

## 2-3 Inverse Variation

As one goes up, the other goes down.

### Key Terms

Inverse variation – The relationship between two quantities having a constant product.  $xy = k$

This relationship is inverse because as one quantity increase, the other decreases.

Example – travel at a steady rate follows the rule  $rate \cdot time = distance$ . For a 24-mile trip,  $rt = 24$ . This is an inverse variation, since as the rate increases, the time decreases and as the rate decreases, the time increases.

Hyperbola – A shape made of two curves, which is the graph of an inverse variation. View the graphs of hyperbolas below.

### Inverse Variation forms

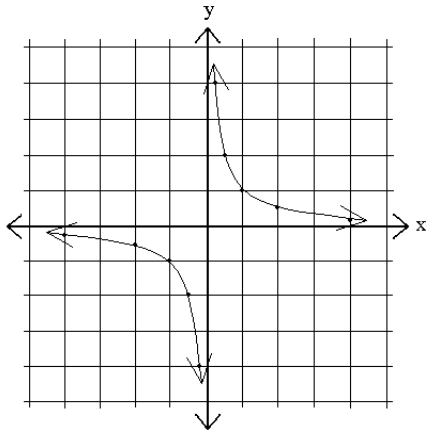
$$xy = k \text{ or } y = \frac{k}{x}; k \neq 0, x \neq 0$$

“ $y$  varies inversely with  $x$ ” or “ $y$  is proportional to  $\frac{1}{x}$ ”

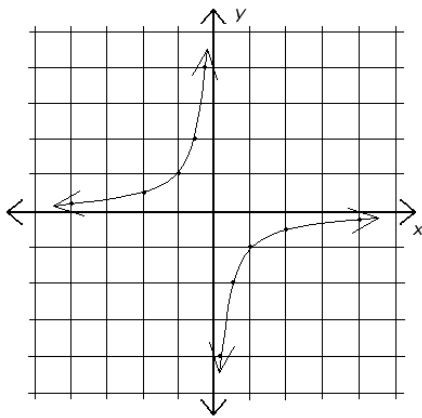
As  $x$  increases, the  $y$  decreases.

The product of the corresponding  $x$  and  $y$  values are constant for a data set.

The graph is a hyperbola and does not intersect either axis.



When  $k$  is positive



When  $k$  is negative

Note that the lines never cross the axes -- they get closer and closer to  $x = 0$  and  $y = 0$ , but  $x$  and  $y$  never equal zero.

Why does a hyperbola have two curves? For the positive and negative values.

### Examples

1.  $xy=36$

If  $x = 2$ , find  $y$

a.  $y = \frac{36}{x}$

$y = 18$

find  $k$

$(2)(18) = k$

$k = 36$

2. The volume ( $v$ ) of a gas in a closed container varies inversely to the pressure ( $p$ ) at a constant temperature. Write an equation.

a.  $vp = k$

3. Suppose the volume of a particular gas is 12 liters when the pressure is 4 atmospheres. Find the variation constant.
- $vp = k$   
 $12 \cdot 4 = k$   
 $48 = k$
4. Rewrite the equation using the variation constant.  
 $vp = 48$
5. Find the volume when the pressure is 8 atmospheres.  
 $v \cdot 8 = 48$   
 $v = 6$  liters
6. When a seesaw was balanced, each person's weight varies inversely with the distance from the center support. If a person who weighs 90 lbs. at one end of a 12 ft seesaw, how far from the support must a 120 lb. person sit in order to balance the seesaw?

Let  $w$  = person's weight and  $d$  = distance from the support center.

Then  $dw = k$ . Using  $w = 90$  and  $d = 6$ ,  $90 \cdot 6 = 540 = k$ .

The equation then becomes  $dw = 540$ .

To find the distance for a 120 lb. person, substitute 120 for  $w$  and solve  $120d = 1080$ .

$$\frac{120d}{120} = \frac{540}{120}$$

$$d = 4.5 \text{ ft}$$

7. If  $y$  varies inversely as  $x$  and  $y = 16$  when  $x = -10$ , find  $x$  when  $y = -8$ .

$$xy = k$$

$$(-10)(16) = k$$

$$k = -160$$

$$-8x = -160$$

$$x = 20$$

8. If  $y$  varies inversely as  $x$  and  $y = 21$  when  $x = 4$ , find  $y$  when  $x = -7$ .

$$xy = k$$

$$(4)(21) = k$$

$$k = 84$$

$$(-7)y = 84$$

$$y = -12$$

**Homework**

Day 1

Read pg. 75-79

Pg. 79 #4, 5, 8-16 (Graph 10 and 13)

Pg. 83 #2-6

Day 2

Pg. 79 #15, 16, 17-21, 24-31

Pg. 87 #2-4, 6-10