

Lesson 5-5

Direct Variation

Lesson Objectives

1. Write an equation of a direct variation.
2. Use ratios and proportions with direct variations.

Vocabulary and Key Concepts

Direct variation is A function in the form $y = Kx$ where $K \neq 0$

The constant of variation is The coefficient of x which is K

Examples

STEPS:

① Add or subtr. x term

② Mult or div # attached to y .

1. Is an Equation a Direct Variation? Is each equation a direct variation? If it is, find the constant of variation.

a. $2x - 3y = 1$
$$\begin{array}{r} -2x \\ \hline -3y = -2x + 1 \\ \hline -3 \end{array}$$

$$y = \frac{2}{3}x - \frac{1}{3} \rightarrow \text{NO}$$

* Watch your signs
* \div all terms by # w/ y .
* Combine only the "like terms"

b. $2x - 3y = 0$
$$\begin{array}{r} -2x \\ \hline -3y = -2x \\ \hline -3 \end{array}$$

$$y = \frac{2}{3}x \rightarrow \text{YES}$$

2. Writing an Equation Given a Point: Write an equation for the direct variation that includes the point $(-3, 2)$.

$$\begin{array}{l} y = Kx \\ z = K(-3) \end{array} \rightarrow \begin{array}{l} 2 = -3K \\ -3 \quad -3 \end{array}$$

$$K = -\frac{2}{3} \quad \text{so equation is:}$$

$$y = -\frac{2}{3}x$$

3. Weight and Mass: The weight an object exerts on a scale varies directly with the mass of the object. If a bowling ball has a mass of 6 kg, the scale reads 59. Write an equation for the relationship between weight and mass.

Weight V.D. w/Mass

When mass = 6, scale reads 59

\downarrow x \downarrow y

$$\begin{array}{l} y = Kx \\ 59 = K(6) \end{array} \rightarrow \begin{array}{l} 59 = 6K \\ 6 \quad 6 \end{array}$$

$$y = \frac{59}{6}x$$

$$K = \frac{59}{6}$$

4. Direct Variations and Tables: For the data in the table at the right, tell whether y varies directly with x. If it does, write an equation for the direct variation.

x	y	$\frac{y}{x}$
-1	2	
1	2	
2	-4	

Find $\frac{y}{x}$ for each pair.

~~$\frac{2}{-1}$~~ $\frac{2}{-1}$, $\frac{2}{1}$, $-\frac{4}{2}$
 $\hookrightarrow -2$ $\hookrightarrow 2$ $\hookrightarrow -2$

Not D.V.

5. Physics: The force you must apply to lift an object is proportional to the object's weight. You would need to apply 0.625 lb of force to a windlass (winch used on ships) to lift a 28-lb weight. How much force would you need to lift 100 lb?

$$\frac{\text{force}_1}{\text{weight}_1} = \frac{\text{force}_2}{\text{weight}_2}$$

$$\frac{0.625}{28} = \frac{x}{100}$$

$$\frac{28x}{28} = \frac{62.5}{28}$$

$$x = 2.2$$

Sentence Answer:
 You need 2.2 lbs of force to lift 100 lbs

Practice

1. Is each equation a direct variation? If it is, find the constant of variation.

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

b. $3y + 4x = 8$
 $-4x \quad -4x$
 $\frac{3y}{3} = \frac{-4x + 8}{3}$
 $y = -\frac{4}{3}x + \frac{8}{3}$
 NO

c. $\frac{2y}{2} = \frac{5x + 1}{2}$
 $y = \frac{5}{2}x + \frac{1}{2}$
 NO

d. $y - 7.5x = 0$
 $+7.5x \quad +7.5x$
 $y = 7.5x$
 yes = 7.5

2. Write the equation of the direct variation that includes the point (-3, -6).

$y = kx$
 $-6 = k(-3)$
 $\frac{-6}{-3} = \frac{-3k}{-3}$
 $k = 2$
 $y = 2x$

3. A recipe for a dozen corn muffins calls for 1 cup of flour. The number of muffins varies directly with the amount of flour used. Write a direct variation for the relationship between the number of cups of flour and the number of muffins.

muffins v.d. w/ flour
 when $x = 1$ c., $y = 12$ muffins
 $y = kx$
 $12 = k(1)$
 $k = 12$
 $y = 12x$

4. For the equation in each table, tell whether y varies directly with x . If it does, write an equation for the direct variation.

a.

x	y
-2	3.2
1	2.4
4	1.6

$$\frac{3.2}{-2} = -1.6 \quad \frac{1.6}{4} = 0.4$$

$$\frac{2.4}{1} = 2.4$$

NO

b.

x	y
4	6
8	12
10	15

$$\frac{6}{4} = \frac{3}{2}$$

$$\frac{12}{8} = \frac{3}{2}$$

$$\frac{15}{10} = \frac{3}{2}$$

Yes!

5. Suppose a windlass requires 0.5 lb of force to lift an object that weighs 32 lb. How much force would you need to lift 160 lb?

$$\frac{0.5}{32} = \frac{\cancel{160}x}{160} \quad \frac{32x}{32} = \frac{80}{32}$$

$$x = 2.5$$

You will need 2.5 lbs of force to lift 160 lbs