



**EXAMPLE 1** **Try It! Identify Inverse Variation**

1. Determine if each table of values represents an inverse variation.

a.

$x$	1	2	3	5	6	15
$y$	25.5	12.75	8.50	5.10	4.25	1.70

b.

$x$	6.6	5.5	4.4	3.3	2.2	1.1
$y$	3	5	7	9	11	13

**EXAMPLE 2** **Try It! Use Inverse Variation**

2. In an inverse variation,  $x = 6$  and  $y = \frac{1}{2}$

a. What is the equation that represents the inverse variation?

b. What is the value of  $y$  when  $x = 15$ ?

**HABITS OF MIND**

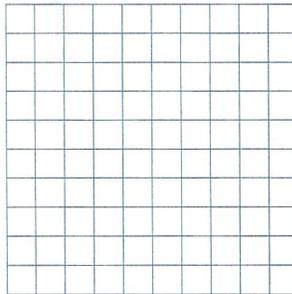
**Construct Arguments** For rectangles that have a constant perimeter, the length increases as the width decreases. Is the relationship between the length and width an inverse variation? Explain.

**EXAMPLE 3**  **Try It! Use an Inverse Variation Model**

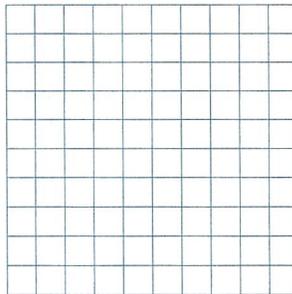
3. The amount of time it takes for an ice cube to melt varies inversely to the air temperature, in degrees. At 70°F, the ice will melt in 20 min. How long will it take the ice to melt if the temperature is 85°F?

**EXAMPLE 4**  **Try It! Graph the Reciprocal Function**

4. Graph the function  $y = \frac{10}{x}$ . What are the domain, range, and asymptotes of the function?

**EXAMPLE 5**  **Try It! Graph Translations of the Reciprocal Function**

5. Graph  $g(x) = \frac{1}{x+2} - 4$ . What are the equations of the asymptotes? What are the domain and range?

**HABITS OF MIND**

**Communicate Precisely** A translation of the reciprocal function has a vertical asymptote at  $x = 5$ . What is a possible equation for the function?

## Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How are inverse variations related to the reciprocal function?

2. **Construct Arguments** Explain why the amount of propane in a grill's tank and the time spent grilling could represent an inverse variation.



3. **Vocabulary** Why is it impossible for the graph of the function  $y = \frac{1}{x}$  to intersect the horizontal asymptote at the  $x$ -axis?

4. **Error Analysis** Carmen said the table of values shown represents an inverse variation. Explain why Carmen is mistaken.

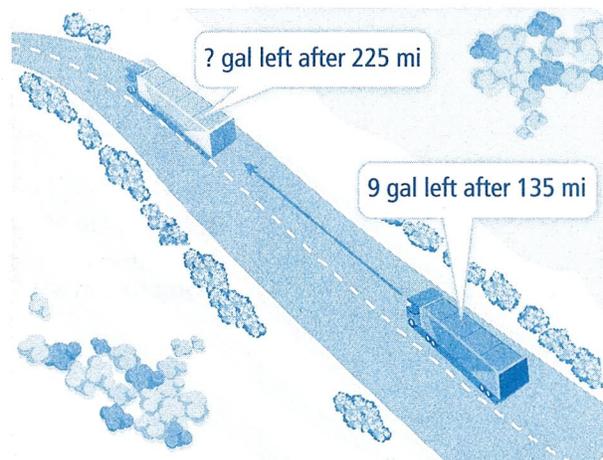
$x$	1	2	3	4	8	16
$y$	24	12	8	6	3	2

## Do You KNOW HOW?

5. In an inverse variation,  $x = -8$  when  $y = -\frac{1}{4}$ . What is the value of  $y$  when  $x = 4$ ?

6. What are the equations of the asymptotes of the function  $f(x) = \frac{1}{x-5} + 3$ ? What are the domain and range?

7. Until the truck runs out of gas, the amount of gas in its fuel tank varies inversely with the number of miles traveled. Model a relationship between the amount of gas in a fuel tank of a truck and the number of miles traveled by the truck as an inverse variation.



## PRACTICE & PROBLEM SOLVING

### UNDERSTAND

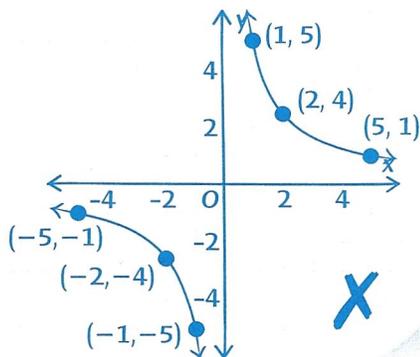
**8. Communicate Precisely** Explain the difference between the graphs of inverse variation functions when  $k > 0$  and when  $k < 0$ .

**9. Generalize** Just from looking at the table of values, how can you determine that the data do *not* represent an inverse variation?

$x$	-2	2	4	6	8	10
$y$	-6	6	12	18	24	30

**10. Construct Arguments** Explain why zero cannot be in the domain of an inverse variation.

**11. Error Analysis** Describe and correct the error a student made in graphing the function  $y = \frac{5}{x}$ .



**12. Higher Order Thinking** The cost to rent a condominium at the beach is \$1,500 per week. If two people share the cost, they each have to pay \$750. Explain why the relationship between the cost per person varies inversely with the number of persons sharing the cost. Then write an inverse variation function that can be used to calculate the cost per person,  $c$ , of  $p$  persons sharing the rental fee.



**13. Generalize** For an inverse variation, write an equation that gives the value of  $k$  in terms of  $x$  and  $y$ .

## PRACTICE & PROBLEM SOLVING

### PRACTICE

Do the tables of values represent inverse variations? Explain. SEE EXAMPLE 1

14.

$x$	$-\frac{1}{4}$	$-\frac{1}{2}$	$\frac{1}{3}$	2	5	11
$y$	$-\frac{9}{2}$	-9	6	36	90	198

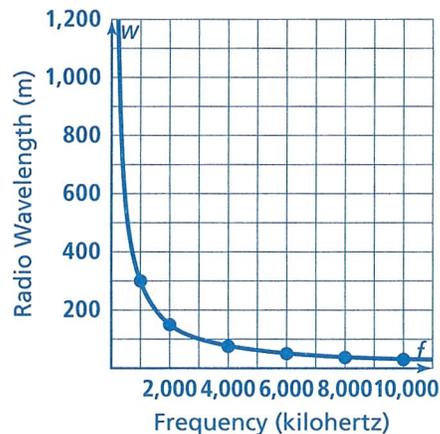
15.

$x$	1	2	3	4	5	6
$y$	60	30	20	15	12	10

16. If  $x$  and  $y$  vary inversely and  $x = 3$  when  $y = \frac{2}{3}$ , what is the value of  $y$  when  $x = -1$ ?

SEE EXAMPLE 2

17. The wavelength,  $w$ , of a radio wave varies inversely to its frequency,  $f$ , as shown in the graph.



A radio wave with a frequency of 1,000 kilohertz has a length of 300 m. What is the frequency when the wave-length is 375 m? SEE EXAMPLE 3

18. Graph the function  $y = \frac{-2}{x}$ . What are the domain, range, and asymptotes of the function? SEE EXAMPLE 4

19. Graph  $g(x) = \frac{1}{x-2} + 6$ . What are the equations of the asymptotes? What are the domain and range? SEE EXAMPLE 5

## PRACTICE & PROBLEM SOLVING

### APPLY

**20. Model With Mathematics** The time  $t$  required to empty a water tank varies inversely as the rate of pumping  $p$ . A pump can empty a water tank in 40 min at the rate of 120 gal/min. Write the equation of the inverse variation. How long it will take the pump to empty the water tank at the rate of 200 gal/min?

**21. Use Structure** The number of downloaded games that can be stored on a video game system varies inversely with the average size of a video game. A certain video game system can store 160 games when the average size of a game is 2.0 gigabytes (GB).

a. Write an inverse equation that relates the number of games  $n$  that will fit on the video game system as a function of the average game size  $s$  in GB.

b. Use the inverse relationship to complete the table of values.

Game Size (GB), $s$	1.0	2.5	3.0	4.0
Number of Games, $n$				

c. Sketch a graph of this inverse relationship on a coordinate plane.

**22. Reason** The voltage  $V$ , in volts, in an electrical circuit varies inversely as the resistance  $R$  in ohms. The voltage in the circuit is 15 volts when the resistance is 192 ohms.

a. Write the equation of the inverse variation.

b. Find the voltage in the circuit when the resistance is 144 ohms.

**23. Boyle's Law** states that the pressure exerted by fixed quantity of a gas,  $P$ , varies inversely with the volume the gas occupies,  $V$ , assuming constant temperature.

The volume and air pressure of a volleyball are 300 in.<sup>3</sup> and 4.5 psi. The volume and air pressure of a basketball are 415 in.<sup>3</sup> and 8 psi. How much smaller would the volleyball have to be to equal the air pressure of the basketball?

**ASSESSMENT PRACTICE**

24. Given that  $\frac{A}{B} = k$ , which of the following is true?
- (A)  $k$  varies inversely with  $A$ .
  - (B)  $k$  varies inversely with  $B$ .
  - (C)  $A$  varies inversely with  $k$ .
  - (D)  $A$  varies inversely with  $B$ .
25. **SAT/ACT** Suppose  $y$  varies inversely as the square of  $x$ . If  $x$  is multiplied by 4, which of the following is true for the value of  $y$ ?
- (A) It is multiplied by 4.
  - (B) It is multiplied by 16.
  - (C) It is multiplied by  $\frac{1}{4}$ .
  - (D) It is multiplied by  $\frac{1}{16}$ .
26. **Performance Task** Suppose Cameron takes a road trip. He starts from his home in the suburbs of Cleveland, OH and travels to Pittsburgh, PA to visit his aunt and uncle.



**Part A** The distance Cameron drives from Cleveland to Pittsburgh is 133 miles. The trip takes him 2 hours. The distance  $d$  in miles that Cameron drives varies directly with the amount of time  $t$  in hours, he spends driving. Write the equation of the direct variation. Use the given relationship and the equation to find the number of miles Cameron would travel if he continues on for 5 more hours.

**Part B** The amount of gas in Cameron’s car is 9 gal after he drives for 2 h. The amount of gas  $g$  in gallons in his tank varies inversely with the amount of time  $t$ , in hours, he spends driving. Write the equation of the inverse variation. Use the given relationship and the equation to find the number of gallons in Cameron’s tank after 5 more hours of driving.