

5-2

Direct Variation



Vocabulary

Review

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

$\frac{\text{horizontal change}}{\text{vertical change}}$	$\frac{y_2 - y_1}{x_2 - x_1}$	$\frac{\text{rise}}{\text{run}}$
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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*.

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.

$$y = \frac{k}{x}$$

$$y = kx$$

$$yx = k$$

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

$$4x + 5y = 0$$

Write the original equation.

$$5y = 0 - \square$$

Subtract \square from each side.

$$y = \square$$

Divide each side by \square .

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

9. In the equation $4x + 5y = 0$, \square 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.	$y = \square \cdot x$
Then I substitute 10 for y and -2 for x .	$10 = \square \cdot (-2)$
Now I divide each side by \square to solve for k .	$\square = \square$
Next, I write an equation by substituting \square for k .	$y = \square \cdot x$
Finally, I determine the value of y when $x = -15$.	$y = \square \cdot \square = \square$



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.

$$y = kx$$

$$\text{ } = k \cdot \text{ }$$

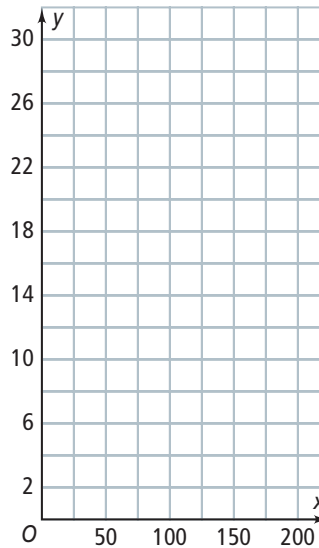
$$\text{ } = k$$

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

13. Make a table of values.

x	$y = \text{ } x$
0	$y = \text{ } \cdot 0 = 0$
25	$y = \text{ } \cdot 25 = \text{ } .$
50	$y = \text{ } \cdot 50 = \text{ } .$
100	$y = \text{ } \cdot 100 = \text{ } .$
125	$y = \text{ } \cdot 125 = \text{ } .$

14. Graph the values from the table.



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 $-2x + y = 3$.

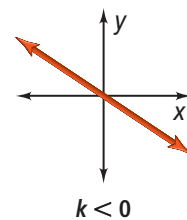
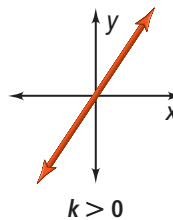
$$-2x + y = 3$$

$$-2 \cdot \text{ } + \text{ } = 3$$

$$\text{ } + \text{ } = 3$$

$$\text{ } \neq 3$$

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

x	y
-3	2.25
1	-0.75
4	-3

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.

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.

$(-3, 2.25)$

$$\frac{\text{[]}}{\text{[]}} = \text{[]}$$

$(1, -0.75)$

$$\frac{\text{[]}}{\text{[]}} = \text{[]}$$

$(4, -3)$

$$\frac{\text{[]}}{\text{[]}} = \text{[]}$$

19. For the data in the table, does y vary directly with x ?

Yes / No

20. The equation for the direct variation shown is $y = \text{[]} \cdot x$.



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 $y = kx$.

$$\text{[]} \stackrel{?}{=} k \cdot \text{[]}$$

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 $k = \text{[]}$.

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!