Skills Practice

Name _____ Date _____

Human Growth
Multiple Representations of Relations and Functions

Vocabulary

Discuss the similarities and differences between each set of terms.

1. relation and function

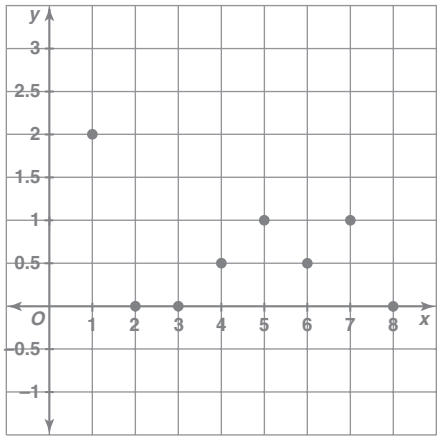
2. domain and range

Problem Set

Create a scatter plot of the relation defined by each table. Then determine if each relation is a function.

1.

Day	Inches of Rain
1	2
2	0
3	0
4	0.5
5	1
6	0.5
7	1
8	0



Yes, the relation is a function.

2.

Day	Average Temperature
1	60
2	64
3	72
4	70
5	72
6	68
7	66
8	62

3.

Day	Average Humidity
1	90%
2	40%
3	50%
4	80%
5	90%
6	80%
7	90%
8	40%

4.

Day	Average Pressure
1	29.5
2	30
3	30.3
4	29.7
5	29.6
6	29.8
7	29.6
8	30.2

Name _____ Date _____

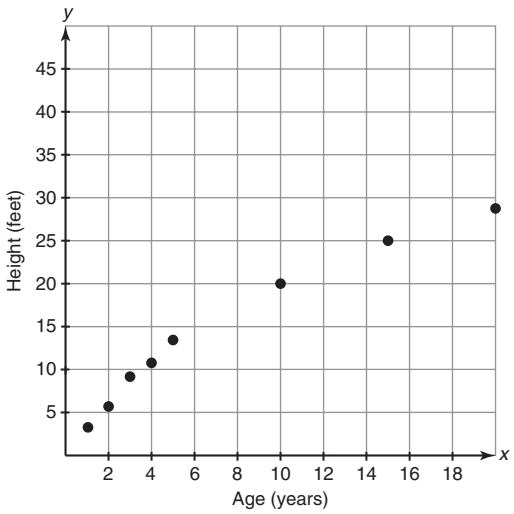
Determine the domain and range of each relation. Then use the scatter plot to make the prediction.

5. The scatter plot shows the relation between the ages of trees in years and their heights in feet. Predict the average height of a tree that is 6 years old.

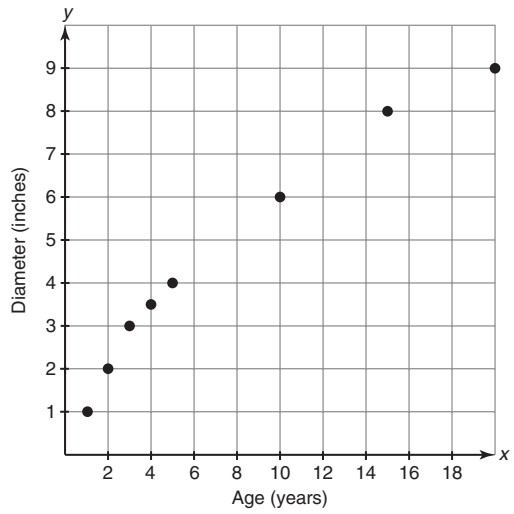
The domain is all ages between 1 year and 20 years.

The range is all heights between 3 feet and 28 feet.

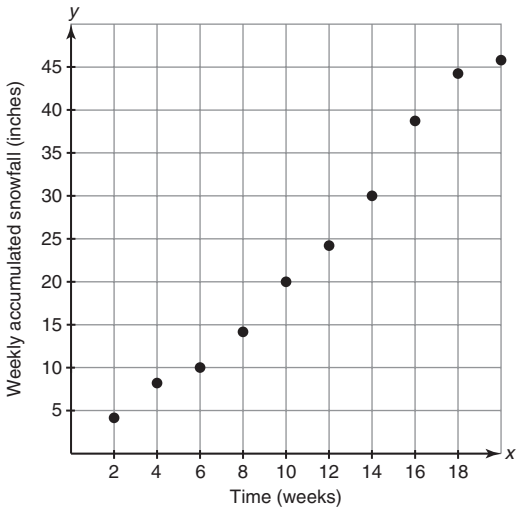
The average height of a tree that is 6 years old is about 17 to 18 feet.



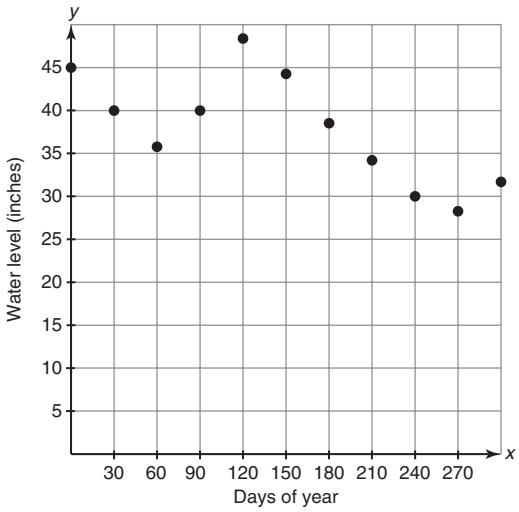
6. The scatter plot shows the relation between the ages of trees in years and the diameters of their trunks in inches. Predict the average diameter of a tree that is 13 years old.



7. The scatter plot shows the weekly accumulated snowfall, in inches, for the 20 weeks of the ski season. Predict the accumulated snowfall after 11 weeks.

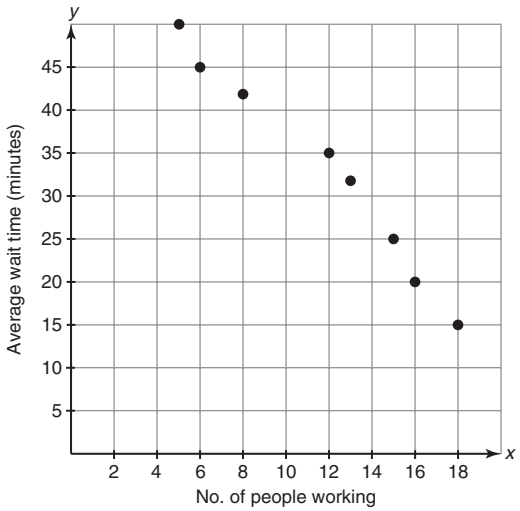


8. The scatter plot shows the water level in a reservoir given a number of days after the beginning of the year. Predict the water level at day 135.

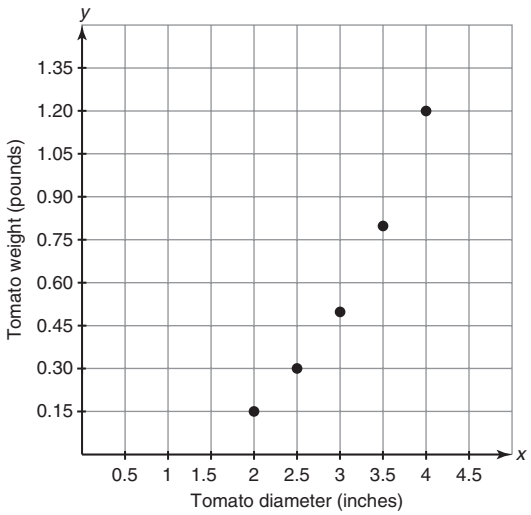


Name _____ Date _____

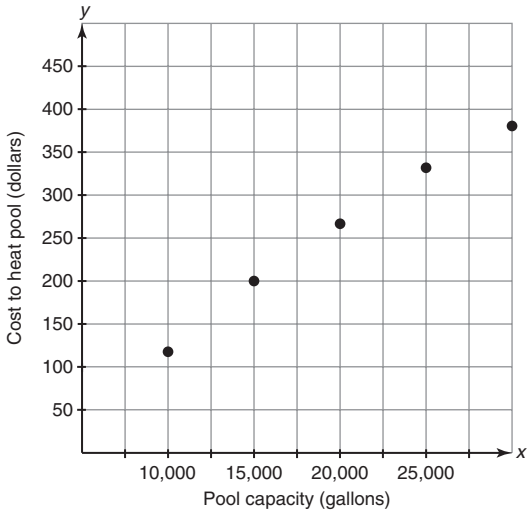
9. The scatter plot shows the relation between the number of people working in a restaurant and the customers' average wait time in minutes for a table. Predict the number of people working in the restaurant if a customer's average wait time for a table is 30 minutes.



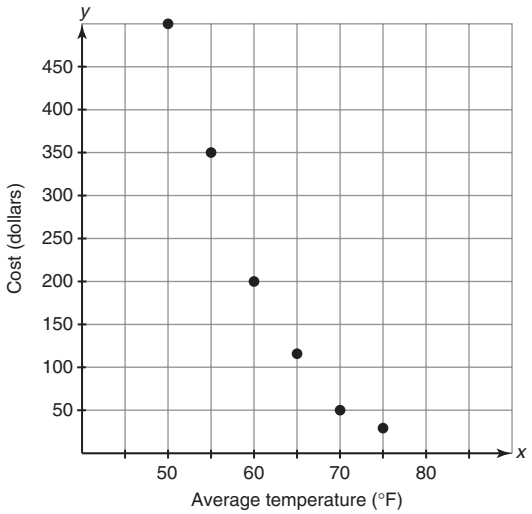
10. The scatter plot shows the relation between the diameter of a tomato in inches and its weight in pounds. Predict the diameter of a 1 pound tomato.



11. The scatter plot shows the cost of heating swimming pools of different sizes in gallons. Predict the size of the pool if it costs $300 to heat it.



12. The scatter plot shows the cost of heating a swimming pool for different values of the average air temperature. Predict the average temperature if the pool costs $300 to heat.



Name _____ Date _____

Write an algebraic equation to model each situation. Define the variables used in the equation.

13. Marissa has just been offered a new job. If she accepts the offer, she will receive a $150 signing bonus, plus a salary of $500 per week.

$y = 500x + 150$, where y represents the amount of money in dollars that Marissa makes in her new job after x weeks

14. To lease a new car, it will cost an initial payment of $2,000 plus $225 per month.

15. Eric has 100 tickets at the beginning of his time at the amusement park. Every time he rides on one of the attractions, it will cost him 5 tickets.

16. Willa is going to knit a sweater. It cost her $10 for the pattern for the sweater, and it costs $6 for each ball of yarn she uses to knit the sweater.

Use the given information to complete each table.

17. Prints 4 U is a printing company that can print a company's name or logo on various office supplies, such as pens, mugs, and mousepads. Your boss would like to order mugs with the company's logo. Prints 4 U charges a one-time printing fee of $45 plus $3.50 per mug ordered. Use this information to complete the table.

Number of Mugs Ordered	Total Cost (dollars)
16	101
25	132.5
40	185
80	325

18. DVDs R Us charges a $20 membership fee and then sells DVDs for $9 each. Use the information to complete the table.

Number of DVDs Ordered	Total Cost (dollars)
15	
25	
50	
100	

19. After spending 5 hours to set up his lathe and other woodworking equipment, it takes Mario 5 minutes to create a wooden candlestick. Use this information to complete the table.

Number of Hours Working	Number of Candlesticks
5	
10	
12	
20	

20. Darren has a $600 credit at the clothing store. Each shirt costs $24. Use this information to complete the table.

Number of Shirts Bought	Remaining Credit (dollars)
5	
10	
20	
25	

Skills Practice

Name _____ Date _____

Down and Up
Linear and Absolute Value Functions

Vocabulary

Match each term with its corresponding definition.

1. linear function	**a.** the unit rate of change of a linear function
2. slope	**b.** the sort of symmetry that exists when a graph has two parts that are mirror images of each other
3. extreme points	**c.** any function that contains an absolute value expression, such as $y = \|x + 1\|$
4. absolute value function	**d.** a function whose graph is a line
5. line symmetry	**e.** in a graph that has line symmetry, this is the line that divides the graph into two mirror images
6. line of symmetry	**f.** the maximum and minimum points of a function

Problem Set

Write a linear function to model each problem situation. Define the variables used in the function.

1. A swimming pool that can hold 20,000 gallons of water is empty. It will be filled continuously at a rate of 1000 gallons per hour until it is full.

   Let t represent the time in hours and let w represent the amount of water in the pool in gallons.

   $w = 1000t$

2. A helium-filled balloon has a volume of 1000 cubic inches. It gradually loses its helium at a rate of 50 cubic inches per hour until all of the helium is gone.

3. An elevator starts at the 30th floor, 300 feet above ground level, and goes down at a rate of 20 feet per second.

4. The temperature of a room is 50 degrees Fahrenheit when a heater is turned on and heats the room at a rate of 5 degrees per hour.

Write an absolute value function to model each problem situation. Define the variables used in the function.

5. A 50-gallon fish tank is emptied at a rate of 10 gallons per hour and then filled back up at the same rate until it is full.

   Let t represent the time in hours and let w represent the amount of water in the fish tank in gallons.

   $w = |50 - 10t|$

Name _____ Date _____

6. An elevator starts at the 40th floor, 400 feet above the ground, and it goes down at a rate of 20 feet per second until it reaches the ground, at which point it heads back up at a rate of 20 feet per second.

7. The temperature in a room is 40 degrees Fahrenheit when a heater is turned on that warms the room at a rate of 4 degrees per hour until the room is 72 degrees. At that point the heater is turned off and the temperature drops at 4 degrees per hour.

8. A swimming pool that holds 30,000 gallons of water begins full and loses water at the rate of 3000 gallons per hour until it is half full, at which point water is added back into the pool at a rate of 3000 gallons per hour.

Identify the constants in each function. Then determine what each constant means in terms of the problem situation.

9. A swimming pool is full and is ready to be drained. The function $y = 18{,}000 - 2000x$ represents the amount of water in gallons in the swimming pool after it has been draining for x hours.

The constants are 18,000 and −2000. The constant 18,000 represents the amount of water in the pool at time $x = 0$ hours, or when the pool is full. The constant −2000 represents the rate at which the pool drains in gallons per hour. The negative sign indicates that the pool is draining.

10. A room is being heated. The function $T = 50 + 5t$ represents the temperature of the room in degrees Fahrenheit after it has been heated for t hours.

11. A hot-air balloon is being filled. The function $V = 500t$ represents the volume in cubic feet of hot air in the balloon after t minutes of being filled.

1

12. A plane is descending for a landing. The function $A = 10{,}000 - 800t$ represents the altitude of the plane in feet after it has been descending for t minutes.

Use the given information to complete each table.

13. A silo holds 50,000 bushels of grain. When the silo is full, a conveyer is turned on, and the grain is emptied out of the silo by the conveyor at a rate of 750 bushels per hour.

Time (hours)	Amount of Grain Left in Silo (bushels)
0	50,000
5	46,250
24	32,000
36	23,000
60	5,000
66	500

14. A stadium is at its full capacity of 60,000 people. At the end of the game, the crowd exits the stadium at a rate of 2400 people per minute.

Time (minutes)	Number of People
0	
2	
5	
8	
15	
25	

Name _____ Date _____

15. A plane flying at 10,000 feet begins to ascend at a rate of 400 feet per minute until it reaches 30,000 feet.

Time (minutes)	Altitude (feet)
0	
10	
15	
25	
40	
50	

16. James has $500 in his savings account, and he decides to deposit $25 each week into the account.

Time (weeks)	Balance (dollars)
0	
3	
8	
15	
25	
50	

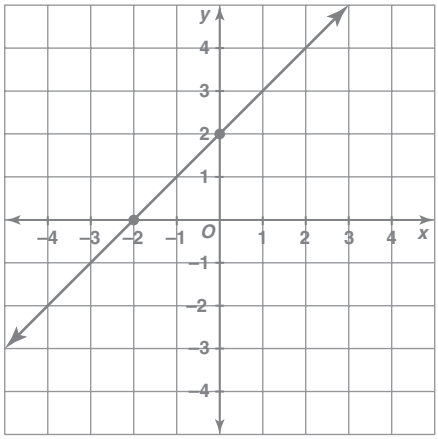
Graph each function. Determine the domain, range, and extrema of each function.

17. $y = x + 2$

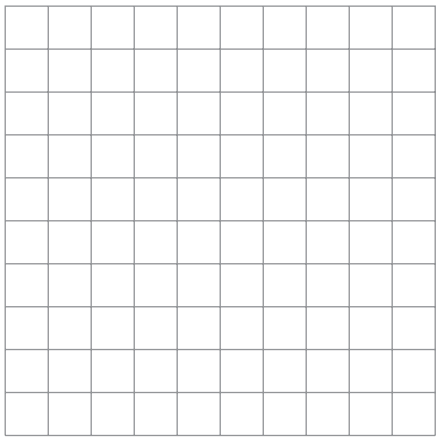
Domain: all real numbers

Range: all real numbers

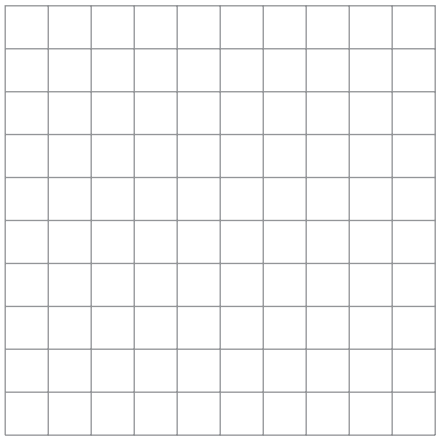
Extrema: none



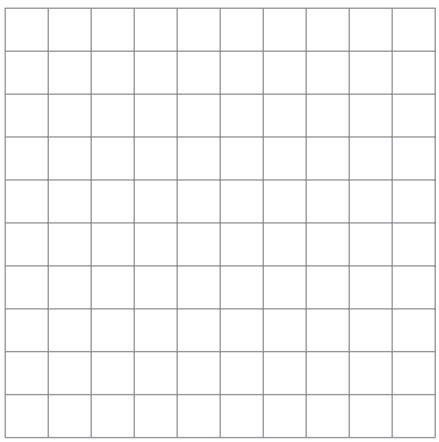
18. $y = 2x - 1$



19. $y = -x + 3$

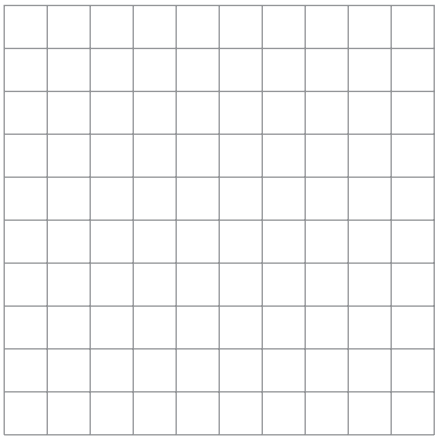


20. $y = -\frac{1}{2}x + 2$

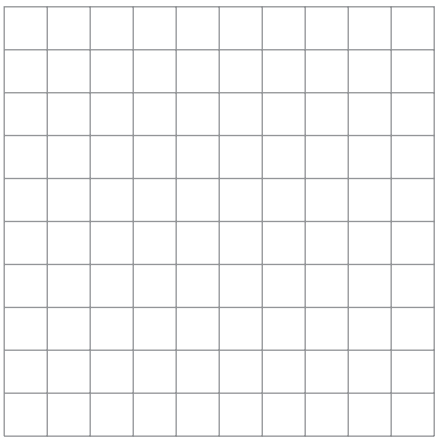


Name _____ Date _____

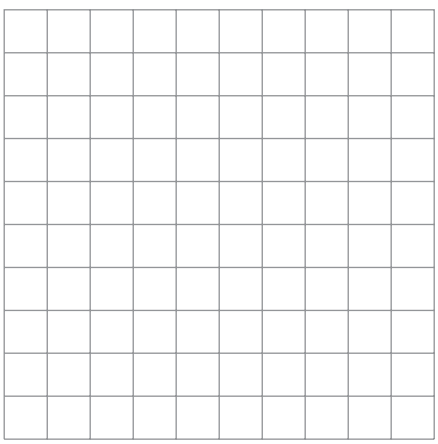
21. $y = |x + 2|$



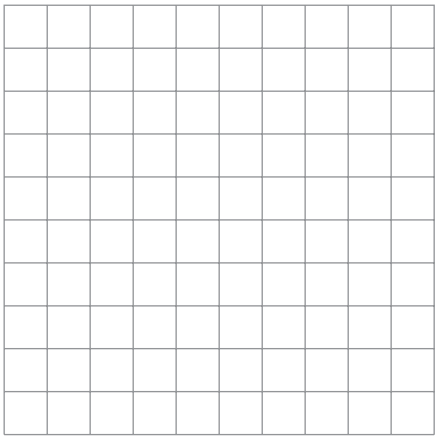
22. $y = |2x - 1|$



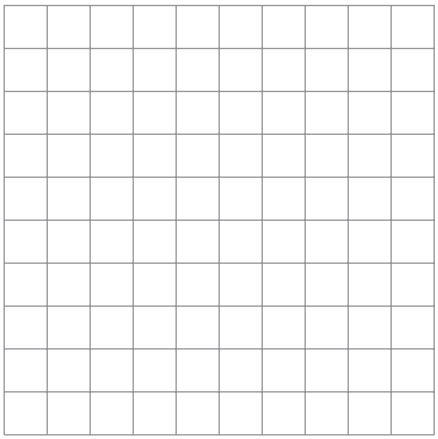
23. $y = |-x + 3|$



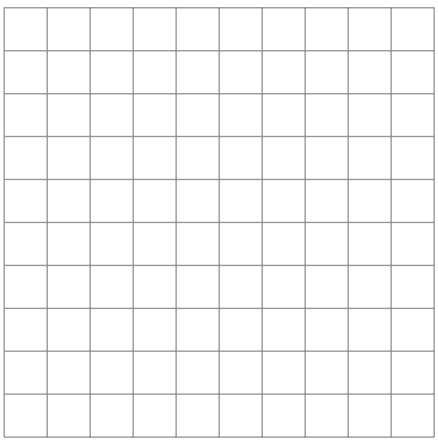
24. $y = \left|-\frac{1}{2}x + 2\right|$



25. $y = 2 + |5x|$



26. $y = 1 - |x + 3|$



Skills Practice

Name _____ Date_____

Let's Take a Little Trip with Me! Every Graph Tells a Story

Vocabulary

Define each term in your own words.

1. interval of increase

2. interval of decrease

3. vertical motion

4. quadratic function

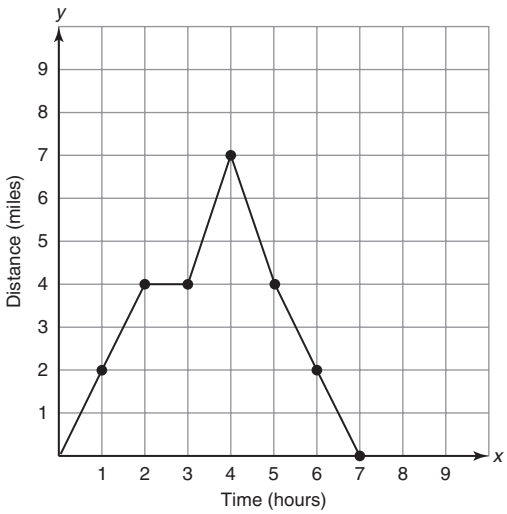
Problem Set

Each graph represents the distance in miles a person is from home versus the amount of time in hours they have traveled. Describe the function in words, being sure to include the domain and range and how the distance changed from hour to hour.

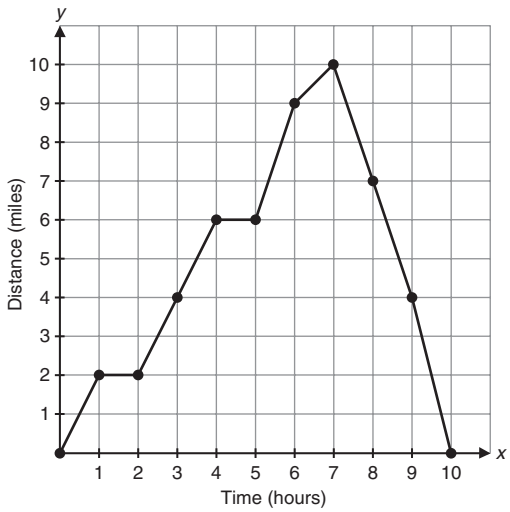
1

1. John sets out for a walk along the beach early in the morning and returns seven hours later.

The domain is (0, 7), which means that the trip lasted for 7 hours. The range is (0, 7), which means that John traveled 7 miles down the beach. John traveled 2 miles in his first hour and 2 more miles in his second hour, then rested for an hour, and traveled 3 miles during the next hour. Then he turned back, traveling 3 miles in the first hour, 2 miles in the next, and 2 miles in the next, which brought him back to his starting point.

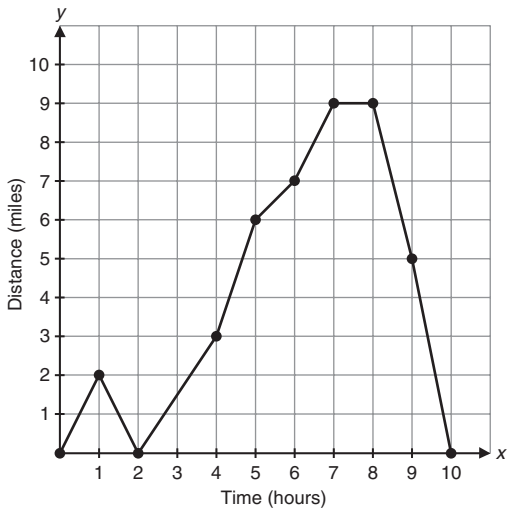


2. Peyton takes her dog for a long walk on Saturday, stopping at different places along the way.

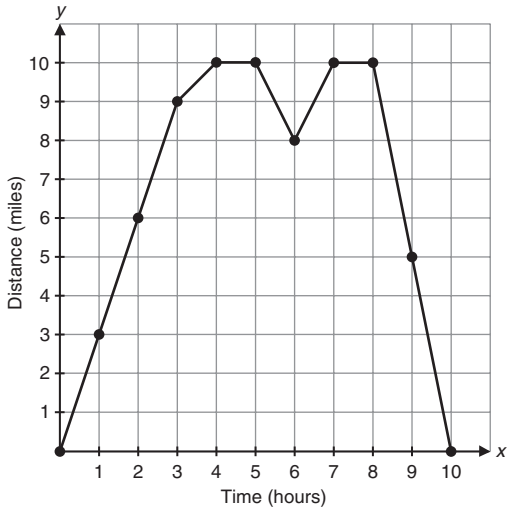


Name _____ Date _____

3. Tonya decides to walk to her friend Alexandra's house, which is 9 miles away, stay awhile, and come back home.

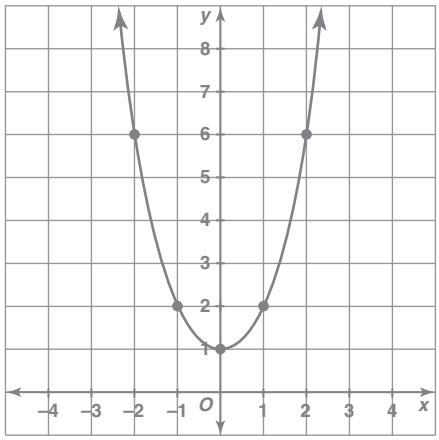


4. Tim decides to walk to his friend Ryan's house, which is 10 miles away, spend some time there, and come back home.

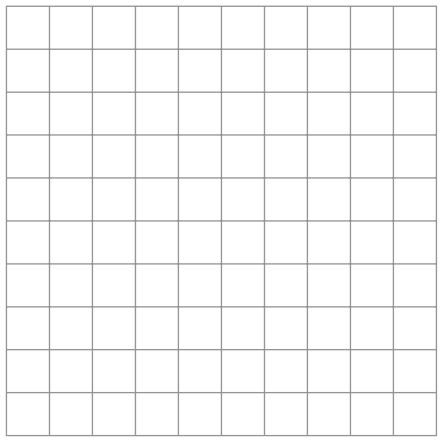


Sketch the graph of each function.

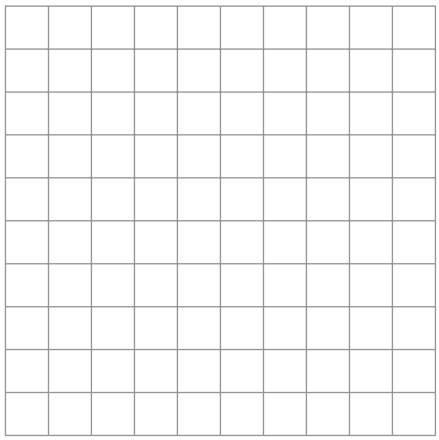
5. $y = x^2 + 1$



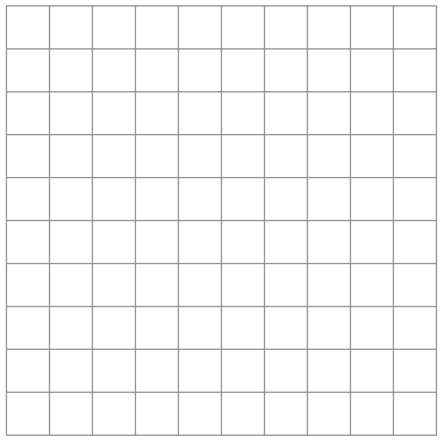
6. $y = x^2 - 1$



7. $y = 2x^2$



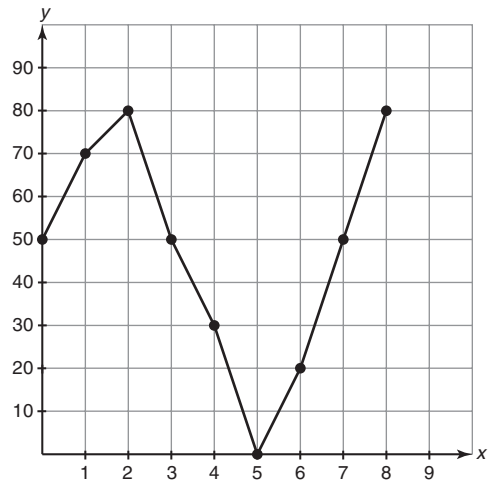
8. $y = -3x^2$



Name _____ Date _____

Determine the intervals of decrease and increase for each function.

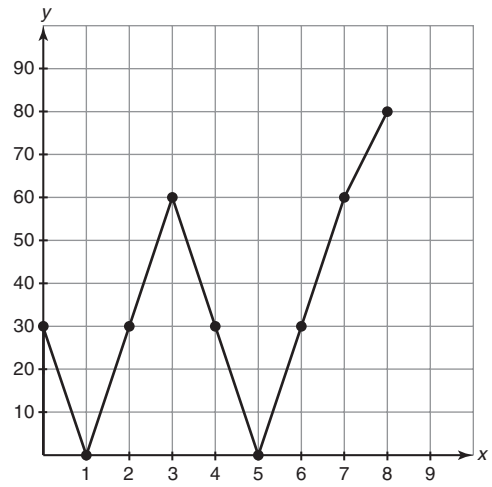
9.



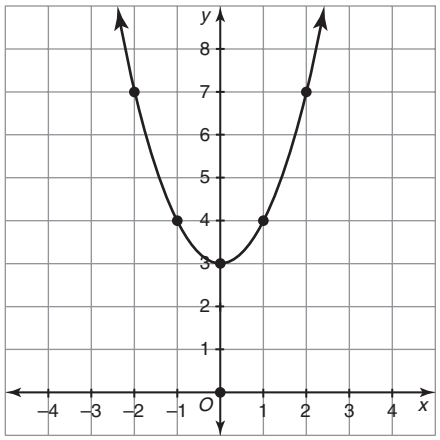
Interval of decrease: (2, 5)

Intervals of increase: (0, 2), (5, 8)

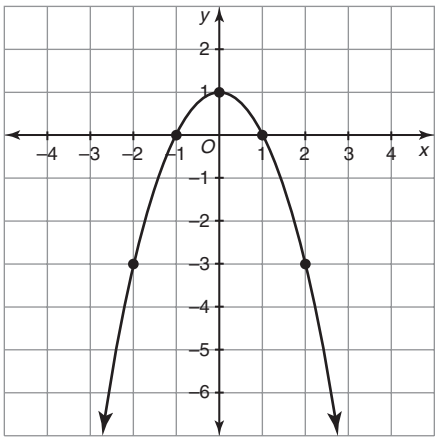
10.



11. $y = x^2 + 3$

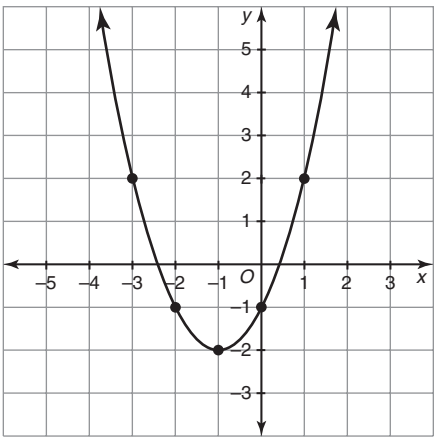


12. $y = -x^2 + 1$



Determine the domain and range of each function shown in the graph.

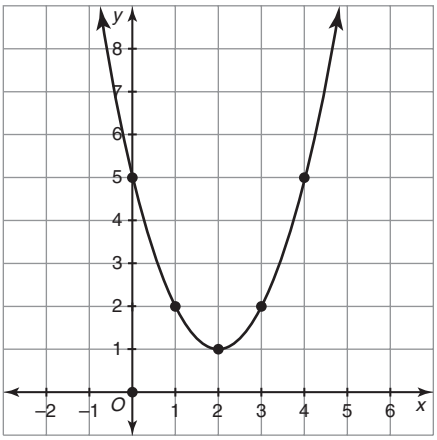
13. $y = x^2 + 2x - 1$



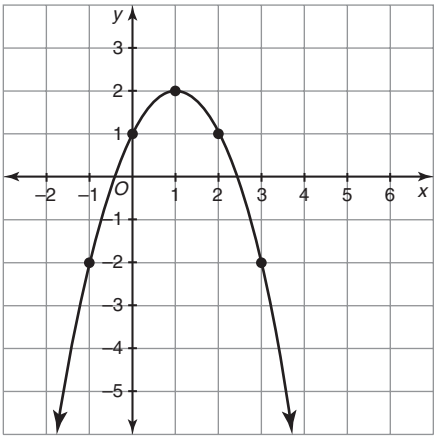
Domain: all real numbers

Range: all real numbers greater than or equal to −2

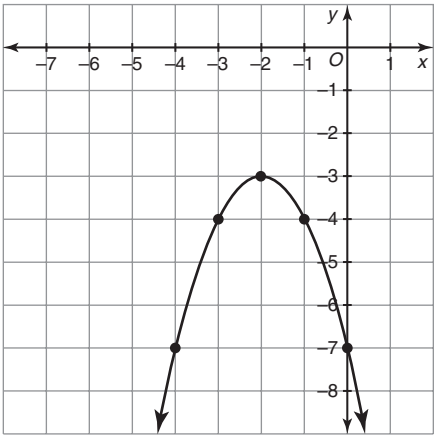
14. $y = x^2 - 4x + 5$



15. $y = -x^2 + 2x + 1$



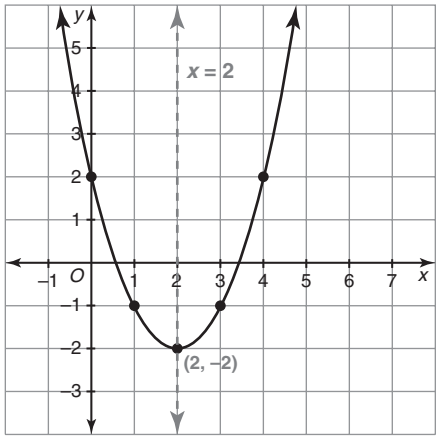
16. $y = -x^2 - 4x - 7$



Name _____ Date _____

Determine the extreme point and the line of symmetry of each function shown in the graph.

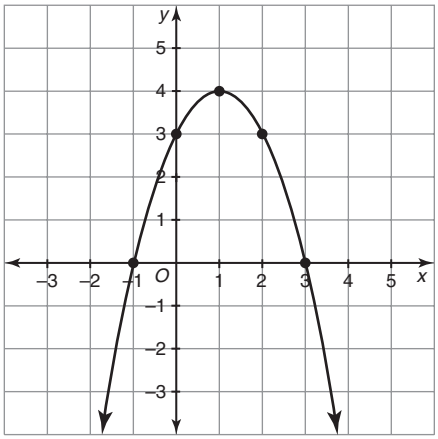
17. $y = x^2 - 4x + 2$



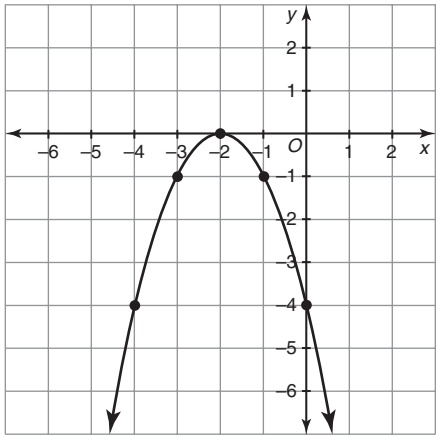
Minimum at (2, −2)

Line of symmetry: $x = 2$

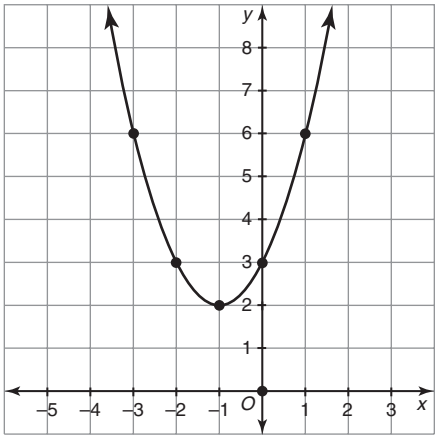
18. $y = -x^2 + 2x + 3$



19. $y = -x^2 - 4x - 4$



20. $y = x^2 + 2x + 3$



1

Skills Practice

Name _____ Date _____

Building a Better Box
Cubic and Indirect Variation Functions

Vocabulary

Provide two examples of each term.

1. cubic function

2. indirect variation function

Problem Set

Use the given information to complete each table with the appropriate measurements.

1. You are building a rectangular wading pool in your yard. You have enough materials so that the length and width of the pool, when added together, will total 20 feet. You want the depth of the pool to be half of the width of the pool. Complete the table for possible widths, lengths, depths, and volumes for the wading pool.

Width (feet)	Length (feet)	Depth (feet)	Volume (cubic feet)
0	20	0	0
2	18	1	36
6	14	3	252
10	10	5	500
16	4	8	512
18	2	9	324
20	0	10	0

2. You are building a rectangular tool shed. You have decided that the perimeter of the tool shed will be 24 feet and that the tool shed will be twice as tall as it is wide. Complete the table for possible widths, lengths, depths, and volumes for the tool shed.

Width (feet)	Length (feet)	Height (feet)	Volume (cubic feet)
0			
3			
5			
6			
9			
10			
12			

3. You are designing a shipping crate. The perimeter must be 16 feet, and the crate must be one and a half times as tall as it is wide. Complete the table for possible widths, lengths, depths, and volumes for the shipping crate.

Width (feet)	Length (feet)	Height (feet)	Volume (cubic feet)
0			
1			
2			
4			
5			
6			
8			

4. You are building a warehouse. The length and width should add up to 100 feet, and the height should be equal to half the width. Complete the table for possible widths, lengths, depths, and volumes for the warehouse.

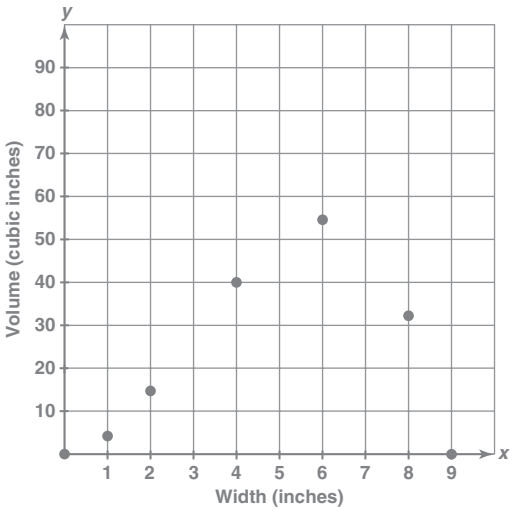
Width (feet)	Length (feet)	Height (feet)	Volume (cubic feet)
0			
10			
20			
50			
60			
80			
100			

Name _____ Date _____

Use the given table to create a scatter plot for the relation between the width and volume.

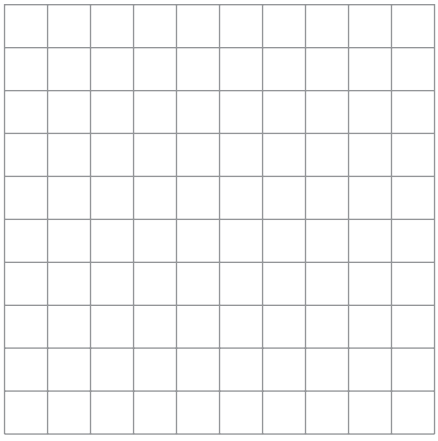
5. You are building a small box in the shape of a rectangular prism to hold your jewelry. You have decided that the perimeter of the base of the box will be 18 inches and that the box will be half as tall as it is wide. The table below includes some possible dimensions for the box.

Width (inches)	Length (inches)	Height (inches)	Volume (cubic inches)
0	9	0	0
1	8	0.5	4
2	7	1	14
4	5	2	40
6	3	3	54
8	1	4	32
9	0	4.5	0



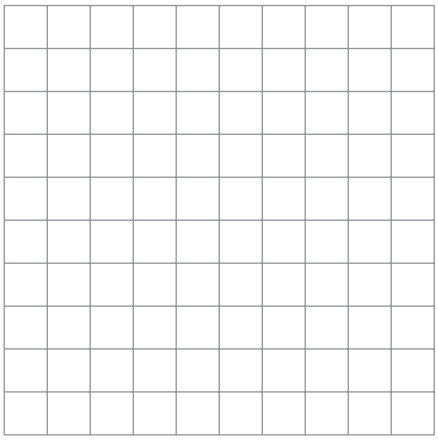
6. You are designing a large chest in the shape of a rectangular prism to store your tools. The perimeter of the base must be 20 feet, and the chest must be as tall as it is wide. The table below includes some possible dimensions for the chest.

Width (feet)	Length (feet)	Height (feet)	Volume (cubic feet)
0	10	0	0
2	8	2	32
4	6	4	96
6	4	6	144
8	2	8	128
10	0	10	0



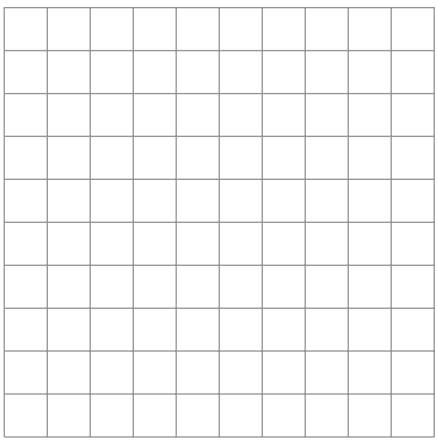
7. You are constructing a small building in the shape of a rectangular prism to house a manufacturing assembly line. The sum of the length and width should be 120 feet, and the height should be 1.2 times the width. The table below includes some possible dimensions for the building.

Width (feet)	Length (feet)	Height (feet)	Volume (cubic feet)
0	120	0	0
20	100	24	48,000
35	85	42	124,950
50	70	60	210,000
80	40	96	307,200
100	20	120	240,000
120	0	144	0



8. You are building a holding pond in the shape of a rectangular prism to hold runoff water after a storm. You have enough materials so that the length and width of the pond, when added together, will total 360 feet. You want the depth of the pond to be two-thirds the width of the pond. The table below includes some possible dimensions for the holding pond.

Width (feet)	Length (feet)	Depth (feet)	Volume (cubic feet)
0	360	0	0
30	330	20	198,000
90	270	60	1,458,000
150	210	100	3,150,000
240	120	160	4,608,000
300	60	200	3,600,000
360	0	240	0



Name _____ Date _____

Use the given information to complete each table with the appropriate measurements.

9. A floor installer has 300 square feet of hardwood flooring. Complete the table with the possible lengths of a rectangular room that can be completely filled with 300 square feet of hardwood flooring.

Width (feet)	Length (feet)	Width (feet)	Length (feet)
1	300	20	15
2	150	30	10
3	100	50	6
5	60	60	5
6	50	100	3
10	30	150	2
15	20	300	1

10. A wallpaper installer has 180 square feet of wallpaper to put on one rectangular wall. Complete the table with the possible widths of a rectangular wall that can be completely filled with 180 square feet of wallpaper.

Height (feet)	Width (feet)	Height (feet)	Width (feet)
1		10	
2		12	
3		15	
4		18	
5		20	
6		30	
9		60	

11. A rancher needs 480 square feet of grass to graze a single sheep. Complete the table with the possible lengths of a rectangular field that is 480 square feet.

Width (feet)	Length (feet)	Width (feet)	Length (feet)
1		16	
4		20	
6		30	
8		40	
10		60	
12		80	
15		480	

12. A gallon of paint will cover 360 square feet. Complete the table with the possible lengths of a rectangular wall that can be completely covered with a gallon of paint, assuming one coat of paint is used.

Height (feet)	Length (feet)	Height (feet)	Length (feet)
1		10	
2		12	
3		15	
4		18	
5		30	
6		60	
9		360	

Use the given information to write an equation that models the situation.

13. A box's height is two inches more than its width, and its length is two inches more than its height. Write an equation describing the box's volume in terms of its width.

$V = w(w + 2)(w + 4)$

$= w^3 + 6w^2 + 8w$

14. A swimming pool's width is two feet more than half its length, and its depth is half its width. Write an equation describing the pool's volume in terms of its length.

15. A gardener has 500 square feet of sod that he wishes to set out in a rectangular area. Write an equation to represent the width of the rectangle that can be covered by 500 square feet of sod.

Name _____ Date _____

16. A gallon of stain covers 300 square feet of a rectangular wooden fence. What is the length of fence that can be painted with a gallon of stain in terms of its height?

17. The perimeter of a rectangular swimming pool is 80 feet, and its depth is one-half its width. What is an equation that describes the swimming pool's volume in terms of its width?

18. A cardboard box has a width and a length that add up to 36 inches, and its height is twice its width. What is an equation that describes the box's volume in terms of its width?

19. Charlie likes to pace in a rectangular pattern. If each of his paces is two feet long, and he takes 100 steps to pace out an entire rectangle, write an equation for the area of the rectangle that he paces in terms of the length of one of the sides.

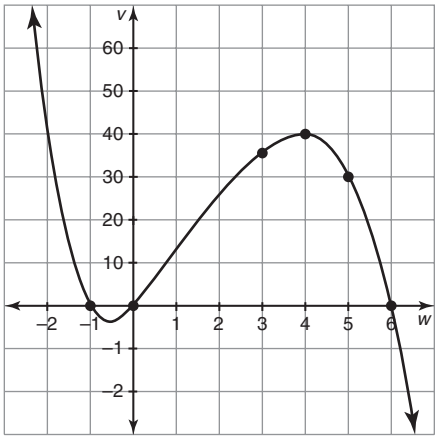
20. Marcia is fencing off her rectangular garden. She has 80 feet of fencing. What is an equation for the area of the garden in terms of the length of one of the sides?

1

Use the given information and the graph to answer the question.

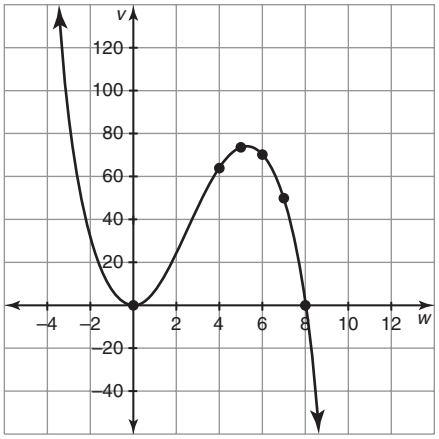
21. A rectangular water trough for horses is to be built such that the width and length add up to 6 feet and the depth is to be 1 foot more than the width. The volume of the trough is given by the formula $V = -w^3 + 5w^2 + 6w$, where w represents the width of the trough, and the graph of the function is given below. What is the largest approximate volume of the horse trough?

Because only positive numbers make sense for the length, we consider only the numbers between 0 and 6, and it looks as though the function has a maximum of about 40, somewhere around $w = 4$. So the maximum volume is around 40 cubic feet.

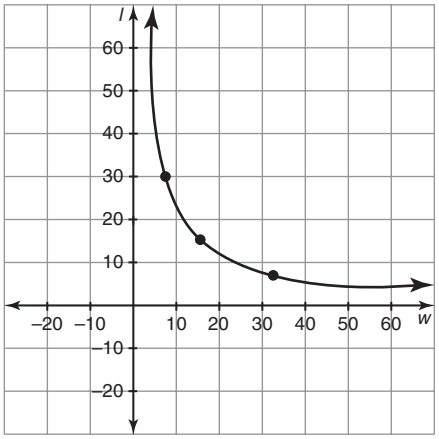


Name _____ Date _____

22. Jack is building a wooden chest to store his clothes. The sum of the width and length of the chest total 8 feet, while its height is the same as its width. The volume of the chest is given by the formula $V = -w^3 + 8w^2$, where w represents the width of the chest, and the graph of the function is given below. What is the largest approximate volume of the chest?



23. Suzanne has 256 square feet of flooring that she will put down in a rectangular pattern with a width w. The length of the room that can be covered with that much flooring is given by $l = \frac{256}{w}$, and the graph of the function is given below. Looking at the graph, what can you say about the maximum length of the room covered with the flooring?



24. Federico is mapping out a garden area. It will have 400 square feet with a width of w and a length given by the formula $l = \frac{400}{w}$. The graph of the function is given below. Looking at the graph, what can you say about what happens to the length of the garden as the width gets larger?