

## 5.6 Direct Variation

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### Learning Targets:

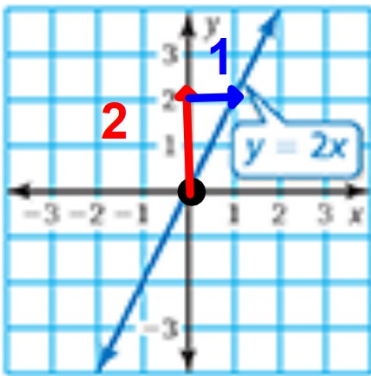
$$y = kx$$

- Identify (Direct Variation) Based on a Table or Graph
- Identify Direct Variation Based on an Equation
- ~~Write a Direct Variation Equation from a Graph~~



Proportional  
Relationship

## Direct Variation = Proportional Relationship



- The points lie on a line

Slope  $\frac{\Delta y}{\Delta x}$

- This line passes through the origin (0, 0)

$$y = 2x$$

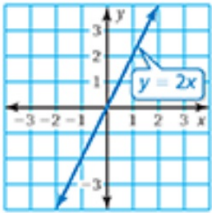
We can also find the slope of this line.

$$\text{Slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{2}{1} = 2$$

## Direct Variation = Proportional Relationship

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Two quantities  $x$  and  $y$  show Direct Variation when



$$y = kx$$

## Direct Variation = Proportional Relationship

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$$y = kx$$

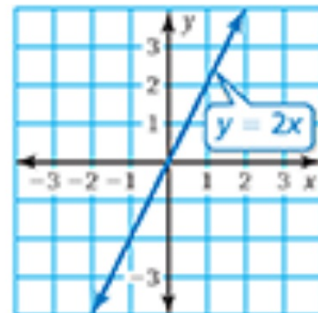
$k$

is called the **Constant of Proportionality**

$k$

is the **Slope of the line**

Rate



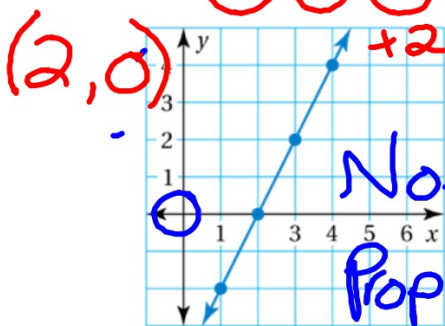
## Identifying Direct Variation - From a table or Graph

Same as identifying a Proportional Relationship

Tell whether  $x$  and  $y$  show direct variation. Explain your reasoning.

a.

x	1	2	3	4
y	-2	0	2	4



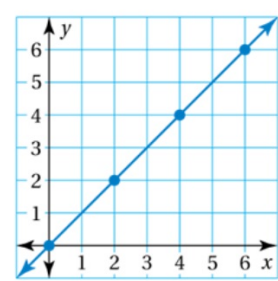
NO  
 $\frac{\Delta y}{\Delta x} = \frac{+2}{-1} = -2$   
 $k = -2$  ✓  
 Not Prop.

❖ The line does *not* pass through the origin. So,  $x$  and  $y$  do *not* show direct variation.

Fail!

b.

x	0	2	4	6
y	0	2	4	6



YES  
 $\frac{\Delta y}{\Delta x} = \frac{+2}{+1} = 2$   
 $k = 2$   
 OR 1

❖ The line passes through the origin. So,  $x$  and  $y$  show direct variation.

YES!

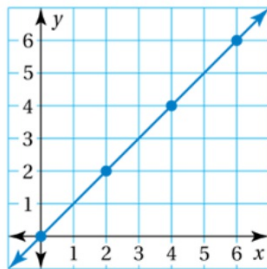
If  $x$  and  $y$  show direct variation, find  $k$ .

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b.

$x$	0	2	4	6
$y$	0	2	4	6

$k =$  the slope of the line



• The line passes through the origin. So,  $x$  and  $y$  show direct variation.

Tell whether  $x$  and  $y$  show direct variation. Explain your reasoning.

Find slope and check  $(0, 0)$

Or graph

$x$	$y$
0	-2
1	1
2	4
3	7

No

did not pass through  $(0,0)$

We practiced this yesterday in Extension 5.2

$x$	$y$
0	0
1	4
2	8
3	12
4	16

Yes

1

4

$$k = \frac{4}{1}$$

## Identifying Direct Variation - From an Equation

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$$y = kx$$

**If an equation can be written in this form, it proves that  $x$  and  $y$  show direct variation.**



## Identifying Direct Variation - From an Equation

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$$y = kx$$

$y = 6x$	<del><math>y = \frac{2}{5}</math></del>	$y = \frac{1}{3}x$
$y = -9x$	$y = 87x$	$y = \frac{5}{2}x$

## Identifying Direct Variation - From an Equation

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$$y = kx$$

Sometimes you must first solve for y

1.  $\frac{4y}{4} = \frac{3x}{4}$   
 $y = \frac{3}{4}x$

Yes

2.  $\frac{2y}{2} = \frac{7x}{2}$   
 $y = \frac{7}{2}x$

Yes

## Identifying Direct Variation - From an Equation

$$y = kx$$

↑      ↑ x

Sometimes you have to solve for y

3.  $\frac{4}{3}y = x \cdot \frac{3}{4}$

$$y = \frac{4}{3}x$$

Yes

4.  $y + 4 = x + 7$

$$\begin{array}{r} y + 4 = x + 7 \\ \quad \quad -4 \quad -4 \\ \hline y = x + 3 \end{array}$$

No

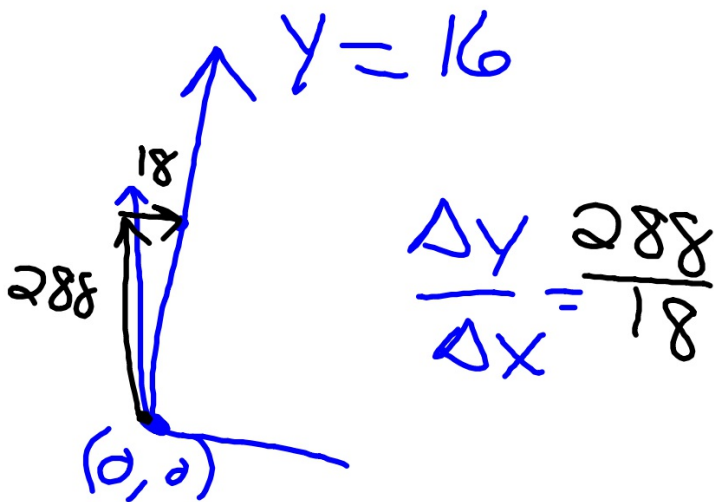
The graph of a proportional relationship passes through the given point and  $(1, y)$ . Find  $y$ .

Given point:  $(18, 288)$

Given point:  $(7, 70)$

$$\frac{Y}{X} = \frac{Y}{1} = \frac{288}{18}$$

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The variables  $x$  and  $y$  vary directly. Use the values to find the constant of proportionality. Then write an equation that relates  $x$  and  $y$ .

Slope

$$y = \underline{99}; x = \underline{9}$$

$$(9, 99) \quad y = \underline{k}x$$

$$k = \frac{99}{9} = 11$$

$$y = 11x$$

$$y = 20; x = 24$$

$$\frac{20}{24} = \frac{5}{6}$$

$$y = \frac{5}{6}x$$

## Real-Life Application

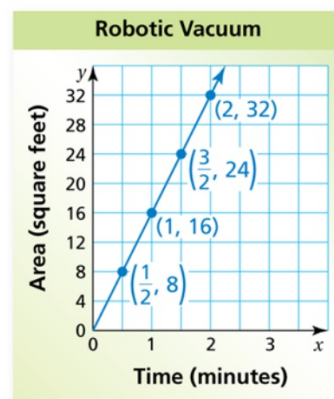
$$y = kx$$

$x$	$y$
$\frac{1}{2}$	8
1	16
$\frac{3}{2}$	24
2	32

The table shows the area  $y$  (in square feet) that a robotic vacuum cleans in  $x$  minutes.

a. Graph the data. Tell whether  $x$  and  $y$  are directly proportional.

- The graph is a line through the origin. So,  $x$  and  $y$  are directly proportional.



b. Write an equation that represents the line.

Choose any two points to find the slope of the line.

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{16}{1} = 16$$

- The slope of the line is the constant of proportionality,  $k$ . So, an equation of the line is  $y = 16x$ .



**Homework**  
**pg 202-203**  
**#2, #4-17, #20-22**

$$\frac{\Delta y}{\Delta x} \quad \left( \frac{1}{2} \right)$$
$$y = \frac{1}{2}x \quad \checkmark$$

