

Chapter 7 Rational Functions

Section 7-1 Inverse Variation

Classifying Direct and Inverse Variation

You have learned that two variables x and y show direct variation when $y = ax$ for some nonzero constant a . Another type of variation is called *inverse variation*.

Core Concept

Inverse Variation

Two variables x and y show **inverse variation** when they are related as follows:

$$y = \frac{a}{x}, a \neq 0$$

The constant a is the **constant of variation**, and y is said to *vary inversely* with x .

EXAMPLE 1 Classifying Equations

Tell whether x and y show *direct variation*, *inverse variation*, or *neither*.

a. $xy = 5$

b. $y = x - 4$

c. $\frac{y}{2} = x$

SOLUTION

Given Equation	Solved for y	Type of Variation
a. $xy = 5$	$y = \frac{5}{x}$	inverse
b. $y = x - 4$	$y = x - 4$	neither
c. $\frac{y}{2} = x$	$y = 2x$	direct

Tell whether x and y show *direct variation*, *inverse variation*, or *neither*.

1. $6x = y$
2. $xy = -0.25$
3. $y + x = 10$

The general equation $y = ax$ for direct variation can be rewritten as $\frac{y}{x} = a$. So, a set of data pairs (x, y) shows direct variation when the ratios $\frac{y}{x}$ are constant.

The general equation $y = \frac{a}{x}$ for inverse variation can be rewritten as $xy = a$. So, a set of data pairs (x, y) shows inverse variation when the products xy are constant.

EXAMPLE 2 Classifying Data

Tell whether x and y show *direct variation*, *inverse variation*, or *neither*.

a.

x	2	4	6	8
y	-12	-6	-4	-3

b.

x	1	2	3	4
y	2	4	8	16

Writing Inverse Variation Equations

EXAMPLE 3 Writing an Inverse Variation Equation

The variables x and y vary inversely, and $y = 4$ when $x = 3$. Write an equation that relates x and y . Then find y when $x = -2$.

SOLUTION

$$y = \frac{a}{x} \quad \text{Write general equation for inverse variation.}$$

$$4 = \frac{a}{3} \quad \text{Substitute 4 for } y \text{ and 3 for } x.$$

$$12 = a \quad \text{Multiply each side by 3.}$$

▶ The inverse variation equation is $y = \frac{12}{x}$. When $x = -2$, $y = \frac{12}{-2} = -6$.

The variables x and y vary inversely. Use the given values to write an equation relating x and y . Then find y when $x = 2$.

▶ 6. $x = 4, y = 5$

▶ 7. $x = 6, y = -1$

▶ 8. $x = \frac{1}{2}, y = 16$

EXAMPLE 4 Modeling with Mathematics

The time t (in hours) that it takes a group of volunteers to build a playground varies inversely with the number n of volunteers. It takes a group of 10 volunteers 8 hours to build the playground.

- Make a table showing the time that it would take to build the playground when the number of volunteers is 15, 20, 25, and 30.
- What happens to the time it takes to build the playground as the number of volunteers increases?

