

12-1 Inverse Variation (Pages 642–647)

A situation in which y decreases as x increases is called an **inverse variation**. In this situation y varies inversely as x or y is inversely proportional to x . Solutions to an inverse variation can be expressed as the **product rule**. The product rule states that for any two solutions (x_1, y_1) and (x_2, y_2) , $x_1 y_1 = x_2 y_2$ and $\frac{x_1}{x_2} = \frac{y_2}{y_1}$.

Inverse Variation	If y varies inversely as x , then as x increases y decreases, or as x decreases y increases. An inverse variation can be described by the equation $xy = k$, where $k \neq 0$.
Product Rule	For solutions (x_1, y_1) and (x_2, y_2) , $x_1 y_1 = x_2 y_2$ and $\frac{x_1}{x_2} = \frac{y_2}{y_1}$.

Example

Solve for x .

If y varies inversely as x and $y_1 = 5$ when $x_1 = 9$, find x_2 when $y_2 = 15$.

Method 1

$$x_1 y_1 = x_2 y_2 \quad \text{Use the product rule.}$$

$$9 \cdot 5 = x_2 \cdot 15 \quad \text{Substitute.}$$

$$45 = x_2 \cdot 15 \quad \text{Simplify.}$$

$$3 = x_2 \quad \text{Divide both sides by 15.}$$

Method 2

$$\frac{x_1}{x_2} = \frac{y_2}{y_1} \quad \text{Use a proportion.}$$

$$\frac{9}{x_2} = \frac{15}{5} \quad \text{Substitute.}$$

$$45 = 15x_2 \quad \text{Cross multiply.}$$

$$3 = x_2 \quad \text{Divide both sides by 15.}$$

Practice

Write an inverse variation equation that relates x and y . Assume that y varies inversely as x . Then solve.

- If $y = 10$ when $x = 7$, find y when $x = 5$.
- If $y = 21$ when $x = 10$, find y when $x = 4$.
- If $y = 17.5$ when $x = 12$, find y when $x = 8$.
- If $y = 5$ when $x = 5$, find x when $y = 2$.
- If $y = 13$ when $x = -3$, find x when $y = -3.9$.
- Find the value of y when $x = 5$ if $y = 8$ when $x = 10$.
- Find the value of y when $x = \frac{3}{4}$ if $y = 27$ when $x = \frac{1}{4}$.
- If $x = 2.1$ when $y = 7.2$ find x when $y = 7.56$.
- Standardized Test Practice** Assuming that y varies inversely as x , find the value of x when $y = -17$ if $y = -12$ when $x = -8\frac{1}{2}$.

A $x = -12\frac{1}{24}$

B $x = -24$

C $x = -6$

D $x = -\frac{1}{6}$