

Section 2-2: Direct Variation

Two variables vary directly when the ratio of y to x is consistent.

$$\frac{y}{x} = \text{the same number (for ALL pairs)}$$

Example 1: For these functions, does y vary directly with x ?

Does every y/x give you the same value?

a.

x	y
1	2
3	6
4	8

$\rightarrow \frac{2}{1} = 2$
 $\rightarrow \frac{6}{3} = 2$
 $\rightarrow \frac{8}{4} = 2$

Yes! VARIES DIRECTLY

b.

x	y
1	4
2	8
3	11

$\rightarrow \frac{4}{1} = 4$
 $\rightarrow \frac{8}{2} = 4$
 $\rightarrow \frac{11}{3}$ is NOT 4

NO! DOES NOT VARY DIRECTLY

If y does vary directly with x , the ratio you calculate is called the **constant of variation** and is often denoted as **k** .

x	y
1	2
3	6
4	8

$$\frac{y}{x} = \frac{2}{1} \quad \frac{6}{3} \quad \frac{8}{4}$$

$$2 \quad 2 \quad 2$$

$k = 2$

...and you can write an equation using that value.

$$y = kx$$

$$y = 2x$$

Example 2: Do these equations represent direct variation?

a. $\frac{y}{6} = x$

Can you re-write the equation in the form $y = kx$?

$y = 6x$ yes! ($k=6$)

b. $y + 2 = x - 2$

$y = x - 4$ no!

Example 3: In the following examples, y varies directly with x .

a. If $y = -4$ when $x = 25$, what is x when $y = 10$?

Step 1: Find k

$$k = \frac{y}{x} = \frac{-4}{25}$$

Step 2: Write equation

$$y = \frac{-4}{25}x$$

Step 3: Plug in new value

$$10 = \frac{-4}{25}x$$

$$\frac{25}{-4} \cdot \frac{10}{1} = x = \frac{250}{-4} = -62.5$$

$\frac{-125}{2}$

b. If $y = -7$ when $x = -3$, find y when $x = 9$

$$k = \frac{-7}{-3}$$

$$y = \frac{7}{3}x$$

$$y = \frac{7}{3}(9) = 21$$

c. If $y = 7$ when $x = 2$, what is x when $y = 3$?

$$k = \frac{7}{2}$$

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

$$3 = \frac{7}{2}x$$

$$x = 3 \cdot \frac{2}{7} = \frac{6}{7}$$