

## 2.3 Direct Variation

as the x-value increases, the y-value increases.  
 OR as x decreases, y decreases.

Direct variation is a linear function where  $k$  is the constant (slope) and the y-intercept is always zero.

$$\boxed{k = \frac{y}{x}} \quad \text{OR} \quad \boxed{y = kx}$$

constant of variation

In direct variation, you can use proportions to solve.

### p. 73 Geometry Quick ✓ #3

The circumference of a circle varies directly with the diameter of a circle.

$$C = \pi d$$

as the diameter of a  $\odot$  gets bigger, the circumference gets bigger.

(a) constant of variation:  $\boxed{k = \pi}$

$$\frac{C}{d} = \pi$$

(b) Find  $d$ , when  $C = 105$

$$\frac{105}{\pi} = \frac{\pi d}{\pi}$$

$33.4 \text{ cm} \approx d$

tenth (one decimal)

FIVE STAR  
 FIVE STAR  
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**Alg.2 Practice 2-3**  $K = \frac{y}{x}$  **Direct Variation**

For each direct variation, find the constant of variation. Then find the value of y when  $x=3$ .

1.  $y=3$  when  $x=-2$       2.  $y=\frac{3}{4}$  when  $x=\frac{1}{8}$       3.  $y=-\frac{3}{8}$  when  $x=-\frac{2}{3}$

$K = \frac{3}{-2} = -\frac{3}{2}$        $K = \frac{3/4}{1/8} = 6$        $K = \frac{(-3/8)}{(-2/3)} = \frac{9}{16}$

$y = -4.5$        $y = 6x$        $y = \frac{9}{16} \cdot 3 = \frac{27}{16}$

Determine whether y varies directly as x. If so, find the constant of variation.

4.  $y = \frac{4}{9}x$       5.  $y = -1.2x$       6.  $y + 4x = 0$       7.  $y - 3x = 1$

Yes,  $K = \frac{4}{9}$       Yes,  $K = -1.2$        $y = -4x$ , Yes,  $K = -4$        $y = 3x + 1$ , NO,  $b=1$

8.  $y = 3x$       9.  $y + 2 = x$       10.  $y - \frac{3}{5}x = 0$       11.  $y = -3.5x + 7$

Yes,  $K = 3$        $y = x - 2$ , NO       $y = \frac{3}{5}x$ , Yes      NO,  $b=7$

For each function, determine whether y varies directly as x. If so, find the constant of variation and write the equation.

12.  $K = \frac{y}{x}$       13.  $\frac{-3}{-1} = 3$       14.  $\frac{-2}{2} = -1$       15.  $\frac{-3}{-2} = 1.5$

x	y
1	1
2	4
3	9

NO      ①  $K = 3$        $K = \frac{1}{2}$       NO

②  $y = 3x$        $y = \frac{1}{2}x$

Write an equation for a direct variation with a graph that passes through each point.

16. (6, 2)      17. (-1.5, 9)      18. (-5, 90)      19. (3, 165)

$K = \frac{2}{6} = \frac{1}{3}$        $K = \frac{9}{-1.5} = -6$        $K = \frac{90}{-5} = -18$        $K = \frac{165}{3} = 55$

$y = \frac{1}{3}x$        $y = -6x$        $y = -18x$        $y = 55x$

20.  $(-1, -\frac{2}{3})$       21.  $(\frac{3}{5}, -\frac{7}{2})$        $y = \frac{-35}{6}x$

$K = \frac{-2/3}{-1} = \frac{2}{3}$        $K = \frac{-7/2}{3/5} = -\frac{35}{6}$

In Exercises 24-27,  $y$  varies directly as  $x$ .

If the problem

22. If  $y = 3$  when  $x = 2$ , find  $x$  when  $y = 5$ .

$$\frac{3}{2} = \frac{5}{x}$$

$$x = 3\frac{1}{3} \text{ or } \frac{10}{3}$$

doesn't ask you to find  $k$ , or the equation, set up a proportion.

23. If  $y = -4$  when  $x = \frac{1}{2}$ , find  $y$  when  $x = \frac{2}{3}$ .

$$\frac{-4}{\frac{1}{2}} = \frac{y}{\frac{2}{3}}$$

$$y = -5\frac{1}{3} \text{ or } -16\frac{1}{3}$$

$$\frac{x}{y} = \frac{x}{y} \text{ or}$$

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

24. If  $y = -14$  when  $x = -7$ , find  $x$  when  $y = 22$ .

$$\frac{-14}{-7} = \frac{22}{x}$$

$$x = 11$$

25. If  $y = \frac{5}{17}$  when  $x = 10$ , find  $y$  when  $x = 5$ .

$$\frac{\frac{5}{17}}{10} = \frac{y}{5}$$

$$y = \frac{5}{34}$$

**Use to Find  $k$ .**

$$y = k \cdot x$$

26. A 15-minute long-distance telephone call costs \$.90. The cost varies directly as the length of the call. Write an equation that relates the cost to the length of the call. How long is a call that costs \$1.32?

$$y = .06x \quad 22 \text{ min}$$

$$1.32 = .06x$$

$$k = \frac{y \text{ cost}}{x \text{ length}}$$

$$k = \frac{.90}{15} = .06$$

27. The distance a spring stretches varies directly as the amount of weight that is hanging on it. A weight of 2.5 pounds stretches a spring 18 inches. Find the stretch of the spring when a weight of 6.4 pounds is hanging on it.

$$y = kx$$

$$k = \frac{y \text{ (distance)}}{x \text{ (weight)}}$$

$$y = 7.2(6.4)$$

$$y = 46.08 \text{ in}$$

$$k = \frac{18}{2.5} = 7.2$$

$$y = 7.2x$$