

Find each percent of change. Describe the percent of change as an increase or decrease. If necessary, round to the nearest tenth.

1. \$2 to \$3 2. \$3 to \$2 3. 4 ft to 5 ft 4. 5 ft to 4 ft
 5. 9 m to 12 m 6. 12 cm to 9 cm 7. 12 in. to 15 in. 8. 15 lb to 18 lb

① $\frac{3-2}{2} = \frac{1}{2}$
 $= 50$
 50% inc

② $\frac{3-2}{3} = \frac{1}{3}$
 dec (33.3%)

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Lesson 5-5

Day 24 Direct Variation

- Lesson Objectives
 Write an equation of a direct variation
 Use ratios and proportions with direct variations

NAEP 2005 Strand: Algebra
 Topics: Patterns, Relations, and Functions; Algebraic Representations
 Local Standards:

P.90

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Key Concepts

Direct Variation

A function in the form $y = kx$ where $k \neq 0$, is a direct variation. The constant of variation k is the coefficient of x . The variables y and x are said to vary directly with each other.

If the variables vary directly, we can use proportions to solve.

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Examples

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

a. $2x - 3y = 1$

$-2x$
 $-2x$
 $-3y = 1 - 2x$
 $y = \frac{1}{-3} + \frac{2}{3}x$

Subtract $2x$ from each side.

Divide each side by -3 .

The equation $y = \frac{2}{3}x - \frac{1}{3}$ have the form $y = kx$. It is NOT a direct variation.

Need to get y alone

$y = \frac{2}{3}x - \frac{1}{3}$

$y = mx + b$
 $y = kx$

If you type the eq into the calculator and the line goes thru the origin - it is Direct Variation

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b. $2x - 3y = 0$
 $-3y = \square$ Subtract $2x$ from each side.
 $y = \square x$ Divide each side by -3 .
 The equation $y = \frac{2}{3}x$ is the form $y = kx$, so the equation \square is a direct variation. The constant of variation is $\frac{2}{3}$.

$$\begin{array}{r} 2x - 3y = 0 \\ -2x \quad -2x \\ \hline -3y = -2x \\ \div -3 \quad \div -3 \\ \hline y = \frac{2}{3}x \end{array}$$

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

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

$y = kx$ Use the general form of a direct variation.
 $x = -3$ $y = 2$

$$\begin{array}{l} 2 = k(-3) \\ \frac{2}{-3} = \frac{-2k}{3} \\ \frac{2}{-3} = k \end{array}$$

$y = kx$
 The equation of the direct variation is $y = -\frac{2}{3}x$

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3 Write an equation for the relationship between weight and mass.

Relate The weight varies directly with the mass. When $x = 6$, $y = 59$.
mass weight

$$y = kx$$

$$\frac{59}{6} = k \left(\frac{6}{6}\right)$$

$y = \frac{59}{6}x$ Write an equation. Substitute $\frac{59}{6}$ for k in $y = kx$.

The equation $y = \frac{59}{6}x$ relates the weight of an object to its mass.

y varies directly x

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Quick Check

1. Is each equation a direct variation? If it is, find the constant of variation.
 a. $7y = 2x$

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

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

yes $y = kx$
 $K = \frac{2}{7}$

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b. $3y + 4x = 8$

$$\begin{array}{r}
 3y + 4x = 8 \\
 -4x \quad -4x \\
 \hline
 3y = 8 - 4x \\
 \frac{3y}{3} = \frac{8 - 4x}{3} \\
 y = \frac{-4x + 8}{3}
 \end{array}$$

$$\begin{array}{r}
 9x \quad 4x \\
 -3x \quad +8x \\
 \hline
 6x \quad 12x \\
 \\
 9x \quad \text{cannot do} \\
 -3 \quad \text{do} \\
 \hline
 4 \\
 3x
 \end{array}$$

$$\boxed{y = \frac{-4x + 8}{3}}$$

NO

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c. $y - 7.5x = 0$

$$\begin{array}{r}
 y - 7.5x = 0 \\
 +7.5x \quad +7.5x \\
 \hline
 \boxed{y = 7.5x}
 \end{array}$$

yes
k = 7.5

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

$$\begin{array}{l}
 y = kx \\
 -6 = k(-3) \\
 \frac{-6}{-3} = \frac{k(-3)}{-3} \\
 \boxed{2 = k} \\
 \boxed{y = 2x}
 \end{array}$$

x ↗ y ↖

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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.

$$\begin{array}{l}
 y = kx \\
 12 = k(1) \\
 \boxed{12 = k} \\
 \boxed{y = 12x}
 \end{array}$$

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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.

The ratio $\frac{y}{x}$ is CONSTANT for each pair of data, so y ~~varies~~ varies directly with x .

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

NOT Direct Variation

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

| x | y |
|-----|-----|
| -2 | 3.2 |
| 1 | 2.4 |
| -4 | 1.6 |

$\rightarrow \frac{3.2}{-2} = -1.6$ NO
 $\rightarrow \frac{2.4}{1} = 2.4$

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

h.

| x | y |
|-----|-----|
| 4 | 6 |
| 8 | 12 |
| 10 | 15 |

$\rightarrow \frac{6}{4} = 1.5$
 $\rightarrow \frac{12}{8} = 1.5$
 $\rightarrow \frac{15}{10} = 1.5$

constant
 K
 $y = 1.5x$
 $y = Kx$

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5. Recall Example 5. Suppose a second 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?

$$\frac{.5 \text{ lb}}{32 \text{ lb}} = \frac{x}{160 \text{ lb}}$$

$$\frac{32x}{32} = \frac{80}{32}$$

$x = 2.5 \text{ lbs force}$

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

24.

| x | y |
|-----|------|
| 3 | 5.4 |
| 7 | 12.6 |
| 12 | 21.6 |

25.

| x | y |
|-----|-----|
| -2 | 1 |
| 3 | 6 |
| 8 | 11 |

26.

| x | y |
|-----|------|
| -6 | 9 |
| 1 | -1.5 |
| 8 | -12 |

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5-5 wkst

(3-28 all)

on a separate sheet

if you finish - turn in

① $y = 5x$
yes
 $k = 5$

② $8x + 2y = 0$
 $-8x$
 $2y = -8x$
 $\frac{2y}{2} = \frac{-8x}{2}$
 $y = -4x$ $k = -4$

⑬ (3, 2) (6, y)

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

⑰ (-2, 8) (x, 12)

$\frac{-2}{8} = \frac{x}{12}$

Sep 28-5:41 AM