Name_____ Class_____ Date_____

2-1

video tutor

Ordered Pairs

Going Deeper

Essential question: *How do you determine whether an ordered pair is a solution of an equation?*

An **ordered pair** (x, y) can be used to write a solution for a two-variable equation such as $y = 10x - 15$. The *order* in an *ordered* pair is important.

(3, 15)

x-value y-value

PREP FOR CC.8.EE.8

1 EXAMPLE **Identifying an Ordered Pair as a Solution**

A group of students is washing cars to raise money. They spend $15 on soap and charge $10 for each car x. The equation for the profit y is $y = 10x - 15$.

A Determine whether each ordered pair is a solution of $y = 10x - 15$. Complete the following by substituting the correct values for each variable.

(5, 35)	(20, 195)	(50, 485)
$y = 10x - 15$	$y = 10x - 15$	$y = 10x - 15$
$35 \stackrel{?}{=} 10(5) - 15$	$195 \stackrel{?}{=} 10(\quad) - 15$	$\quad \stackrel{?}{=} 10(\quad) - 15$
$35 \stackrel{?}{=} 50 - 15$	$195 \stackrel{?}{=} \quad - 15$	$\quad \stackrel{?}{=} \quad - 15$
$35 = 35$	$195 \neq$	

Circle the correct answer.

(5, 35) is / is not a solution of $y = 10x - 15$.

(20, 195) is / is not a solution of $y = 10x - 15$.

(50, 485) is / is not a solution of $y = 10x - 15$.

B What does the ordered pair (50, 485) mean in this situation?

_____

_____

The ordered pair (x, y) represents (number of _____, _____ in $).

TRY THIS!

Determine whether each ordered pair is a solution of $y = 10x - 15$.

1a. (5, 25) **1b.** (10, 75) **1c.** (25, 235)

_____ _____ _____

REFLECT

1d. Error Analysis A student claims that the ordered pair (10, 5) is a solution of the equation $y = 21 - 2x$. Do you agree or disagree? Why?

PRACTICE

Complete each table of solutions.

1. The temperature y in Albany, NY, is 6°F colder than the temperature x in New York City. This situation is represented by the equation $y = x - 6$.

x	$x - 6$	y	(x, y)
56			
48			
44			
41			

Is (60, 54) a solution to $y = x - 6$? What does the ordered pair represent in this situation?

2. Nate scored x number of 2-point baskets and y number of 1-point free throws. He scored 18 points in all. This situation is represented by the equation $y = 18 - 2x$.

x	$18 - 2x$	y	(x, y)
3			
4			
5			
10			

Is (10, –2) a solution to $y = 18 - 2x$? What does the ordered pair represent in this situation and does it make sense?

3. Nina bought a frozen yogurt for $1.40. She paid with x quarters and y dimes. Write an equation that represents the situation. Then find all ordered pair solutions that make sense for the problem.

4. Create an equation that has (3, 5) as a solution. Then give a possible scenario for your equation.

Name _____ Class _____ Date _____

2-3

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Interpreting Graphs

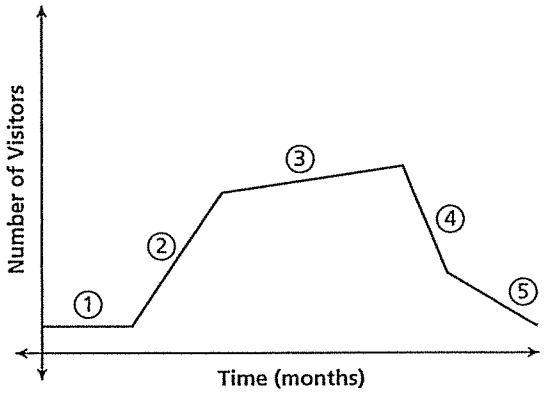
Going Deeper

Essential question: *How can you describe a relationship given a graph and sketch a graph given a description?*

CC.8.F.5

1 EXPLORE Interpreting Graphs

A roller coaster park is open from May to October each year. The graph shows the number of park visitors over its season.



A Segment 1 shows that attendance during the opening days of the park's season stayed constant. Describe what Segment 2 shows.

_____

_____

B Based on the time frame, give a possible explanation for the change in attendance represented by Segment 2.

_____

_____

C Which segments of the graph show decreasing attendance? Give a possible explanation.

_____

_____

REFLECT

1. Explain how the slant of each segment of the graph is related to whether attendance increases or decreases.

_____

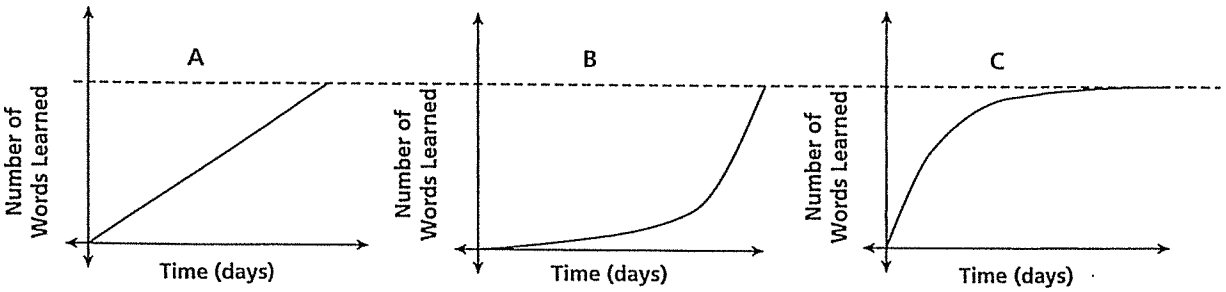
_____

2 EXPLORE Matching Graphs to Situations

Grace, Jet, and Mike are studying 100 words for a spelling bee.

- **Grace started by learning many words each day, but then learned fewer and fewer words each day.**
- **Jet learned the same number of words each day.**
- **Mike started by learning only a few words each day, but then learned a greater number of words each day.**

Match each student's study progress with the correct graph.



_____ _____ _____

A Describe the progress represented by Graph A.

_____

_____

_____

B Describe the progress represented by Graph B.

_____

_____

_____

C Describe the progress represented by Graph C.

_____

_____

_____

D Determine which graph represents each student's study progress and write the students' names under the appropriate graphs.

REFLECT

2. What would it mean if one of the graphs slanted downward from left to right?

_____

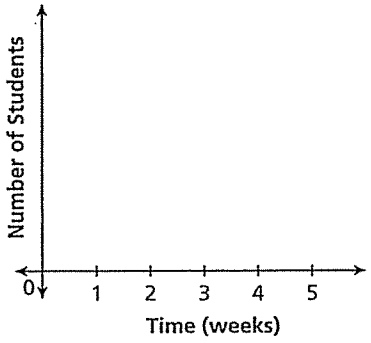
_____

CC.8.F.5

3 EXPLORE Sketching a Graph for a Situation

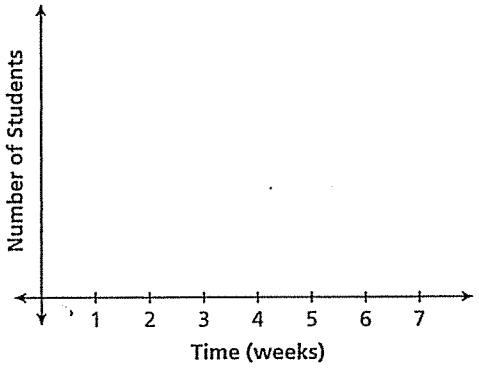
Mrs. Sutton provides free math tutoring to her students every day after school. No one comes to tutoring sessions during the first week of school. Over the next two weeks, use of the tutoring service gradually increases.

A Sketch a graph showing the number of students who use the tutoring service over the first three weeks of school.



B Mrs. Sutton's students are told that they will have a math test at the end of the fifth week of school. How do you think this will affect the number of students who come to tutoring?

C Considering your answer to B, sketch a graph showing the number of students who might use the tutoring service over the first six weeks of school.



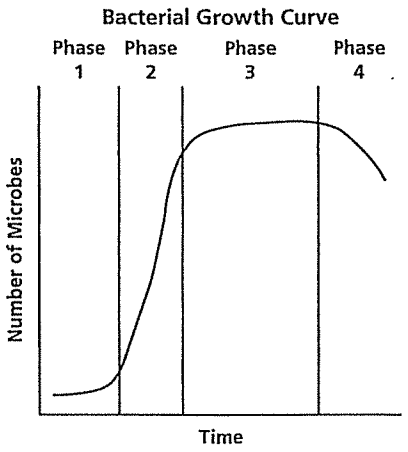
REFLECT

3a. Suppose Mrs. Sutton offered bonus credit to students who came to tutoring sessions. How do you think this would affect the number of students who come to tutoring?

3b. How would your answer to **3a** affect the graph?

PRACTICE

In a lab environment, colonies of bacteria follow a predictable pattern of growth. The graph shows this growth over time.

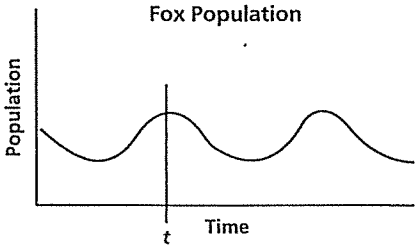


1. During which phase is growth slowest? During which phase is growth fastest? Explain.

2. What is happening to the population during Phase 3?

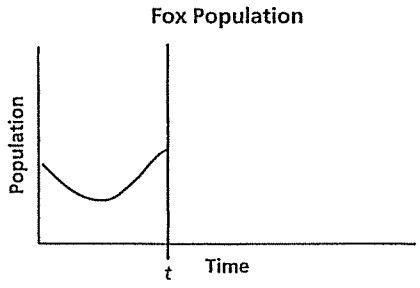
3. What is happening to the population during Phase 4?

A woodland area on an island contains a population of foxes. The graph describes the changes in the fox population over time.



4. What is happening to the fox population before time *t*?

5. At time *t*, a conservation organization moves a large group of foxes to the island. Sketch a graph to show how this action might affect the population on the island after time *t*.



6. At some point after time *t*, a forest fire destroys part of the woodland area on the island. Describe how your graph from problem 5 might change.

Name _____ Class _____ Date _____

2-4

Functions

Going Deeper

Essential question: *How do you represent a function with a table or graph?*

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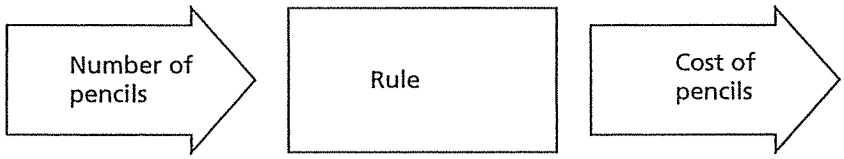
CC.8.F.1

1 EXPLORE **Understanding Relationships**

Carlos needs to buy some new pencils from the school supply cabinet at school. Carlos asks his classmates if they know how much pencils cost. Angela says she bought 2 pencils for $0.50. Paige bought 3 pencils for $0.75, and Spencer bought 4 pencils for $1.00.

Carlos thinks about the rule for the price of a pencil as a machine. When he puts the number of pencils he wants to buy into the machine, the machine applies a rule and tells him the total cost of that number of pencils.



i.	2	?	
ii.	3	?	
iii.	4	?	
iv.	x		
v.	12		

A Use the prices in the problem to fill in rows **i–iii** of the table.

B Describe any patterns you see. Use your pattern to determine the cost of 1 pencil.

_____

_____

C Use the pattern you identified to write the rule applied by the machine. Write the rule as an algebraic expression and fill in row **iv** of the table.

D Carlos wants to buy 12 pencils. Use your rule to fill in row **v** of the table to show how much Carlos will pay for 12 pencils.

TRY THIS!

There are 6 pencil-top erasers in 2 packages of erasers. There are 9 erasers in 3 packages.

1a. Write a rule in words for the number of packages Carlos needs to buy to get x erasers. Then write the rule as an algebraic expression.

_____

1b. How many packages does Carlos need to buy to get 18 erasers?

_____

REFLECT

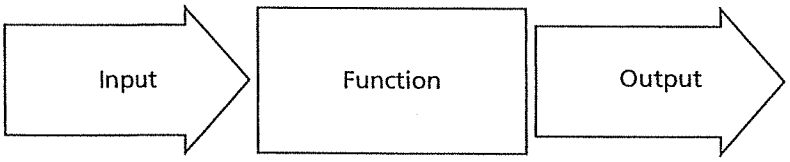
1c. How can you decide what operation to use in your rule?

_____

_____

_____

The rules in 1 are functions, and the machines are function machines. The value that is put into a function machine is the **input**. The result after applying the function machine's rule is the **output**. A **function** is a rule that assigns exactly one output to each input.



A table of values can represent a function if each input value is paired with only one output value.

CC.8.F.1

2 EXAMPLE **Recognizing Functions**

Tell whether each relationship is a function.

A

Input	Output
15	70
60	88
75	95
45	80

Each input has only one _____.

This relationship _____ a function.

B

Input	Output
14	60
13	55
14	57
15	52

The input _____ has more than one output.

This relationship _____ a function.

The input values (x) and output values (y) of a function can be displayed in a table or written as ordered pairs (x, y). These ordered pairs can be graphed in the coordinate plane to show a graph of the function.

Some function rules can be written as equations such as $y = 2x$. By substituting values for x, you can generate corresponding y-values. The ordered pairs (x, y) are solutions of the equation.

CC.8.F.4

3 EXAMPLE **Graphing a Function**

Graph the function $y = 2x + 3$.

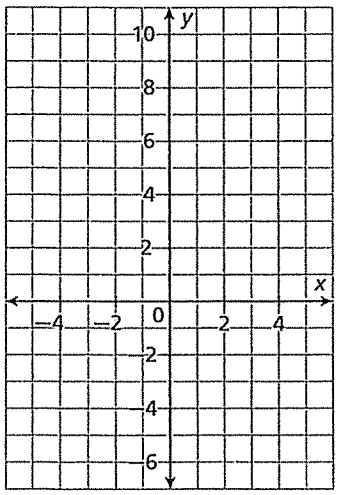
Create a table of values.

x	$2x + 3$	y
-4	$2(-4) + 3$	
-1	$2(\quad) + 3$	
0		
2		
3		

Write ordered pairs.

(x, y)
$(-4,\quad)$
$(-1,\quad)$
$(0,\quad)$
$(\quad,\quad)$
$(\quad,\quad)$

Graph the ordered pairs.



Draw a line through the points to represent all the possible x-values and their corresponding y-values.

PRACTICE

Fill in each table. In the row with x as the input, write a rule as an algebraic expression for the output. Then complete the last row of the table using the rule.

1.

Input	Output
Tickets	Cost ($)
2	40
5	100
7	140
8	160
x	
10	

2.

Input	Output
Minutes	Pages Read
2	1
10	5
20	10
30	15
x	
60	

3.

Input	Output
Muffins	Cost ($)
1	2.25
3	6.75
6	13.50
12	27.00
x	
18	

Tell whether each relationship is a function.

4.

Input	6	7	8	7	9
Output	75	80	87	88	95

_____

5.

Input	1	2	3	4	5
Output	4	8	12	16	20

_____

6. (1, 3), (2, 5), (3, 0), (4, −1), (5, 5)

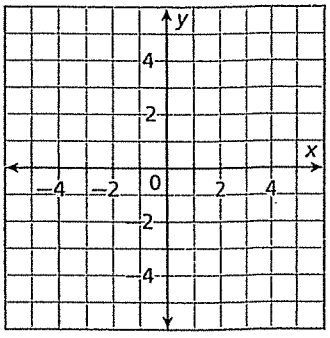
_____

7. (2, 7), (6, 4), (0, 3), (2, 6), (1, 5)

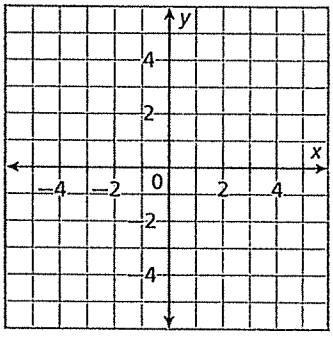
_____

Graph each function on the coordinate plane.

8. $y = -2x$



9. $y = x - 3$



Name _____ Class _____ Date _____

2-5

Equations, Tables, and Graphs

Going Deeper

Essential question: *How can you use equations, tables, and graphs to represent relationships between two variables?*

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CC.8.F.4

1 EXAMPLE **Generating Different Representations of Data**

Lisa and Leon work after school at their uncle's store. The table shows the hours Lisa worked *x* and the hours Leon worked *y* each week for a month.

Lisa, *x*	3	4	6	8
Leon, *y*	5	6	8	10

A Write an equation from the data in the table.

Compare each output value with its corresponding input value.

Lisa, *x*	3	4	6	8	← input values
Leon, *y*	5	6	8	10	← output values

$5 - 3 =$ $6 - \quad =$ $\quad - \quad =$ $\quad - \quad =$

For each hour Lisa worked, Leon worked _____ more hours.

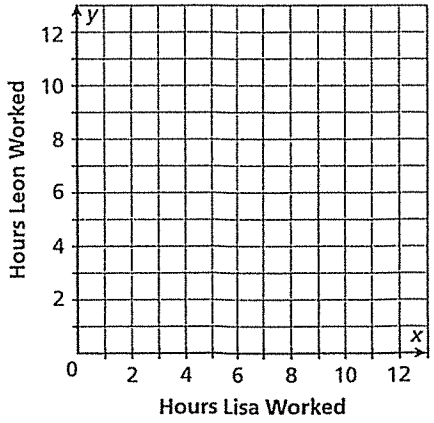
The equation is Leon = Lisa + .

$y =$ $+$

B Make a graph of the data.

Write the input and output values as ordered pairs.

x	*y*	(*x*, *y*)
3	5	(3, 5)
4	6	(4,)
6	8	(,)
8	10	(,)



Then plot the ordered pairs and connect the points with a line.

TRY THIS!

1a. Write an equation from the data in the table. Then write the input and output values as ordered pairs.

x	0	1	2	3
y	0	3	6	9
(*x*, *y*)				

_____

REFLECT

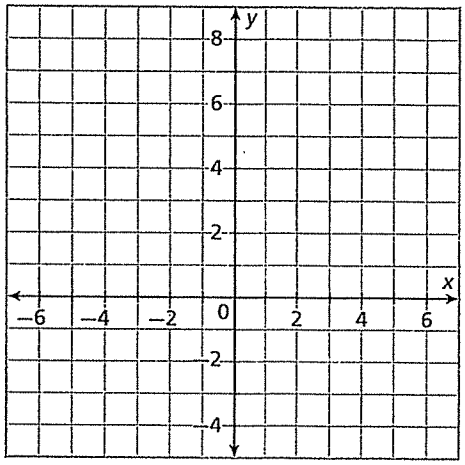
1b. How can you use the graph to predict the number of hours Leon will work when Lisa works 10 hours?

PRACTICE

Complete each table to write an equation. Use the same grid to graph each equation.

1.

x	0	1	3	5
y	4	5	7	9
(x, y)				

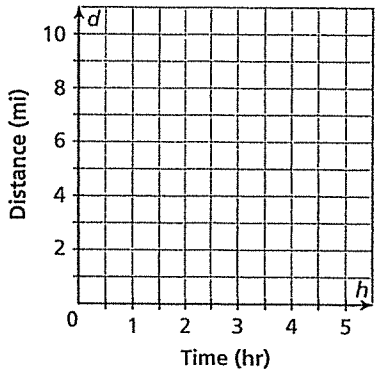


2.

x	0	−1	−2	−3
y	0	2	4	6
(x, y)				

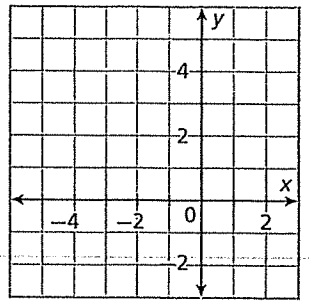
3. Lupe is walking in a walkathon. The distance she walks is represented by the equation $d = 1.5h$, where h is the number of hours she walks and 1.5 is how many miles she walks in an hour. Make a table and sketch a graph of the data.

h	0	2	4	6
d				
(h, d)				



4. **Conjecture** Why did you not graph the equation $d = 1.5h$ in Quadrant IV?

5. Over 5 days, the temperatures in Chicago, in °F, were 0, −2, −3, −1, and 2. On those same days, the temperatures in Detroit were three degrees warmer. Write an equation and sketch a graph of the data.



Name _____ Class _____ Date _____

2-1

Additional Practice

Determine whether each ordered pair is a solution of $y = 4 + 2x$.

1. (1, 1) _____
2. (2, 8) _____
3. (0, 4) _____
4. (8, 2) _____

Determine whether each ordered pair is a solution of $y = 3x - 2$.

5. (1, 1) _____
6. (3, 7) _____
7. (5, 15) _____
8. (6, 16) _____

Use the given values to complete the table of solutions.

9. $y = x + 5$ for $x = 0, 1, 2, 3, 4$

x	$x + 5$	y	(x, y)
0			
1			
2			
3			
4			

10. $y = 3x + 1$ for $x = 1, 2, 3, 4, 5$

x	$3x + 1$	y	(x, y)
1			
2			
3			
4			
5			

11. $y = 2x + 6$ for $x = 0, 1, 2, 3, 4$

x	$2x + 6$	y	(x, y)
0			
1			
2			
3			
4			

12. $y = 4x - 2$ for $x = 2, 4, 6, 8, 10$

x	$4x - 2$	y	(x, y)
2			
4			
6			
8			
10			

13. Alexis opened a savings account with a $120 deposit. Each week she will put $20 into the account. The equation that gives the total amount t in her account is $t = 120 + 20w$, where w is the number of weeks since she opened the account. How much money will Alexis have in her savings account after 5 weeks?

_____

Problem Solving

Use the table at the right for Exercises 1–2.

1. Write the ordered pair that shows the average miles per gallon in 1990.

_____

2. The data can be approximated by the equation $m = 0.30887x - 595$ where m is the average miles per gallon and x is the year. Use the equation to find an ordered pair (x, m) that shows the estimated miles per gallon in the year 2020.

_____

Average Miles per Gallon

Year	Miles per Gallon
1970	13.5
1980	15.9
1990	20.2
1995	21.1
1996	21.2
1997	21.5

For Exercises 3–4 use the equation $F = 1.8C + 32$, which relates Fahrenheit temperatures F to Celsius temperatures C.

3. Write ordered pair (C, F) that shows the Celsius equivalent of 86 °F.

_____

4. Write ordered pair (C, F) that shows the Fahrenheit equivalent of 22 °C.

_____

Choose the letter for the best answer.

5. A taxi charges a $2.50 flat fee plus $0.30 per mile. Use an equation for taxi fare t in terms of miles m. Which ordered pair (m, t) shows the taxi fare for a 23-mile cab ride?

   A (23, 6.90) C (23, 9.40)

   B (23, 18.50) D (23, 64.40)

6. The perimeter p of a square is four times the length of a side s, or $p = 4s$. Which ordered pair (s, p) shows the perimeter for a square that has sides that are 5 in.?

   F (5, 1.25) H (5, 9)

   G (5, 20) J (5, 25)

7. Maria pays a monthly fee of $3.95 plus $0.10 per minute for long-distance calls. Use an equation for the phone bill p in terms of the number of minutes m. Which ordered pair (m, p) shows the phone bill for 120 minutes?

   A (120, 15.95) C (120, 28.30)

   B (120, 474.10) D (120, 486.00)

8. Tickets to a baseball game cost $12 each, plus $2 each for transportation. Use an equation for the cost c of going to the game in terms of the number of people p. Which ordered pair (p, c) shows the cost for 6 people?

   F (6, 74) H (6, 84)

   G (6, 96) J (6, 102)

Name _____ Class _____ Date _____

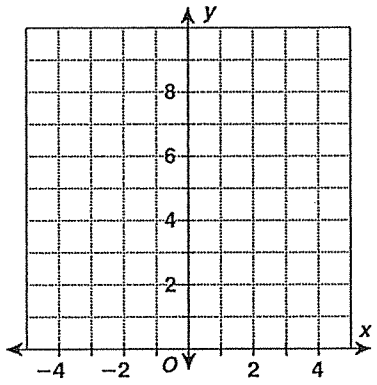
2-4

Additional Practice

Complete the table and graph each function.

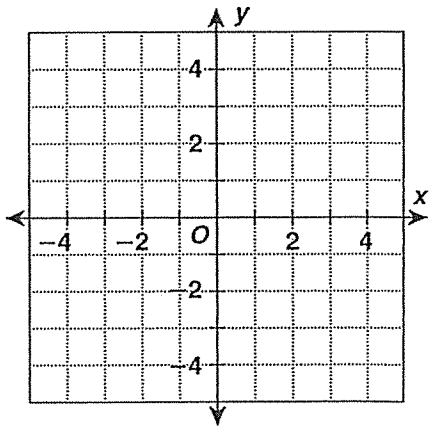
1. $y = -2x + 5$

x	$-2x + 5$	y
–2		
–1		
0		
1		
2		



2. $y = x - 2$

x	$x - 2$	y
–2		
–1		
0		
1		
2		



Determine if each relation represents a function.

3. (–2, 1), (–1, 2), (0, 3), (1, 4)

_____

4.

x	1	2	1	2
y	6	5	–6	–5

_____

5.

x	y
0	0
1	–1
2	–8
3	–27
4	–64

_____

6. (7, –1), (9, –7), (7, 0), (12, –1), (15, 0)

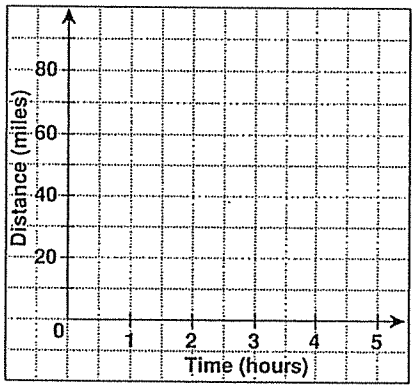
_____

Problem Solving

A cyclist rides at an average speed of 20 miles per hour. The equation $y = 20x$ shows the distance, y, the cyclist travels in x hours.

1. Make a table for the equation and graph the equation at the right.

x	$20x$	y
0		
1		
2		
3		



2. Is the relationship between the time and the distance the cyclist rides a function?

_____

3. If the cyclist continues to ride at the same rate, about how far will the cyclist ride in 4 hours?

_____

4. About how far does the cyclist ride in 1.5 hours?

_____

5. If the cyclist has ridden 50 miles, about how long has the cyclist been riding?

_____

The cost of renting a jet-ski at a lake is represented by the equation $f(x) = 25x + 100$ where x is the number of hours and $f(x)$ is the cost including an hourly rate and a deposit. Choose the letter for the best answer.

6. How much does it cost to rent the jet-ski for 5 hours?

   A $125

   B $225

   C $385

   D $525

7. If the cost to rent the jet-ski is $300, for how many hours is the jet-ski rented?

   F 6 hours

   G 8 hours

   H 12 hours

   J 16 hours

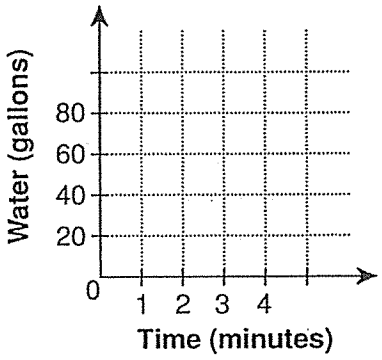
Name _____ Class _____ Date _____

2-5

Additional Practice

1. The amount of water in a tank being filled is represented by the equation $g = 20m$, where g is the number of gallons in the tank after m minutes. Complete the table and sketch a graph of the equation.

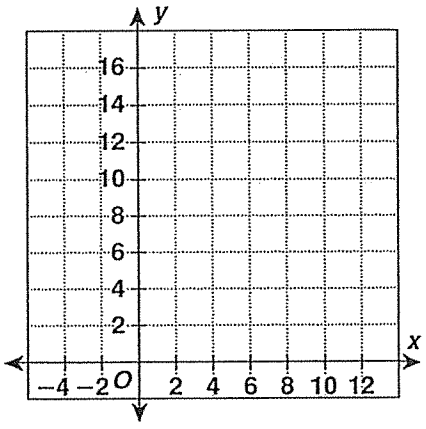
m	$20m$	g
0		
1		
2		
3		
4		



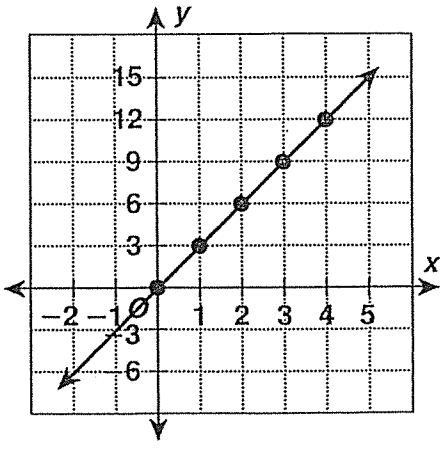
2. Use the table to make a graph and to write an equation.

x	0	2	5	8	12
y	4	6	9	12	16

_____



3. Use the graph to make a table and to write an equation.



x					
y					

_____

Problem Solving

Use the graph to answer Exercises 1–4. An aquarium tank is being drained. The graph shows the number of gallons of water, *q*, in the tank after *m* minutes. Write the correct answer.

1. How many gallons of water are in the tank before it is drained?

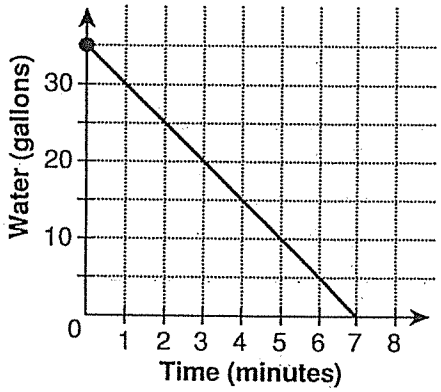
   _____

2. How many gallons of water are left in the tank after 2 minutes?

   _____

3. How long does it take until there are 10 gallons of water left in the tank?

   _____



4. How long does it take to drain the tank?

   _____

Use the graph to answer Exercises 5–7. The graph shows the distance, *d*, a hiker can hike in *h* hours. Choose the letter of the best answer.

5. How far can the hiker hike in 4 hours?

   A $1\frac{1}{3}$ mi C 8 mi

   B 4 mi D 12 mi

6. How long does it take the hiker to hike 6 miles?

   F $2h$ H $4h$

   G $3h$ J $18h$

7. Which equation represents the graph?

   A $d = 3h$ C $d = h + 3$

   B $d = \frac{1}{3}h$ D $d = h - 3$