Section 5-5: Direct Variation

Direct Variation is a special Linear Function.

- It has a constant ratio $\frac{Y}{X} = k$

  k = the Variation Constant

- Direct Variation Equation:

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

Direct Variation Equations:

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

Does each equation represent Direct Variation?

1. $y - 3 = x$ NO

   If you rearrange this equation into y= form you get: y = x +3
   this is not the same as y = kx
   and y = x + 3 doesn't go through the origin.

2. $4y = -12x$ YES

   If you rearrange this equation into y= form you get: y = -3x which IS the same as y = kx

3. $4x - 2y = 10$ NO

   If you rearrange this equation into y= form you get: y = -2x - 5

   this is not the same as y = kx
   and y = x + 3 doesn't go through the origin.

4. $6x + 12y = 0$ YES

   If you rearrange this equation into y= form you get: y = -0.5x which IS the same as y = kx

Given the table shows a direct variation relationship, find the value of ?.

To solve Direct Variation situations you can use either equation or you can use a Proportion

X	Y
-20	55
-12	33
?	-38.5
32	-88

Using a Direct Variation Equation

$\frac{Y}{X} = -2.75$

$Y = -2.75X$

$\frac{-38.5}{-2.75} = \frac{-2.75X}{-2.75}$

Using a Proportion

$\frac{33}{-12} = \frac{-38.5}{X}$

$X = 14$

The data below comes from a Direct Variation relationship.

X	Y
−5	−31.5
−2.4	−15.12
4.5	28.35
7	44.1
11	69.3

$\frac{Y}{X} 6.3 = k$

1. Write a Direct Variation Equation.

   $Y = 6.3X$ or $\frac{Y}{X} = 6.3$

2. Find x when y = 30

   $\frac{30}{6.3} = \frac{6.3X}{6.3}$ $X = 4.76$

3. Find y when x = 20

   $Y = 6.3(20)$

   $y = 126$

The given point is part of a Direct Variation relationship.

Write the equation for each Direct Variation relationship.

5. $(9,5)$ (x, y)

$k = \frac{y}{x} = \frac{5}{9}$

EQ $y = kx$

$y = \frac{5}{9}x$

6. $(-4,1)$

$y = -\frac{1}{4}x$

The ordered pairs are for the same Direct Variation relationship.

Write a direct variation equation then find the missing value.

7. $(2,5)\&(x,16)$

Write a Direct Variation Eq.

$\frac{y}{x} = \frac{5}{2} = 2.5$

$y = 2.5x$

$16 = 2.5x$

$6.4 = x$

OR use a Proportion

$\frac{5}{2} = \frac{16}{x}$

8. $(10,y)\&(-3,75)$

$\frac{y}{10} = \frac{75}{-3}$

$y = -250$

Remember the phrase: "Y varies directly with X"

The number of tires (y) a company can make varies directly with the number of employees (x) at work that day. One a recent day the company had 32 workers present and they produced 776 tires.

1. Find the Variation Constant, include units.

$k = \frac{y}{x} = \frac{776\text{ T}}{32\text{ work}} = 24.25\ \text{Tires/work}$

2. Write a Direct Variation Equation.

$y = 24.25x$

$y = 24.25x$

3. Find the number of Employees that would be needed to make 1200 tires.

$\frac{1200\text{ T}}{x} = \frac{776\text{ T}}{32}$ OR $1200 = 24.25x$

Use a Proportion

Or use a Direct Variation Equation

$49.48 = x \rightarrow 50$ workers

The amount of money (Y) raised varies directly with the number of people (X) who contribute. $1746 was raised when 24 people contributed.

1. Find the variation constant, including units.

$$k = \frac{Y}{X} = \frac{\$1746}{24 \text{ people}} = \$72.75/\text{person}$$

2. Find the number of people it would take to raise $10,000. ($10,000 = Y)

Use a proportion or use a Direct Variation Equation

EQ: $y = 72.75x$

$$\frac{1000}{72.75} = \frac{72.75x}{72.75}$$

Proportion:

$$\frac{\$1746}{24 \text{ people}} = \frac{\$10,000}{x}$$

$x = 137.46$

Round to 138 people