Lesson 9–4

Example 1 Direct Variation

If y varies directly as x and $y = -240$ when $x = 75$, find y when $x = 32$.

$\frac{y_1}{x_1} = \frac{y_2}{x_2}$ Direct proportion

$\frac{-240}{75} = \frac{y_2}{32}$ $y_1 = -240$, $x_1 = 75$, and $x_2 = 32$

$-240(32) = 75(y_2)$ Cross multiply.

$-7680 = 75y_2$ Simplify.

$-102.4 = y_2$ Divide each side by 75.

When $x = 32$, the value of y is -102.4.

Example 2 Joint Variation

Suppose y varies jointly as x and z. Find y when $x = 6$ and $z = 30$, if $y = 7$ when $z = 10$ and $x = 3$.

Use a proportion that relates the values.

$\frac{y_1}{x_1 z_1} = \frac{y_2}{x_2 z_2}$ Joint variation

$\frac{7}{3(10)} = \frac{y_2}{6(30)}$ $y_1 = 7$, $x_1 = 3$, $z_1 = 10$, $x_2 = 6$, and $z_2 = 30$

$7(6)(30) = 3(10)(y_2)$ Cross multiply.

$1260 = 30y_2$ Simplify.

$42 = y_2$ Divide each side by 30.

When $x = 6$ and $z = 30$, the value of y is 42.

Example 3 Inverse Variation

If a varies inversely as b and $a = -102$ when $b = 68$, find a when $b = 3$.

$\frac{a_1}{b_2} = \frac{a_2}{b_1}$ Inverse variation

$\frac{-102}{3} = \frac{a_2}{68}$ $a_1 = -102$, $b_1 = 68$, and $b_2 = 3$

$-102(68) = 3(a_2)$ Cross multiply.

$-6936 = 3a_2$ Simplify.

$-2312 = a_2$ Divide each side by 3.

When $b = 3$, the value of a is -2312.

Example 4 Use Inverse Variation

GEOMETRY The volume of any cylinder can be found by using the formula $V = \pi r^2 h$, where r is the radius of the cylinder and h is its height.

a. Solve the formula for h.

$V = \pi r^2 h$	Original formula
$h = \frac{V}{\pi r^2}$	Divide each side by πr^2.

b. How does h vary with respect to r^2?

h varies inversely as r^2 since there is some nonzero constant $(V \div \pi)$ such that $h = \frac{(V \div \pi)}{r^2}$.

c. If the radius of a cylinder is 2 in. and the volume is 6π in. , what is the height?

$h = \frac{V}{\pi r^2}$	Formula from part a
$= \frac{6\pi}{\pi(2)^2}$	$r = 2$, $V = 6\pi$
$= 1.5$	Simplify.

The height of the cylinder is 1.5 in.