you UNDERSTAND?

Vocabulary Determine whether each statement is *always, sometimes,* or *never* true.

The ordered pair (0, 0) is a solution of the direct variation equation $y = kx$.

21. Substitute (0, 0) into $y = kx$.

$\stackrel{?}{=} k \cdot$

22. The statement is ___?___ true.

_____

You can write a direct variation in the form $y = k + x$, where $k \neq 0$.

23. Is $y = k + x$ of the form $y = kx$?

Yes / No

24. The statement is ___?___ true.

_____

The constant of variation for a direct variation represented by $y = kx$ is $\frac{y}{x}$.

25. When you divide each side of $y = kx$ by x, you obtain $k =$ _____.

26. Because you cannot divide by 0, the statement is ___?___ true.

_____

Math Success

Check off the vocabulary words that you understand.

☐ direct variation ☐ constant of variation for a direct variation

Rate how well you can *work with direct variation.*

Need to review 0 2 4 6 8 10 Now I get it

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