Chapter 18

Name _____

Graphs and Patterns

Show What You Know

Plotting Points on a Number Line

1. Plot 4 on the horizontal number line.

2. Plot 7 on the horizontal number line.

3. Plot 1 on the vertical number line.

4. Plot 8 on the vertical number line.

Extend Patterns

Find the missing numbers. Then write a description for each pattern.

5. 0, 5, 10, 15, _____, _____, _____
   description: _____

6. 70, 60, 50, 40, _____, _____, _____
   description: _____

7. 12, 18, 24, 30, _____, _____, _____
   description: _____

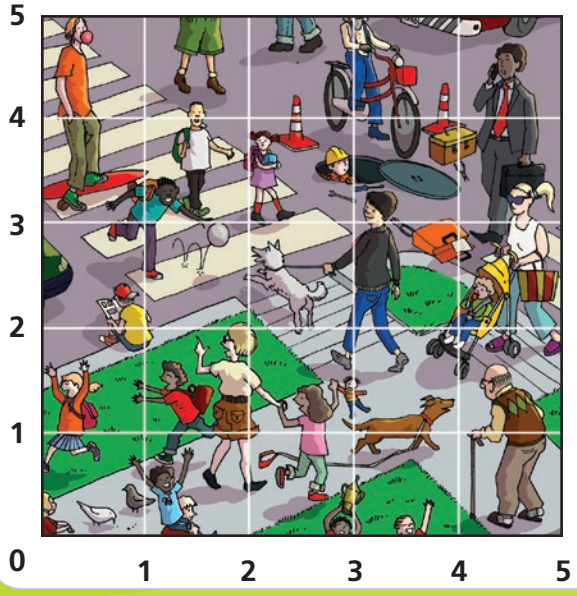
8. 150, 200, 250, 300, _____, _____, _____
   description: _____

9. 200, 180, 160, 140, _____, _____, _____
   description: _____

MATH in the Real World

Graph and connect the map coordinates to locate the secret documents in the lost briefcase.

(3, 3), (4, 2), (4, 4), (5, 3)

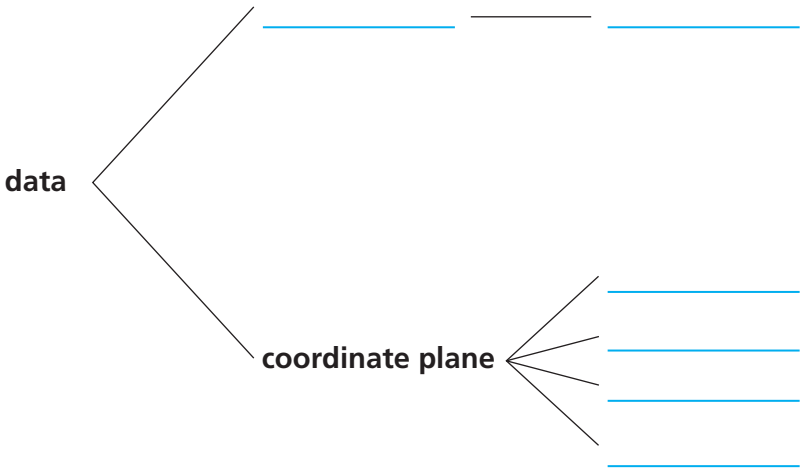


Vocabulary Builder

Go Online For more help

Visualize It

Use the checked words to complete the tree map.



Connect to Vocabulary

Review Words
- data
- ✓ pattern
- ✓ rule

Preview Words
- ✓ ordered pair
- ✓ origin
- ✓ *x*-axis
- *x*-coordinate
- ✓ *y*-axis
- *y*-coordinate

Understand Vocabulary

Complete the sentences using the review words and preview words.

1. A _____ is an ordered set of numbers or objects.
2. The pair of numbers used to locate points on a plane is an _____.
3. The point, (0, 0), also called the _____, is where the *x*-axis and the *y*-axis intersect.
4. On a coordinate plane, the horizontal number line is the _____, and the vertical number line is the _____.
5. The first number in an ordered pair is the _____, and the second number in an ordered pair is the _____.

Name _____

Record Inputs and Outputs in a Two-Column Table

I Can generate a number pattern.

CONNECT A pattern is an ordered set of numbers. You can use a rule or an equation to describe a pattern. When an equation describes the pattern, find the value of the unknowns to make a table or write the pattern.

UNLOCK the Problem Real World

Luisa is making flan. For every egg, she can make three flans. The rule $f = 3e$ describes the relationship between the number of flans f and the number of eggs e. How many flans can Luisa make if she uses 5 eggs?

You can use an input/output table or a list to show a pattern. When a pattern is shown in a table, it shows the relationship between the inputs and outputs. When a pattern is shown in a list, it only shows the outputs in order.

Complete the input/output table. Replace e in the equation $f = 3e$ with the value shown in the table to find the value of the output f.

Input	Eggs	e	1	2	3	4	5
Output	Flans	f					

The pattern for the number of flans is 3, 6, _____, _____, _____.

The fifth number in the pattern is _____.

So, Luisa can make _____ flans.

Math Talk

MP Look for and make use of structure.

Explain how you can use the pattern to find how many flans can be made using 9 eggs.

- What if Luisa changed her recipe to make 4 flans with every egg? How would the pattern change?

_____

_____

_____

Example Find the pattern.

The rule for the number of circles in a figure is $c = f + 2$ where c is the number of circles and f is the figure number. How many circles will be in Figure 8?

Figure 1

Figure 2

Figure 3

Complete the input/output table.

Input	Figures	f	1	2	3	4	5	6	7	8
Output	Circles	c								

The pattern for the number of circles

is 3, 4, _____, _____, _____, _____, _____, _____.

The eighth number in the pattern is _____.

So, there are _____ circles in Figure 8.

Share and Show

Use the rule to complete the table.

1. Rule: $g = 2n + 6$.

Input	Output
n	g
1	
2	
3	
4	

2. Rule: $p = r \times 12$.

Input	r	2	4	6	8
Output	p				

Name _____

On Your Own

Use the rule to make an input/output table. Include four input/output pairs in your table.

3. For input x and output y, the rule is $y = x + 4$.

4. For input s and output a, the rule is $a = 11s$.

5. For input u and output v, the rule is $v = 7u$.

6. For input m and output n, the rule is $n = m \times 10$.

7. Explain how you can use the formula for the perimeter of a square, $P = 4s$, to generate a pattern. Use the pattern to find the perimeter of a square with sides that are 5 cm long.

8. Bao makes origami paper cranes for a mobile. He can make 5 cranes with each sheet of paper. Complete the input/output table to show the number of cranes Bao can make with 6 sheets of paper.

Input	Sheets	s	1	2	3	4	5	6
Output	Cranes	c						

9. Max decides to make paper owls. He can make 4 paper owls from each sheet of paper. Complete and use the input/output table to find how many sheets of paper Max would use to make 24 paper owls.

MATH on the Spot

Input	Sheets	s						
Output	Owls	o						

Problem Solving · Applications

Fill in the bubble completely to show your answer.

10. Matilda is reading a map of the route to her grandfather's house in another state. The equation $m = 25i$ describes the relationship between i, the number of inches on the map, and m, the number of actual miles. How many miles are represented by 12 inches?

Ⓐ 200 miles Ⓒ 400 miles

Ⓑ 600 miles Ⓓ 300 miles

11. To find the total cost of a field trip, use the equation $c = 4s$, where s is the number of students and c is the cost of the field trip. How much will it cost for 14 students to attend the field trip?

Number of students (s)	3	6	9	12
Cost of field trip in dollars (c)	12	24	36	48

Ⓐ $15 Ⓒ $56

Ⓑ $17 Ⓓ $60

12. Robin places 3 roses and 2 daffodils in each vase. How many flowers will she need if she has 6 vases?

Ⓐ 30

Ⓑ 12

Ⓒ 18

Ⓓ 5

13. Sergei uses the pattern rule $y = 4 + b$ to generate the first three outputs in the pattern. Which of the following is the fifth output in the pattern?

Input	b	1	2	3	4	5
Output	y	5	6	7		

Ⓐ 5 Ⓒ 8

Ⓑ 9 Ⓓ 10

Name _____

Record Inputs and Outputs in a Two-Column Table

Use the rule to make an input/output table.
Include four input/output pairs in your table.

1. **Rule:** The output is $a + 5$.

2. **Rule:** The output is $3c$.

3. **Rule:** The output is $d \times 6$.

4. **Rule:** The output is $10 + b$.

5. **Rule:** The output is $8e$.

6. **Rule:** The output is $12f$.

7. **Rule:** The output is $8 + 2g$.

8. **Rule:** The output is $k \times 2$.

Problem Solving

9. Suki uses toothpicks to build a number of separate shapes for her math project. She uses 1 toothpick for each side of a shape. Complete the input/output table to show how many toothpicks Suki needs to make 6 hexagons.

Input	Hexagons	*h*	1	2	3	4	5	6
Output	Toothpicks	*t*						

Lesson Check

Fill in the bubble completely to show your answer.

10. If c is cups of sugar and b is number of batches of cookies, which rule matches the information in the table?

Input	Batches	b	2	3	4
Output	Cups	c	4	6	8

Ⓐ The output is $b \times 2$.

Ⓑ The output is $c \times 2$.

Ⓒ The output is $b + 2$.

Ⓓ The output is $c + 2$.

11. Tia hangs chili-shaped party lights in her back yard. The rule $c = 14f$ gives the number of chili lights c there are for each foot f of wire. How many lights are on 8 feet of wire?

Ⓐ 126

Ⓑ 112

Ⓒ 98

Ⓓ 96

12. Harlan uses the pattern rule $l = d + 2$ to represent the number of laps she swims each day for a week. Which is the number of laps she swims on the sixth day?

Input	Day	d	1	2	3
Output	Laps	l	3	4	5

Ⓐ 6

Ⓑ 7

Ⓒ 8

Ⓓ 9

13. Gage uses the equation $e = 25b$ to determine how much he earns for selling hand-carved bowls at the craft fair. If b represents the number of bowls sold and e represents his earnings, how much will Erik earn if he sells 9 bowls?

Number of bowls	1	2	3
Earnings	$25	$50	$75

Ⓐ $225

Ⓑ $100

Ⓒ $150

Ⓓ $45

Spiral Review

14. Multiply.

8.65×2.7

15. Subtract.

$13\frac{2}{8} - 6\frac{7}{8}$.

Name _____

Write a Rule for Number Patterns in Tables

I Can write a rule to describe a pattern.

UNLOCK the Problem

When the output in a pattern depends on the input, you can write a rule to describe the relationship between inputs and outputs.

Ellery wants to buy light-up balls for a party. They cost $1 each. The store charges the same shipping fee regardless of how many light-up balls are ordered. So, Ellery has to pay for the light-up balls and pay a shipping fee. The table below shows the cost c for w light-up balls. How much will Ellery pay for 12 light-up balls?

Write a rule to describe the pattern in the table.

Input	w	2	4	6	8
Output	c	4	6	8	10

STEP 1 Describe the relationship between the number of light-up balls and the cost.

Think: Input ↓ Output ↓

$2 + 2 = 4$ 2 light-up balls + 2 = cost

$4 + 2 = 6$ 4 light-up balls + 2 = cost

$6 + 2 = 8$ 6 light-up balls + 2 = cost

$8 + 2 = 10$ 8 light-up balls + 2 = cost

Math Talk

MP **Construct arguments and critique reasoning of others.**

Explain how you can find the cost for 5 light-up balls.

The output is _____ more than the input.

STEP 2 Decide what operation to use to write a rule.

$c =$ _____ $+$ _____ **Think:** Add 2 to the input to get the output. Since the pattern is additive, use addition to write a rule.

STEP 3 Use the rule to find the cost of 12 light-up balls.

$c = w + 2$

$c =$ _____ $+ 2$ Replace w with the number of light-up balls.

$c =$ _____ Add to find the cost.

So, the 12 light-up balls cost $ _____.

Example Find the rule.

Patterns can also involve multiplication.

The output is _____ times the input. The pattern is multiplicative.

The rule is $y =$ _____ $\times$ _____.

Think:

$1 \times$ _____ $= 7$

$2 \times$ _____ $= 14$

$3 \times$ _____ $= 21$

$4 \times$ _____ $= 28$

Input	Output
n	*y*
1	7
2	14
3	21
4	28

Share and Show

Math Board

1. Use a rule to describe the pattern in the table.

Input	*s*	1	2	3	4
Output	*t*	9	18	27	36

Multiply by _____.

Rule: _____

Decide if the pattern shown in the table is additive or multiplicative. Write a rule to describe the pattern.

2.

Input	Output
a	*c*
2	5
4	7
6	9
8	11

The pattern is _____.

Rule: _____

3.

Input	*r*	1	2	3	4
Output	*p*	13	26	39	52

The pattern is _____.

Rule: _____

Name _____

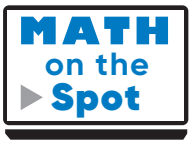
4. **Write Math** Explain how you can find a rule for a pattern in a table.

5. Explain whether the formula for the area of a rectangle can be used to show an additive pattern or a multiplicative pattern.

On Your Own

6. To make soup, Juan adds 3 cups of hot water to each package of dried soup. Write a rule for the pattern. Make a table to determine how many cups of hot water are needed for 18 packages of dried soup.

7. Liam and Nora are playing a spelling game. The number of points for each word a player spells correctly is the sum of the number of letters in the word and 3 bonus points for spelling correctly. The table below shows the scoring system. Find the rule and the number of points for spelling an eight-letter word correctly.



Input	Letters	l	3	4	5	6
Output	Points	p	6	7	8	9

8. Kirk is building a storage cabinet. To be sure of having enough wood, he allows an extra 2 inches on measurements. Write a rule for the pattern. Determine the number of inches Kirk would measure if he wanted an 11-inch board.

Problem Solving · Applications

Fill in the bubble completely to show your answer.
Use the table for 9–10.

Number of volcanoes	2	3	4	5
Flour (c)	12	18	24	30
Salt (c)	4	6	8	10
Cooking oil (tbsp)	8	12	16	20

9. Using the recipe shown in the table, how many cups of flour will you need to make 13 model volcanoes?

Ⓐ 30 cups
Ⓒ 78 cups
Ⓑ 48 cups
Ⓓ 54 cups

10. If v is the number of volcanoes and s is the number of cups of salt, which of the following rules describes the pattern in the table?

Ⓐ $v = s + 2$
Ⓒ $s = v + 2$
Ⓑ $s = v \times 2$
Ⓓ $v = s \times 2$

11. The table shows the shipping boxes received by Snazzy Stuff clothing store. Suppose that the store pays $8 for a shirt. How much money does the store pay for 10 boxes of shirts?

Input	Number of boxes	1	2	3	12
Output	Shirts	12	24	36	144

Ⓐ $120
Ⓒ $960
Ⓑ $96
Ⓓ $192

12. Which of the following rules describes the pattern in the table?

Input	b	1	2	3
Output	e	4	8	12

Ⓐ $e = b + 4$
Ⓒ $b = e + 4$
Ⓑ $e = b \times 4$
Ⓓ $b = e \times 4$

Name _____

Write a Rule for Number Patterns in Tables

Find the rule to describe the pattern in the table. Decide if the rule is additive or multiplicative.

1.

Input	Output
m	*n*
1	11
2	22
3	33
4	44

The rule is _____.

Rule: _____

2.

Input	*d*	3	5	7	9
Output	*f*	7	9	11	13

The rule is _____.

Rule: _____

3.

Input	*p*	2	3	4	5
Output	*q*	30	45	60	75

The rule is _____.

Rule: _____

4.

Input	Output
s	*t*
4	10
6	12
8	14
10	16

The rule is _____.

Rule: _____

Problem Solving Real World

5. Marco pours 12 ounces of cranberry juice into a punch bowl. He uses a container to add sparkling water to the bowl one ounce at a time. Write a rule to show the pattern and use it to calculate how many ounces of liquid Marco will have in the bowl after adding 8 containers of sparkling water.

_____

_____

_____

Lesson Check

Fill in the bubble completely to show your answer.

6. The winning entry in the inventors' competition was a robot made with wheels, gears, and bolts. Using the table shown below, how many bolts are needed to make 7 robots?

Number of robots	1	2	3	4
Wheels	4	8	12	16
Gears	3	6	9	12
Bolts	8	16	24	32

Ⓐ 40
Ⓑ 21
Ⓒ 28
Ⓓ 56

7. Which of the following rules describes the pattern in the table?

Input	h	3	4	5
Output	j	12	13	14

Ⓐ $j = h + 9$
Ⓑ $j = 9h$
Ⓒ $h = j + 9$
Ⓓ $h = 9j$

8. The equation $c = \$0.75p$ represents the cost of mailing a package for each pound, where c is the cost and p is the number of pounds. If Leila mails a package that weighs 5 pounds, what is the total cost?

Ⓐ \$3.00
Ⓑ \$4.50
Ⓒ \$3.75
Ⓓ \$3.55

9. The equation $d = m + 16$ represents the total distance traveled after driving m number of miles. If Mrs. Kiki drives 35 miles, what is the total distance traveled?

Ⓐ 41 miles
Ⓑ 21 miles
Ⓒ 51 miles
Ⓓ 19 miles

Spiral Review

10. Which product is greater than $\frac{3}{8}$?

Ⓐ $\frac{3}{8} \times \frac{1}{2}$
Ⓑ $\frac{3}{8} \times \frac{7}{8}$
Ⓒ $\frac{3}{8} \times \frac{8}{7}$
Ⓓ $\frac{3}{8} \times \frac{11}{12}$

11. Which is another way to write $\frac{15}{9}$?

Ⓐ 15×9
Ⓑ 9×15
Ⓒ $15 \div 9$
Ⓓ $9 \div 15$

Name _____

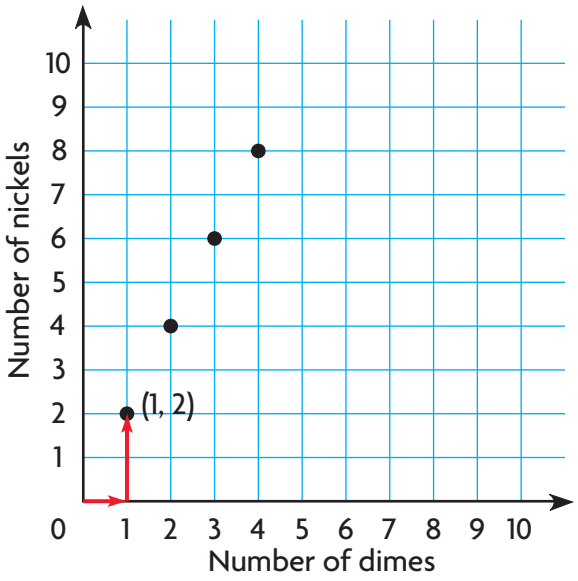
Write a Rule for Number Patterns in Graphs

I Can write a rule for a pattern given in a graph.

Number patterns can be represented on a graph. Points on a plane represent the number pairs in the pattern. The first number in the pair is the input and is the distance the point is from 0 on a horizontal number line. The second number is the output and is the distance the point is from 0 on a vertical number line.

UNLOCK the Problem Real World

Sona has some dimes. Adil offers to give her nickels for her dimes. The graph shows the relationship between the number of dimes Sona gives to Adil and the number of nickels she receives in exchange. Find a rule to describe the pattern.



STEP 1 Write number pairs that relate the number of dimes to the number of nickels.

Think: The number of dimes is input. The horizontal distance from 0 for the first point is 1.

(1, _____)

(2, _____)

(3, _____)

(4, _____)

Think: The number of nickels is output. The vertical distance for the first point is _____.

Math Idea

An additive pattern uses addition in its rule. A multiplicative pattern uses multiplication in its rule.

STEP 2 Describe the relationship between the number of dimes and the number of nickels.

The output is _____ times the input. The pattern uses multiplication.

STEP 3 Write the rule. Let *n* stand for number of nickels, and *d* stand for the number of dimes.

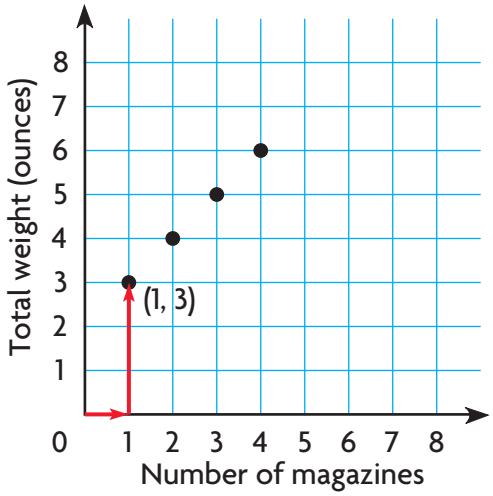
$n =$ _____ $\times$ _____

Think: The relationship is multiplicative. Use multiplication to write the rule.

Additive patterns can also be represented in a graph.

Example Find the rule for the pattern shown in the graph.

Jack mails some magazines in a box. The graph shows the relationship between the number of magazines and the total weight of the magazines and the box.



STEP 1 Write number pairs that relate the number of magazines and the total weight.

(1, _____)

(2, _____)

(3, _____)

(4, _____)

STEP 2 Describe the relationship between the number of magazines and the weight.

The output is the sum of the number of magazines and _____.
The pattern uses addition.

STEP 3 Write the rule. Let *w* stand for total weight, and *m* stand for the number of magazines.

$w =$ _____ + _____

Math Talk

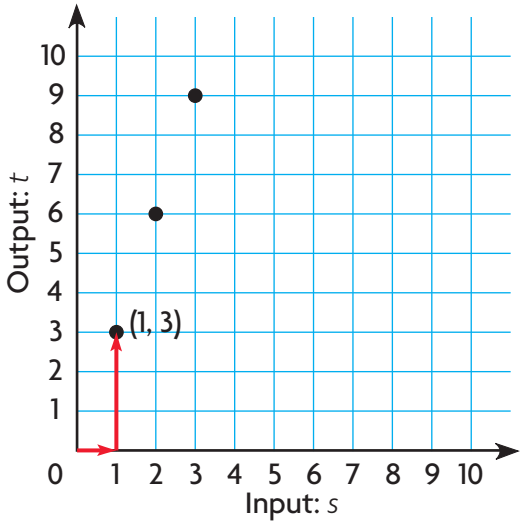
MP Model with mathematics.

Explain what the 2 stands for in $w = m + 2$.

Share and Show Math Board

Is the pattern *additive* or *multiplicative*? Find the rule for the pattern.

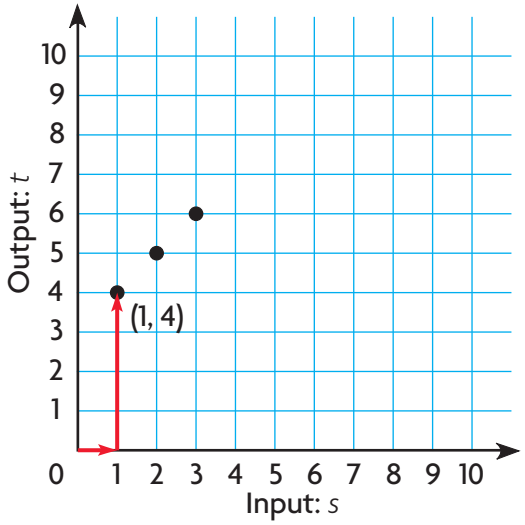
1.



_____

Rule: _____

2.



_____

Rule: _____

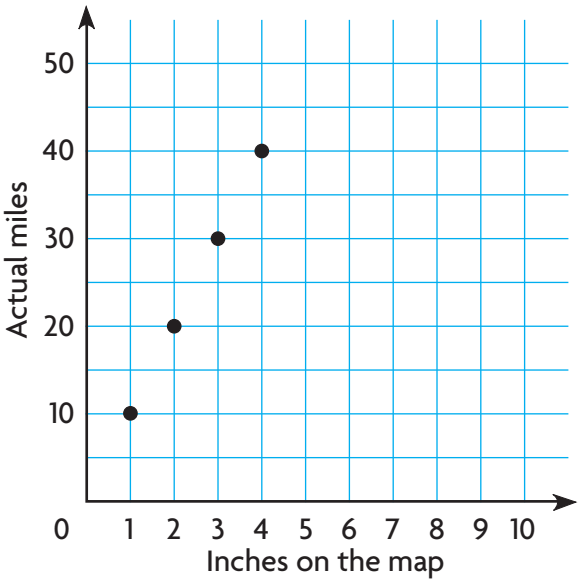
Name _____

On Your Own

3. **Write Math** Explain the differences between the graphs in problems 1 and 2.

4. **Write Math** Explain how you can tell whether a pattern shown in a graph is additive or multiplicative.

Use the graph for 5–6.



5. Maryanne's map uses a scale to show how many miles each inch on the map represents. Use the pattern shown in the graph to find the rule for calculating the actual distance. Use *m* for number of miles and *i* for number of inches.

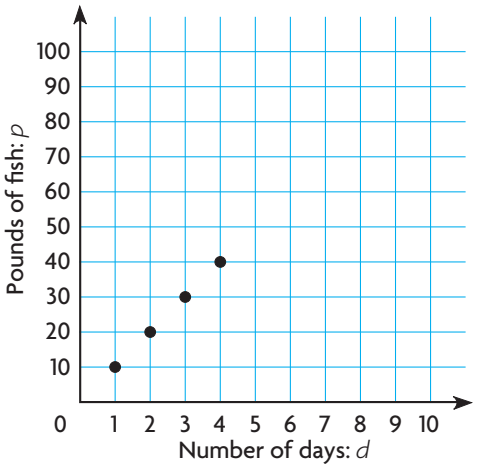
MATH on the Spot

6. If the distance on the map is 2.5 inches, how many miles is the actual distance? Explain how you calculated the actual distance.

7. Olivia uses 1 red button for the nose and 2 blue buttons for the eyes for each rag doll she makes. Would the pattern comparing the number of nose buttons to the total number of buttons on one doll be multiplicative or additive? Explain.

Problem Solving · Applications

Fill in the bubble completely to show your answer. Use the graph.



8. The graph shows the number of pounds of fish the seals at an aquarium eat each day. Which statement and equation about the relationship is true?

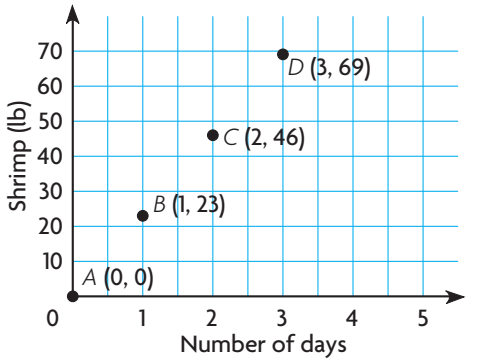
Ⓐ additive pattern, $d = p + 3$

Ⓑ addition pattern, $p = d + 3$

Ⓒ multiplicative pattern, $p = 10 \times d$

Ⓓ multiplicative pattern, $d = 3 \times p$

Use the graph for 9–10.



9. The graph shows the relationship between the number of days and the amount of shrimp that a bottlenose dolphin eats. Which point on the graph shows the amount of shrimp that the dolphin consumes in two days?

Ⓐ point A

Ⓑ point B

Ⓒ point C

Ⓓ point D

10. If s is the amount of shrimp a bottlenose dolphin eats and n is the number of days, which of the following describes the rule for the pattern shown in the graph?

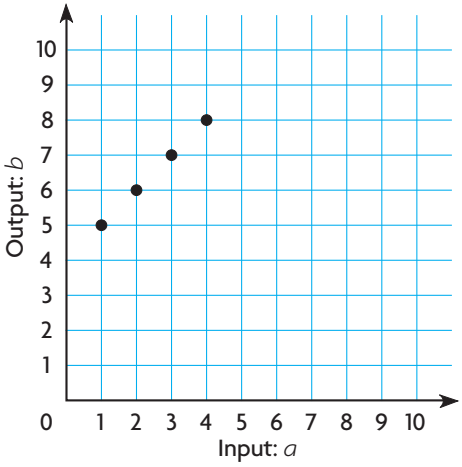
Ⓐ $s = n + 23$

Ⓑ $s = n \times 23$

Ⓒ $n = s \times 23$

Ⓓ $n = s + 23$

11. Which of the following rules describes the pattern in the graph?



Ⓐ $a = 4b$

Ⓑ $b = 4a$

Ⓒ $b = 4 + a$

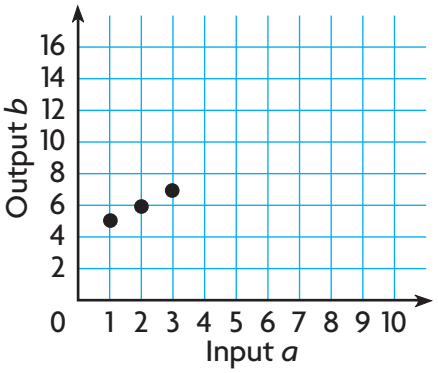
Ⓓ $a = 4 + b$

Name _____

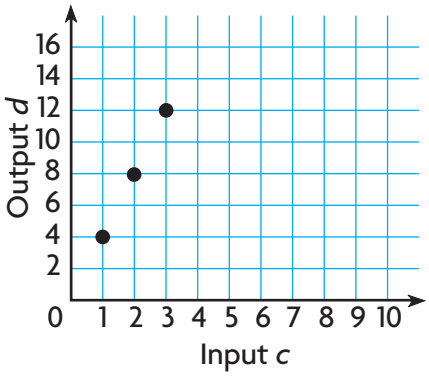
Write a Rule for Number Patterns in Graphs

Is the pattern *additive* or *multiplicative*? Write the rule for the pattern.

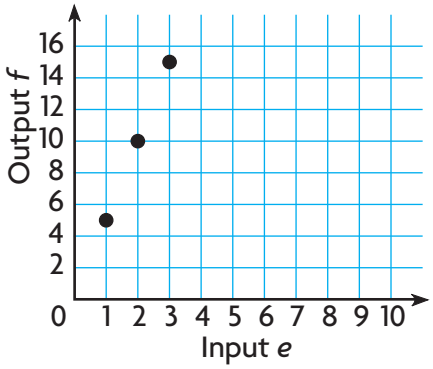
1.



2.



3.



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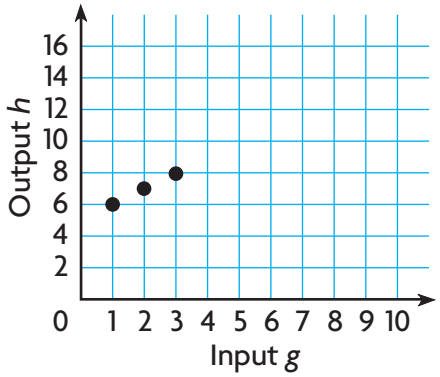


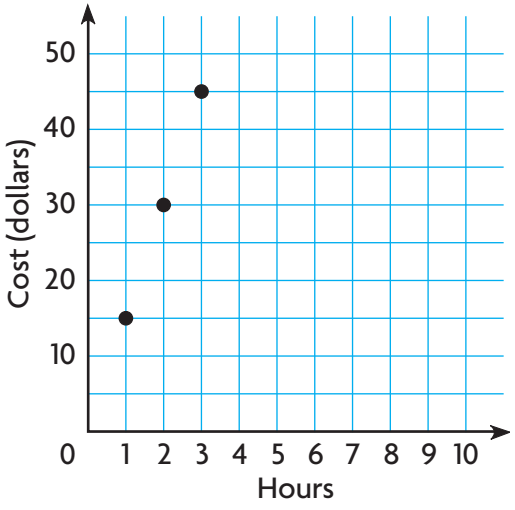
Problem Solving Real World

5. Patrice rents a rowboat for several hours. Use the pattern shown in the graph to write the rule for calculating the cost of renting the rowboat. Use c for the cost and h for the number of hours.

_____

6. If Patrice rents the boat for 4 hours, what is the cost of the rental?

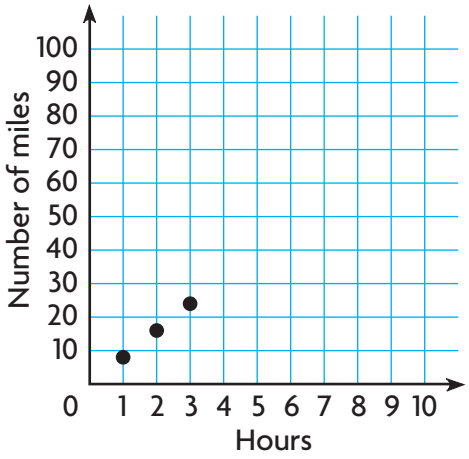
_____



Lesson Check

Fill in the bubble completely to show your answer.

7. The graph shows the relationship between the number of hours Ivana bikes and the distance she travels. How many miles does Ivana bike in 4 hours?



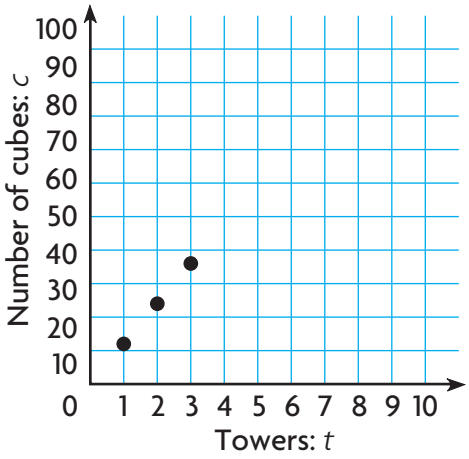
Ⓐ 22 miles

Ⓑ 12 miles

Ⓒ 32 miles

Ⓓ 42 miles

8. Rashid uses cubes to build towers. The graph shows the relationship between the number of towers t and the number of cubes c he uses. Which equation describes this relationship?



Ⓐ $c = 12 + t$

Ⓑ $c = 12t$

Ⓒ $t = 12 + c$

Ⓓ $t = 12c$

Spiral Review

9. Complete each number sentence.

$56 \div 10 =$ _____

$56 \div 100 =$ _____

$56 \div 1{,}000 =$ _____

10. At a school carnival, Parker spends $5.75. Laurent spends 3 times as much as Parker. Azora spends $2.50 more than Laurent. How much does Azora spend?

_____

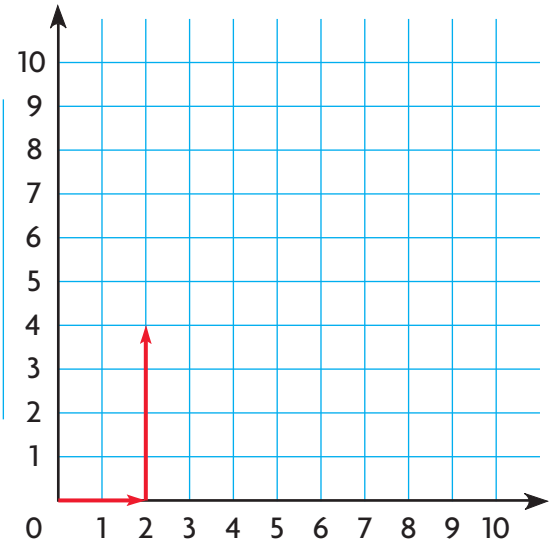
Name _____

Graph a Number Pattern

I Can graph a number pattern.

UNLOCK the Problem

An airport taxi uses the rule $f = m + 2$ to calculate the fare for passengers. The number of miles m is the input, and the output is the fare f in dollars. Graph the pattern.



_____

STEP 1 Label the horizontal number line to show that the input is number of miles. Label the vertical number line to show that the output is the fare.

STEP 2 Write a number pair and graph it.

For a trip that is 2 miles, the fare will be $_____.

The number pair is (2, _____).

Move right _____ units. Then move up _____ units and draw a point to represent the number pair.

STEP 3 Graph several number pairs.

Move right _____ units. (_____, _____) Move up _____ units.

Move right _____ units. (_____, _____) Move up _____ units.

Move right _____ units. (_____, _____) Move up _____ units.

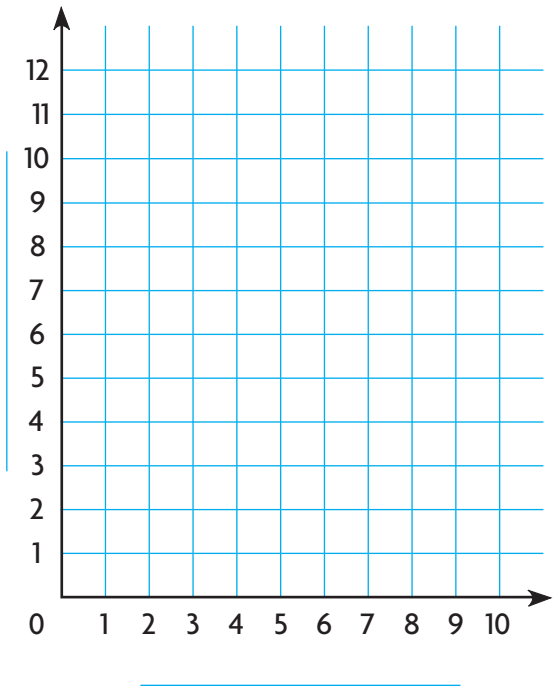
Math Talk

MP Reason abstractly and quantitatively.

Explain what each number in the number pair represents.

Example Graph a multiplicative pattern.

Celina is counting the number of wheels on tricycles. The rule is $w = 3t$, where t is the number of tricycles and w is the number of wheels. Use the rule to show a pattern on the graph.



STEP 1 Label the horizontal number line to show the input is the number of tricycles. Label the vertical number line to show the output is the number of _____.

STEP 2 Write a number pair and graph it.

The input _____ times 3 is equal to the output _____.

The number pair is (_____ , _____).

STEP 3 Graph several number pairs.

Move right _____ units. (_____, _____) Move up _____ units.

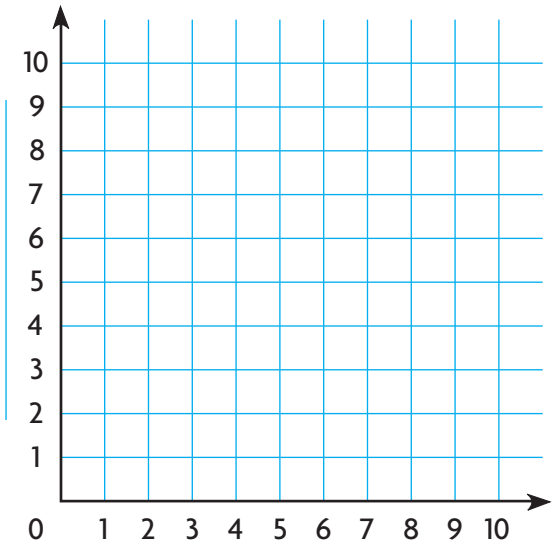
Move right _____ units. (_____, _____) Move up _____ units.

Move right _____ units. (_____, _____) Move up _____ units.

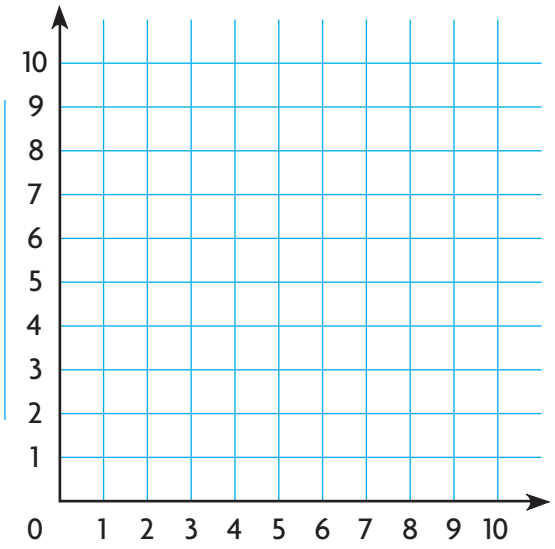
Share and Show Math Board

Use the rule to graph a pattern.

1. Each doll needs 2 shoes. The rule is $s = 2d$, where d is the number of dolls and s is the number of shoes.



2. The score for guessing the correct word is 4 and the number of letters in the word. The rule is $s = 4 + l$, where l is the number of letters and s is the score.



Name _____

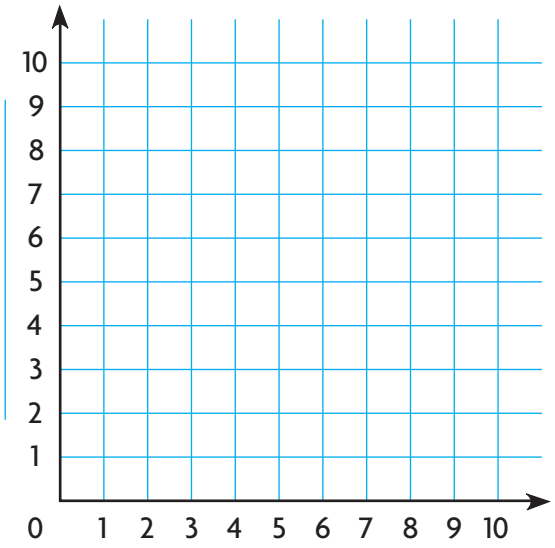
On Your Own

3. **Write Math** Explain how you can plot a point on the graph to represent a number pair.

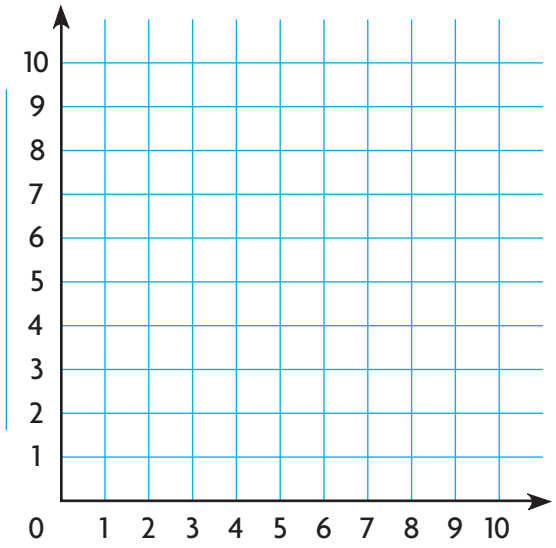
4. **Write Math** Explain how the first point in your graph for Problem 2 would change if the rule changes to $s = 5 + l$.

5. Rita uses red and blue ribbons in a design. The length of the blue ribbon b is always 3 inches greater than the length of the red ribbon r. Write a rule and plot 4 points on the graph to show the pattern.

MATH on the Spot



6. Mina uses green and red ribbons for her design. The length of the green ribbon g is always twice the length of the red ribbon r. Write a rule to describe Mina's design and plot 4 points on the graph to show the pattern.



Problem Solving · Applications

Fill in the bubble completely to show your answer.

7. A recipe for carrot juice uses the formula $j = 6c$, where j is the amount of juice in ounces and c is the number of pounds of carrots needed. How many pounds of carrots are needed for a 30-ounce glass of carrot juice?

Ⓐ 5 pounds

Ⓑ 24 pounds

Ⓒ 180 pounds

Ⓓ 36 pounds

8. Khalid uses the rule $y = x + 5$ to complete a table and make a graph. Which number pair will be on the graph?

Input	Output
x	*y*
1	6
2	7
3	
4	
5	

Ⓐ (6, 1)

Ⓑ (4, 8)

Ⓒ (5, 0)

Ⓓ (4, 9)

9. The rule $d = 12t$ shows the cost in dollars d for the number of movie tickets t. Which two points could be on the graph?

Ⓐ (0, 12) and (36, 3)

Ⓑ (1, 11) and (2, 24)

Ⓒ (0, 0) and (3, 36)

Ⓓ (0, 12) and (3, 36)

10. Lamar uses the rule $s = 7g$ to show the number of snacks he needs s for the number of guests at his party g. Which number pair shows the number of snacks needed for 4 guests?

Ⓐ (4, 28)

Ⓑ (1, 8)

Ⓒ (4, 14)

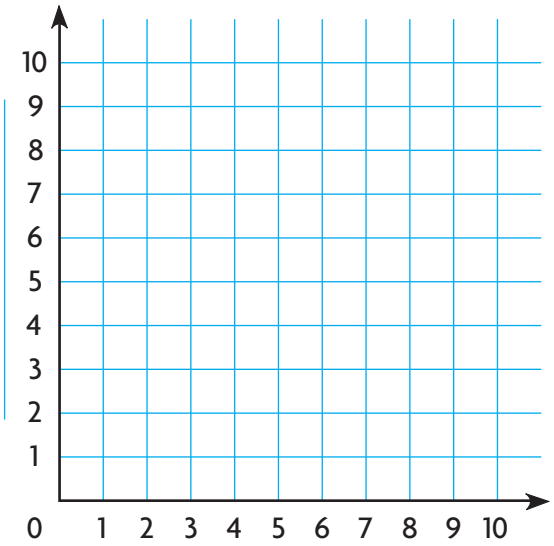
Ⓓ (28, 4)

Name _____

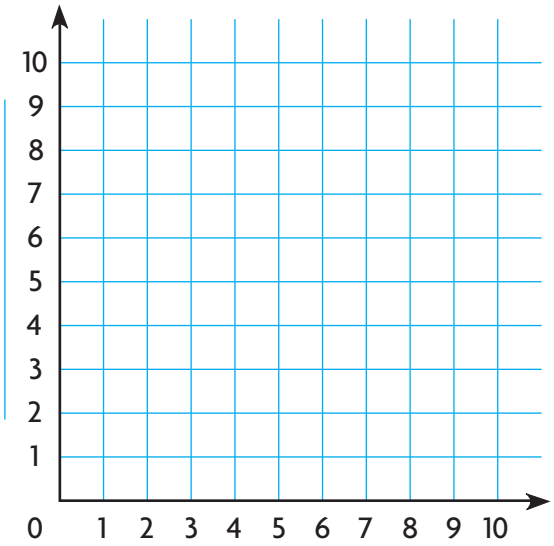
Graph a Number Pattern

Use the rule to graph a pattern.

1. The cost for printing pages at a print shop is a $5 processing fee and $1 for each page. The rule is $c = 5 + p$, where p is the number of pages and c is the total cost.



2. Mario uses craft sticks to form triangles. The rule is $c = 3t$, where c represents the number of craft sticks and t represents the number of triangles.



Problem Solving Real World

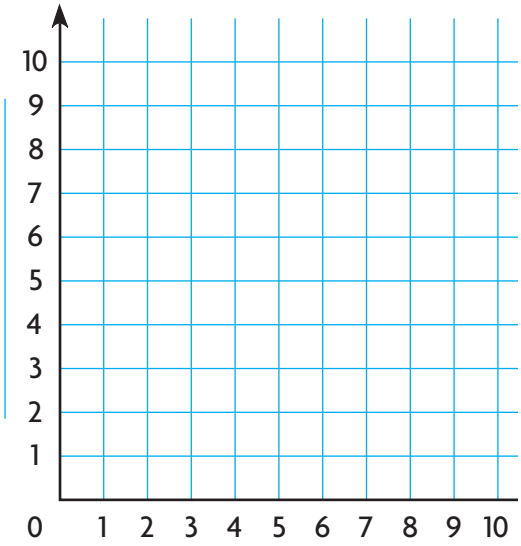
Use the graph for 3–4.

3. A department store offers free samples of a 2-ounce container of lotion with every fragrance purchase of any size. Write a rule to describe the number of ounces of product received for each purchase. Plot 3 points on the graph to show the pattern. Use t for the total number of ounces of product received and f for the ounces of fragrance sold.

_____

4. Cristina buys 6 ounces of fragrance on Monday and returns to buy another 4 ounces of fragrance on Friday. How many ounces of fragrance will she have in all?

_____



Lesson Check

Fill in the bubble completely to show your answer.

5. Blanca uses the rule $b = 4a$ to complete a table and make a graph. Which number pair will be on the graph?

a	2	3	4	5
b	8			

Ⓐ (3, 12)

Ⓑ (3, 7)

Ⓒ (4, 8)

Ⓓ (12, 3)

6. An online music store charges a $6 fee for becoming a member and $1 to download each song. Noriko uses the rule $c = 6 + s$ to calculate her cost. Which number pair shows the cost of 5 songs?

Ⓐ (5, 6)

Ⓑ (5, 11)

Ⓒ (5, 5)

Ⓓ (1, 5)

Spiral Review

7. For a science project, Claire measures a leaf that is 62 millimeters long. How many decimeters long is the leaf?

8. A soccer team has two water coolers that each hold 3.5 gallons of water. There are 16 cups in each gallon. How many cups of water would be needed to fill both water coolers?

9. Bijoux buys 38 stamps that cost $0.56 each. How much does she spend on stamps?

10. Divide. 505.6 ÷ 64

Name _____

Understand Ordered Pairs

I Can identify and plot points.

CONNECT Locating a point on a coordinate plane is similar to describing directions using North-South and West-East. The horizontal number line on the plane is the ***x*-axis**. The vertical number line on the plane is the ***y*-axis**.

Each point on the coordinate plane can be described by an **ordered pair** of numbers. The ***x*-coordinate** is the first number in the ordered pair. It is the horizontal location, or the distance the point is from 0 in the direction of the *x*-axis. The ***y*-coordinate** is the second number in the ordered pair. It is the vertical location, or the distance the point is from 0 in the direction of the *y*-axis.

(x, y)

x-coordinate — *y*-coordinate

The *x*-axis and the *y*-axis intersect at the point (0, 0), called the **origin**.

UNLOCK the Problem

Real World

Write the ordered pairs for the locations of the arena and the aquarium.

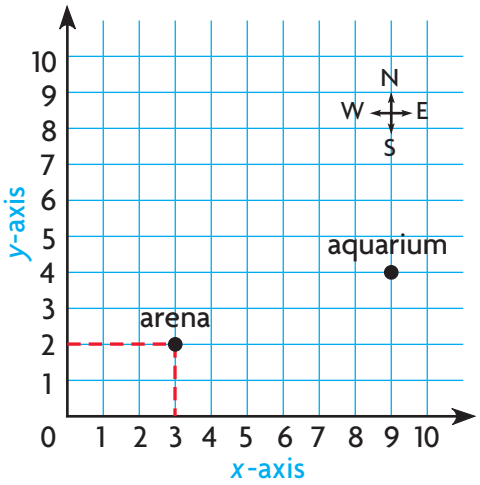
Locate the point for which you want to write an ordered pair.

Look below at the *x*-axis to identify the point's horizontal distance from 0, which is its *x*-coordinate.

Look to the left at the *y*-axis to identify the point's vertical distance from 0, which is its *y*-coordinate.

So, the ordered pair for the arena is (3, 2) and the ordered pair for the aquarium

is (_____, _____).



- Describe the path you would take to get from the origin to the aquarium, using horizontal, then vertical movements.

_____

_____

Math Talk

MP **Attend to precision.**

Use the *x*- and *y*-coordinates to describe the distance of the point (3, 2) from the *x*- and *y*-axes.

Example 1 Use the graph.

A point on a coordinate plane can be labeled with an ordered pair, a letter, or both.

1. Plot the point (5, 7) and label it *J*.

From the origin, move right 5 units and then up 7 units.

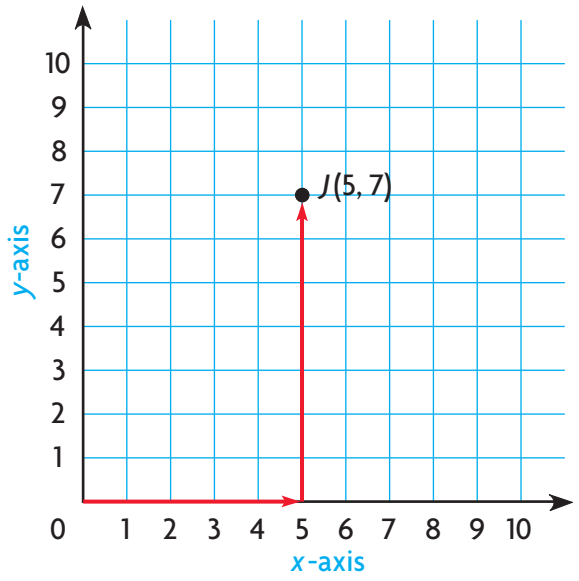
Plot and label the point.

2. Plot the point (8, 0) and label it *S*.

From the origin, move right _____ units and

then up _____ units.

Plot and label the point.

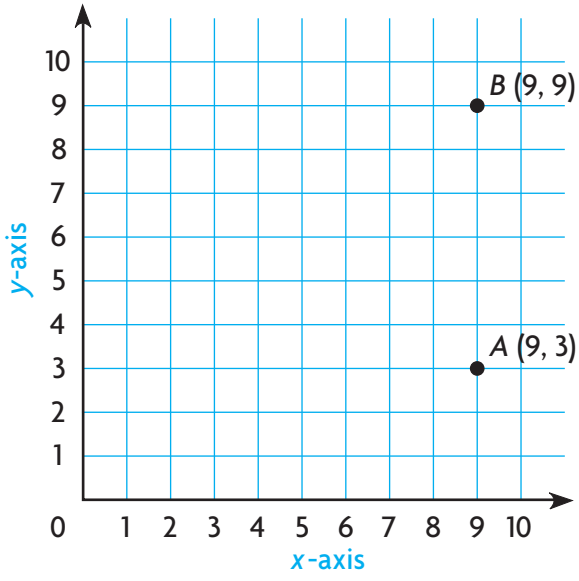


Example 2 Find the distance between two points.

You can find the distance between two points when the points are along the same horizontal or vertical line.

- Draw a line segment to connect point *A* and point *B*.
- Count vertical units between the two points.

There are _____ units between points *A* and *B*.



1. Points *A* and *B* form a vertical line segment and have the same *x*-coordinates. How can you use subtraction to find the distance between the points?

_____

_____

_____

_____

2. Graph the points (3, 2) and (5, 2). Explain how you can use subtraction to find the horizontal distance between these two points.

_____

_____

Name _____

Share and Show

Math Board

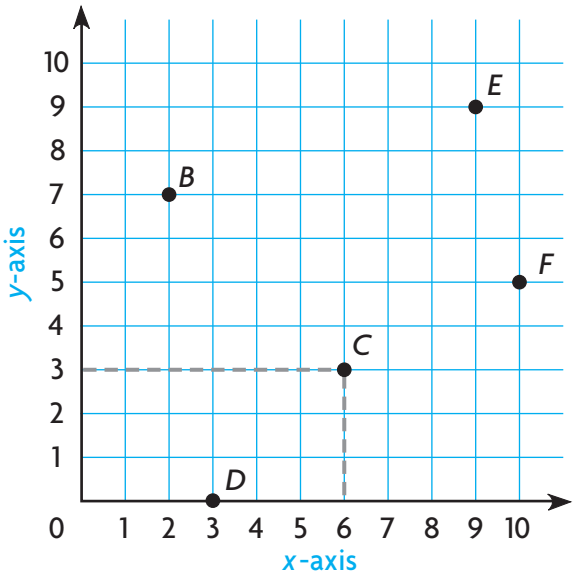
Use Coordinate Plane A to write an ordered pair for the given point.

1. C _____
2. D _____
3. E _____
4. ✓ F _____

Plot and label the points on Coordinate Plane A.

5. $M(0, 9)$
6. $H(8, 6)$
7. $K(10, 4)$
8. $T(4, 5)$
9. $W(5, 10)$
10. ✓ $R(1, 3)$

Coordinate Plane A



On Your Own

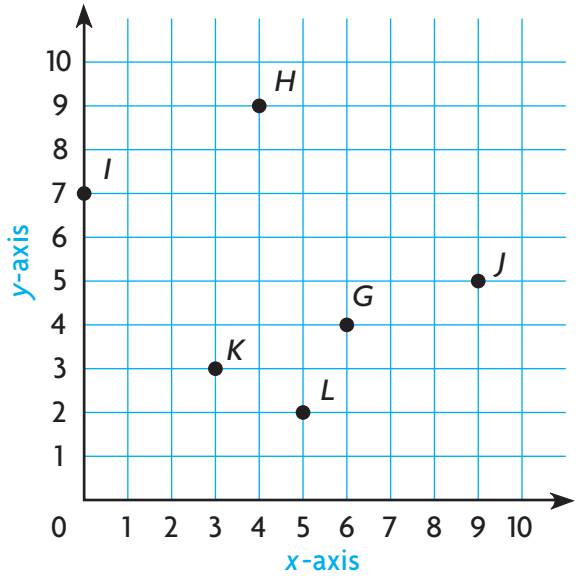
Use Coordinate Plane B to write an ordered pair for the given point.

11. G _____
12. H _____
13. I _____
14. J _____
15. K _____
16. L _____

Plot and label the points on Coordinate Plane B.

17. $W(8, 2)$
18. $E(0, 4)$
19. $X(2, 9)$
20. $B(3, 4)$
21. $R(4, 0)$
22. $F(7, 6)$
23. $T(5, 7)$
24. $A(7, 1)$

Coordinate Plane B



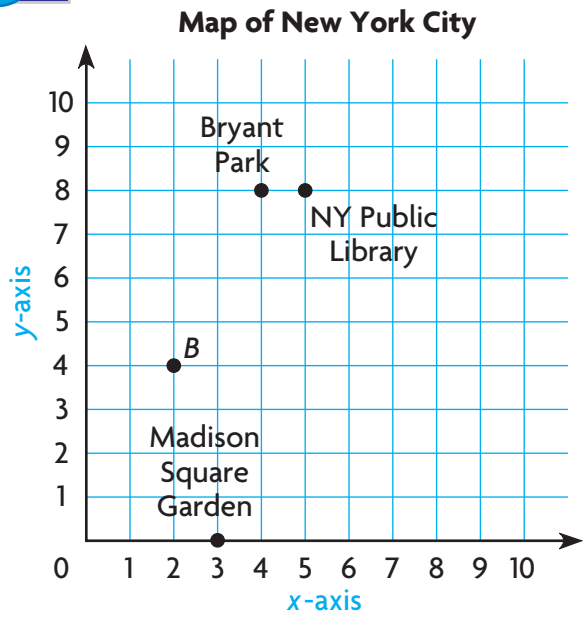
25. **Write Math** Explain how to find the distance between point F and point A.

_____

_____

Problem Solving · Applications

Nathan and his friends are planning a trip to New York City. Use the map for 26–30. Each unit represents 1 city block.



26. What ordered pair gives the location of Bryant Park?

_____

27. MP The Empire State Building is located 5 blocks right and 1 block up from (0, 0). Write the ordered pair for this location. Plot and label a point for the Empire State Building.

_____

28. Nathan says that Madison Square Garden is located at (0, 3) on the map. Is his ordered pair correct? Explain.

MATH on the Spot

_____

_____

29. Paulo walks from point *B* to Bryant Park. Raul walks from point *B* to Madison Square Garden. If they only walk along the plane lines, who walks farther? Explain.

_____

_____

30. Look at the map of New York City above. Suppose a subway station is located at (6, 5). Which of the following accurately describes the location of the subway station? Mark all that apply.

Ⓐ The station is 2 blocks right and 3 blocks down from Bryant Park.

Ⓑ The station is 4 blocks right and 1 block down from point B.

Ⓒ The station is 1 block right and 3 blocks down from the library.

Ⓓ The station is 5 blocks right and 3 blocks up from Madison Square Garden.

Name _____

Understand Ordered Pairs

Use Coordinate Plane A to write an ordered pair for the given point.

1. A (2, 3)

2. B

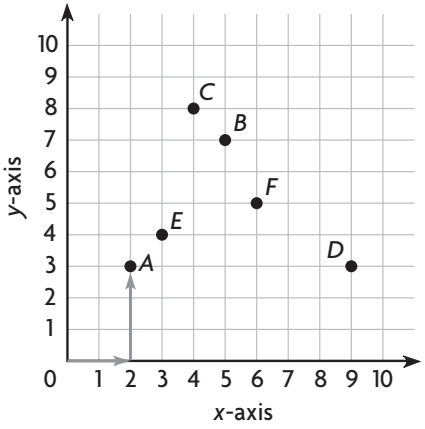
3. C

4. D

5. E

6. F

Coordinate Plane A



Plot and label the points on Coordinate Plane B.

7. $N\,(7, 3)$

8. $R\,(0, 4)$

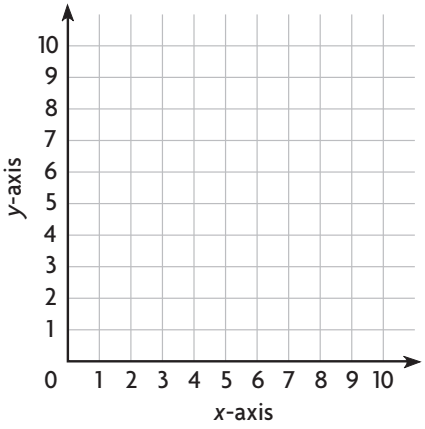
9. $O\,(8, 7)$

10. $M\,(2, 1)$

11. $P\,(5, 6)$

12. $Q\,(1, 5)$

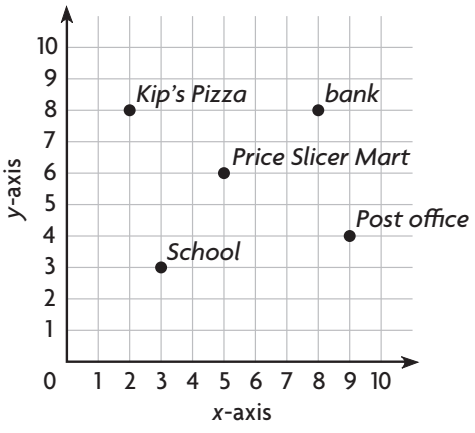
Coordinate Plane B



Problem Solving Real World

Use the map for 13–14.

Port Charlotte



13. Which building is located at (5, 6)?

_____

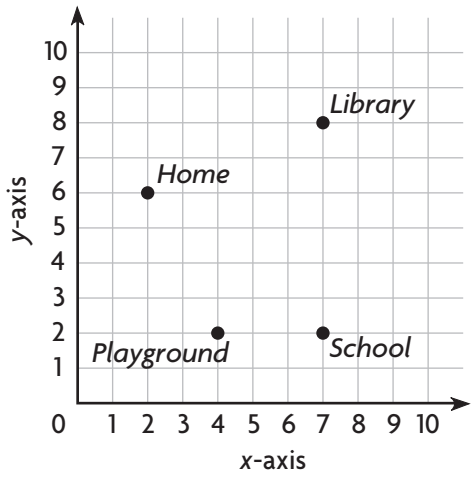
14. What is the distance between Kip's Pizza and the bank?

_____

15. Write Math What is a situation in which you might locate points on a coordinate plane?

_____

Lesson Check



16. What ordered pair describes the location of the playground?

_____

17. What is the distance between the school and the library?

_____

Spiral Review

18. What is the value of the underlined digit?

45,7<u>6</u>9,331

_____

19. Joji charges $18 for each lawn he mows. Suppose he mows 17 lawns per month. How much money will Joji make per month?

_____

20. Harlow can bicycle at a rate of 18 miles per hour. How many hours would it take him to bicycle a stretch of road that is 450 miles long?

_____

21. Yiren uses 192 beads to make a bracelet and a necklace. It takes 5 times as many beads to make a necklace as it does to make a bracelet. How many beads are used to make the necklace?

_____

Name _____

Graph Data

I Can use a coordinate plane to display data collected in an experiment.

UNLOCK the Problem

Materials ■ paper cup ■ water ■ Fahrenheit thermometer ■ ice cubes ■ stopwatch

When data is collected, it can be organized in a table.

A. Fill the paper cup more than halfway with room-temperature water.

B. Place the Fahrenheit thermometer in the water and find its beginning temperature before adding any ice. Record this temperature in the table at 0 seconds.

C. Place three cubes of ice in the water and start the stopwatch. Find the temperature every 10 seconds for 60 seconds. Record the temperatures in the table.

Water Temperature

Time (in seconds)	Temperature (in °F)
0	
10	
20	
30	
40	
50	
60	

Try Another Problem

1. Explain why you would record the beginning temperature at 0 seconds.

2. Describe what happens to the temperature of the water in 60 seconds, during the experiment.

3. MP Analyze your observations of the temperature of the water during the 60 seconds, and explain what you think would happen to the temperature if the experiment continued for 60 seconds longer.

You can use a coordinate plane to graph and analyze the data you collected in the experiment.

STEP 1 Write the related pairs of data as ordered pairs.

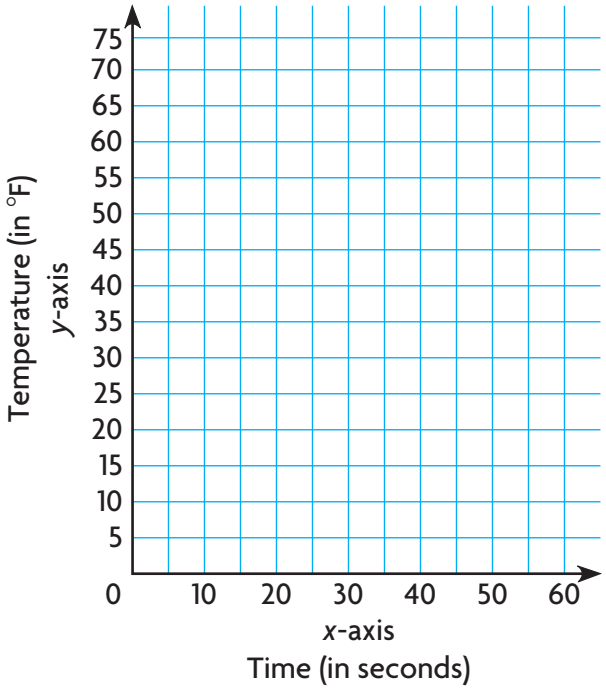
(0, _____) (20, _____) (40, _____)

(10, _____) (30, _____) (50, _____)

(60, _____)

STEP 2 Construct a coordinate plane and write a title for it.

STEP 3 Plot a point for each ordered pair.



Math Talk

MP **Reason abstractly and quantitatively.**

What is the ordered pair that you recorded for the data at 10 seconds? Explain what each coordinate represents.

Name _____

Share and Show Math Board

For items 1–3, graph the data on the coordinate plane.

1. Write the ordered pairs for each point.

_____

2. What does the ordered pair (3, 38) tell you about Adelmo's age and height?

_____

_____

3. Why would the point (6, 42) be nonsense?

_____

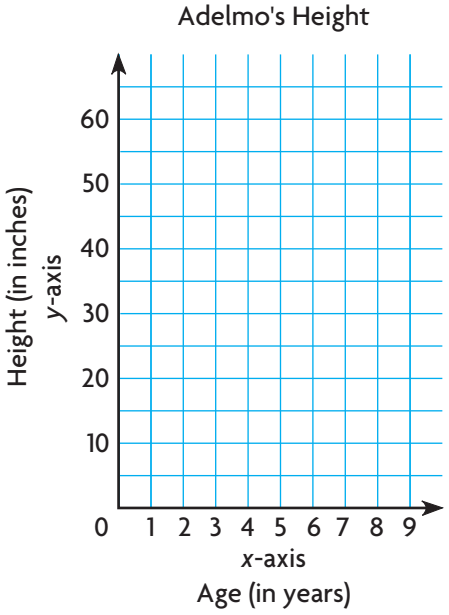
_____

_____

_____

_____

Adelmo's Height					
Age (in years)	1	2	3	4	5
Height (in inches)	30	35	38	41	44

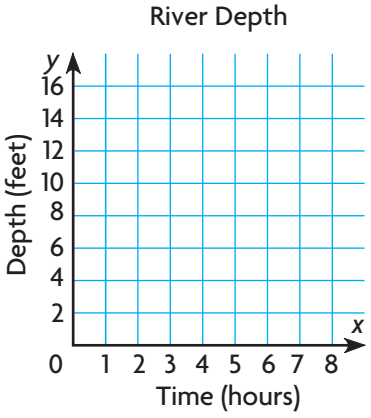


Problem Solving · Applications Real World

4. The table shows the depth of the Dakota River at different times during a rainstorm.

Graph the ordered pairs from the tiles on the coordinate plane.

Dakota River					
Time (hours)	1	2	3	4	5
Depth (feet)	7	8	10	12	15



(1, 7)

(2, 8)

(3, 10)

(4, 12)

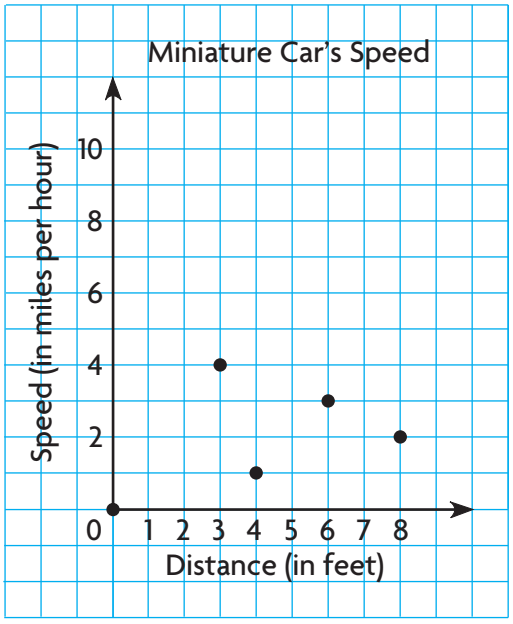
(5, 15)

5. Mary places a miniature car onto a track with launchers. The speed of the car is recorded every foot. Some of the data is shown in the table. Mary graphs the data on the coordinate plane below.

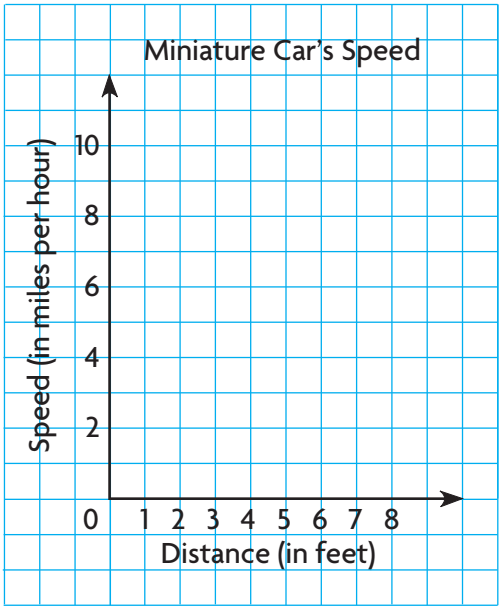
Miniature Car's Speed	
Distance (in feet)	Speed (in miles per hour)
0	0
1	4
2	8
3	6
4	3

MATH on the Spot

Look at Mary's graphed data. Find her error.



Graph the data and correct the error.



6. MP Describe the error Mary made.

7. At what distance do you think the car will stop? Explain and write the ordered pair.

Name _____

Graph Data

Graph the data on the coordinate plane.

1.

Outdoor Temperature					
Hour	1	3	5	7	9
Temperature (°F)	61	65	71	75	77

a. Write the ordered pairs for each point.

_____

_____

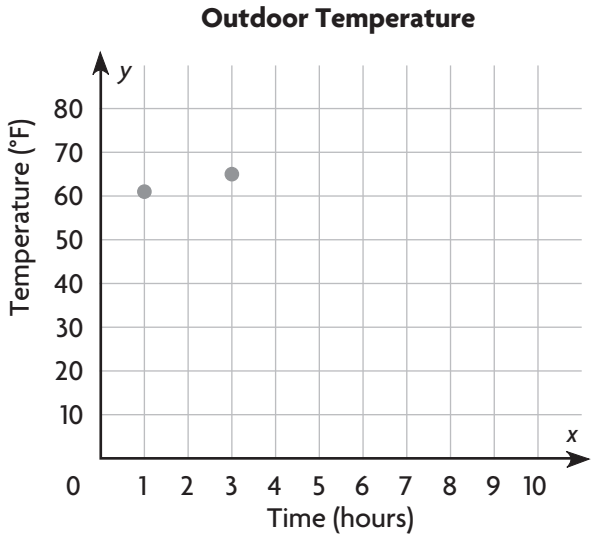
b. How would the ordered pairs be different if the outdoor temperature were recorded every hour for 4 consecutive hours?

_____

_____

_____

_____



Problem Solving Real World

2.

Windows Repaired					
Day	1	2	3	4	5
Total Number Repaired	14	30	45	63	79

a. Write the ordered pairs for each point.

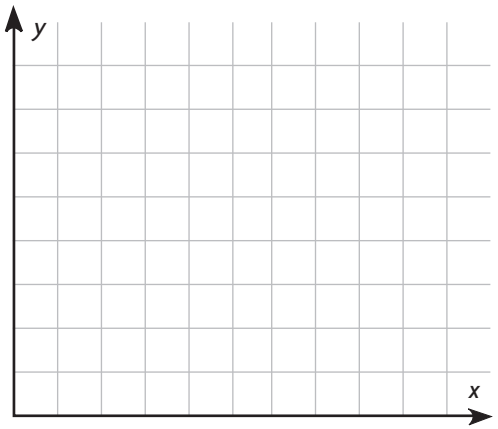
_____

_____

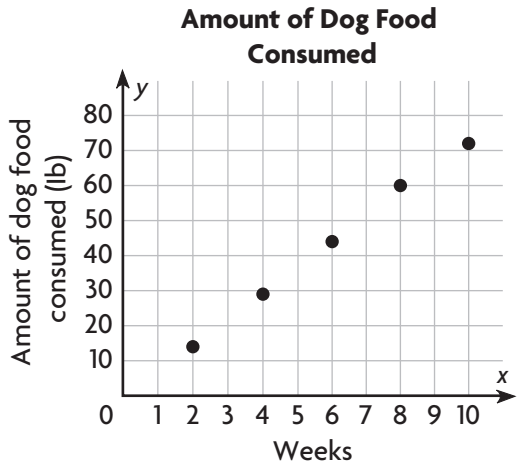
b. What does the ordered pair (2, 30) tell you about the number of windows repaired?

_____

_____



Lesson Check



3. About how many weeks did it take for the dog to consume 45 pounds of food?

_____

4. By the end of Week 8, how much food had the dog consumed?

_____

Spiral Review

5. A restaurant chain ordered 3,940 pounds of rice in 20-pound bags. About how many 20-pound bags of rice did the chain order?

_____

6. The population of Linton is 12 times as great as the population of Ellmore. The combined population of both towns is 9,646 people. What is the population of Linton?

_____

7. Dinesh needs $\frac{1}{2}$ cup of bread crumbs for a casserole and $\frac{1}{3}$ cup of bread crumbs for the topping. How many cups of bread crumbs does Dinesh need?

_____

8. Jessie bought 3 T-shirts for $6 each and 4 T-shirts for $5 each. What expression can you use to describe how much Jessie spent?

_____

Name _____

Graph and Analyze Relationships

I Can write and graph ordered pairs on a coordinate grid using two numerical patterns.

UNLOCK the Problem Real World

Sasha is making hot cocoa for a party. For each mug of cocoa, he uses 3 tablespoons of cocoa mix and 6 fluid ounces of hot water. If Sasha uses an entire 18-tablespoon container of cocoa mix, how many fluid ounces of water will he use?

- How many tablespoons of cocoa mix does Sasha add for each mug of cocoa?

_____

- How many fluid ounces of water does Sasha add for each mug of cocoa?

_____

STEP 1 Use the two given rules in the problem to generate the first four terms for the number of tablespoons of cocoa mix and the number of fluid ounces of water.

Cocoa Mix (tbsp)	3				...	18
Water (fl oz)	6				...	

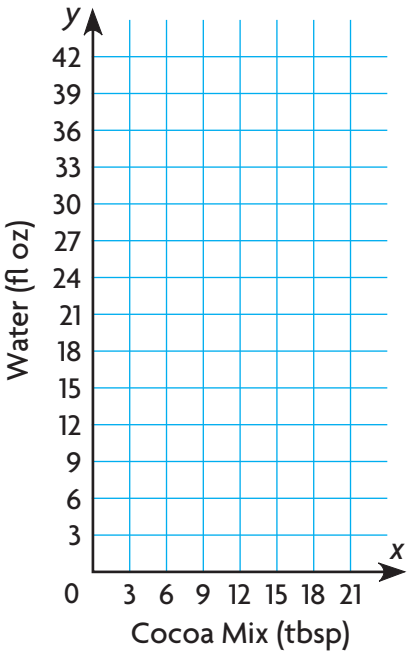
STEP 2 Write the number pairs as ordered pairs, relating the number of tablespoons of cocoa mix to the number of fluid ounces of water.

(3, 6) _____ _____ _____

STEP 3 Graph and label the ordered pairs. Then write a rule to describe how the number pairs are related.

- What rule can you write that relates the amount of cocoa mix to water?

_____



So, Sasha will use _____ fluid ounces of water if he uses the entire container of cocoa mix.

- MP Write the final number pair as an ordered pair. Then graph and label it. Starting at the origin, connect the points with straight line segments. What do the connected points form? Explain why this is formed.

_____

_____

_____

Example

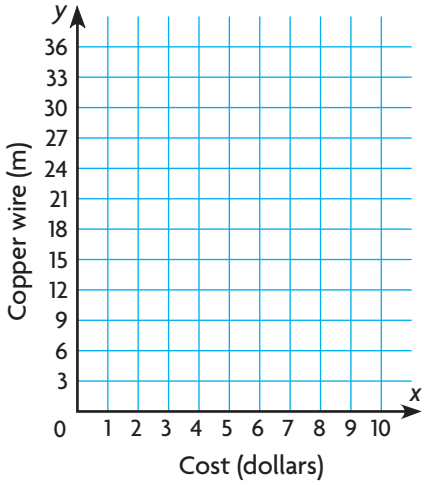
Each $2-bag of copper wire contains 6 meters of wire.

Write the number pairs as ordered pairs and graph the data. Then write a rule that relates the cost to the number of meters of copper wire.

Think: Multiply the number of dollars by _____ to find the number of meters of copper wire.

Find the unknown term in the table.

Cost (dollars)	2	4	6	8
Copper wire (m)	6	12	18	



Math Talk

MP Look for and make use of structure.

How are the terms in each sequence related? How is one sequence related to the other?

Share and Show

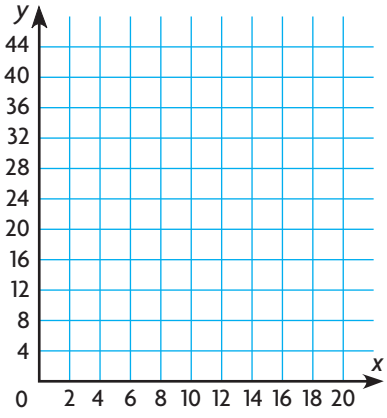
Math Board

Graph and label the related number pairs as ordered pairs. Complete the rule that describes how one sequence is related to the other. Then use the rule to find the unknown term.

1. For every 2 square feet of lawn, Charlie needs 8 ounces of fertilizer.

Lawn (sq ft)	2	4	6	8	10
Weight (oz)	8	16	24	32	

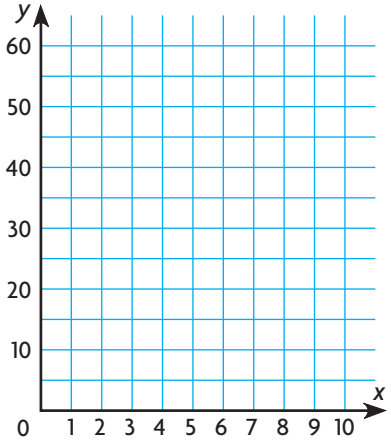
Multiply the number of square feet by _____ to find the ounces of fertilizer needed.



2. On Mary's map, every 2 inches represents 10 miles.

Map (in.)	2	4	6	8	10
Miles	10	20	30	40	

Multiply the number of inches by _____ to find the distance in miles.



Name _____

On Your Own

3. On Sandy's scale drawing of the school campus, 2 inches equals 4 yards. The distance between the swings and the track is 10 inches on the drawing, and the distance between the track and the basketball court is 4 inches on the drawing. How much farther is the track from the swings than from the basketball court, in actual distance?

Draw your own graph. Write a rule that describes how one sequence of terms is related to the other. Complete the table and solve.

Map (in.)	2	4	6	8	10
Distance (yds)	4	8	12	16	

Rule: _____

_____

_____

_____

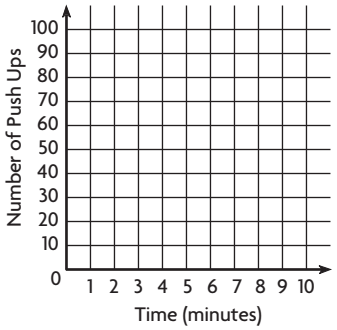
4. Eric recorded the total number of push ups he did each minute for 4 minutes.

Time (minutes)	1	2	3	4
Number of Push Ups	15	30	45	60

Write the number pairs as ordered pairs.

_____

Graph the ordered pairs on a coordinate plane.



Write a rule to describe how the number pairs are related.

_____

_____

Problem Solving · Applications

5. Elsa solved the following problem.

MATH on the Spot

Lou and George are making chili for the Annual Firefighter's Ball. Lou uses 2 teaspoons of hot sauce for every 2 cups of chili that he makes, and George uses 3 teaspoons of the same hot sauce for every cup of chili in his recipe. Who has the hotter chili, George or Lou?

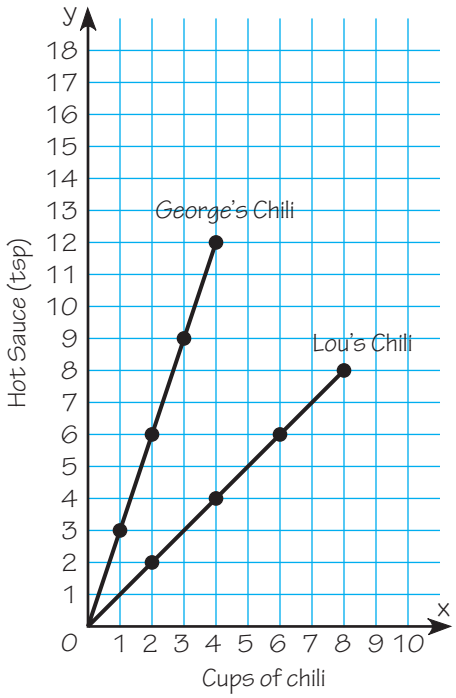
Write the related number pairs as ordered pairs and then graph them. Use the graph to compare who has the hotter chili, George or Lou.

Lou's chili (cups)	2	4	6	8
Hot sauce (tsp)	2	4	6	8

George's chili (cups)	1	2	3	4
Hot sauce (tsp)	3	6	9	12

Lou's chili: (2, 2), (4, 4), (6, 6), (8, 8)

George's chili: (1, 3), (2, 6), (3, 9), (4, 12)



Elsa said that George's chili was hotter than Lou's, because the graph showed that the amount of hot sauce in George's chili was always 3 times as great as the amount of hot sauce in Lou's chili. Does Elsa's answer make sense, or is it nonsense? Explain.

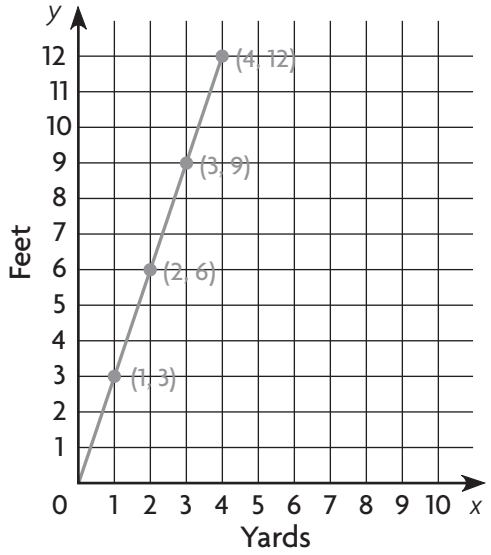
Name _____

Graph and Analyze Relationships

Graph and label the related number pairs as ordered pairs. Then complete and use the rule to find the unknown term.

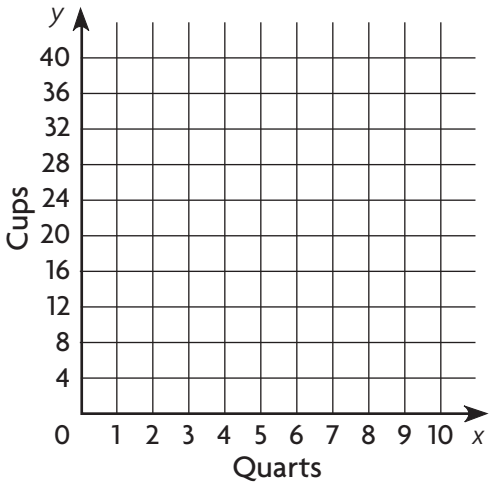
1. Multiply the number of yards by 3 to find the number of feet.

Yards	1	2	3	4
Feet	3	6	9	12



2. Multiply the number of quarts by _____ to find the number of cups that measure the same amount.

Quarts	1	2	3	4	5
Cups	4	8	12	16	



Problem Solving Real World

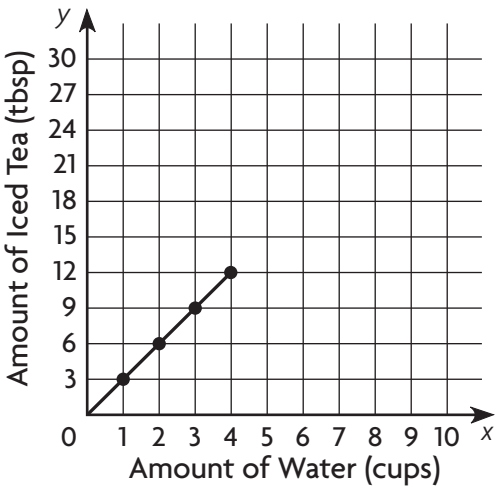
3. How can you use the graph for Exercise 2 to find how many cups are in 9 quarts?

4. How many cups are equal to 9 quarts? _____

Lesson Check

Use the data to complete the graph. Then answer the questions.

Paola is making a pitcher of iced tea. For each cup of water, she uses 3 tablespoons of powdered iced tea mix.



1. Fill in the missing number to complete the following rule.

Multiply the amount of iced tea mix by _____ to get the amount of water.

2. Suppose Paola uses 18 tablespoons of iced tea mix. How many cups of water does she need to use?

Spiral Review

3. A biologist counted 10,000 migrating monarch butterflies. How do you express 10,000 as a power of 10?

4. Find the quotient. Write your answer using a decimal and round to the nearest hundredth.

$8{,}426 \div 82$

5. What is $54.38 + 29.7$?

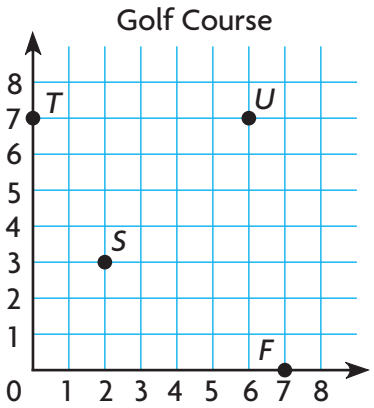
6. On a certain day, \$1 is worth 76.12 Indian rupees. Omar has \$75. How many rupees will he get in exchange?

Name _____

Chapter 18

Chapter Review

1. The letters on the coordinate plane represent the locations of the first four holes on a golf course. Which of the following accurately describe the location of a hole? Mark all that apply.



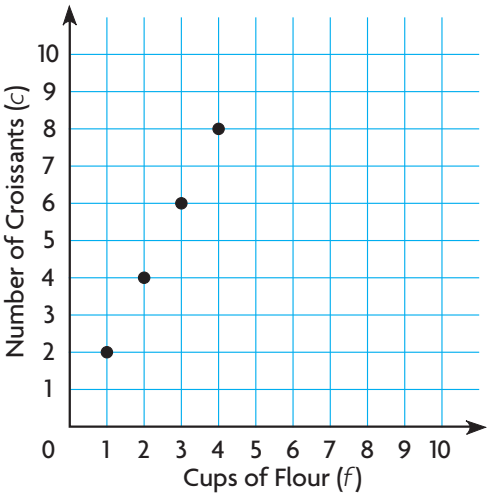
(A) Hole U is 4 units left and 4 units down from hole S.

(B) Hole F is 1 unit right and 7 units down from hole U.

(C) Hole T is 2 units left and 4 units up from hole S.

(D) Hole S is 3 units left and 5 units up from hole F.

2. The graph shows the amount of flour it takes to make croissants. Which rule describes the pattern on the graph?



(A) $c = f + 1$

(B) $f = c + 1$

(C) $c = 2f$

(D) $f = 2c$

3. Steve uses the rule $l = 8s$ to determine the number of legs 5 spiders have. What is the value of ▢?

Spiders	s	2	3	4	5
Legs	l	16	24	32	▢

(A) 8

(B) 40

(C) 10

(D) 14

4. Portia made a table to figure out how much she earned selling T-shirts.

Day	1	2	3	4	5
Number of T-shirts sold	5	10	15	20	25
Amount earned ($)	20	40	60	80	?

For problems 4a–4b, use the table to choose the correct values to describe how one sequence is related to the other.

4a. The unknown number in Day 5 is

90
100
120

.

4b. The rule that describes how the number of T-shirts sold relates to the amount earned is

add 15
multiply by 5
multiply by 4

.

5. Jawan made a table to figure out how much he earns at his job.

Job Earnings						
Week	1	2	3	4	...	6
Hours Worked	6	12	18	24	...	36
Amount Earned ($)	54	108	162	216	...	?

Part A

Write a rule that relates the amount Jawan earns to the number of hours worked. Explain how you can check your rule.

Part B

How much does he earn from his job in Week 6?

$ _____

Name _____

6. Look for a pattern.

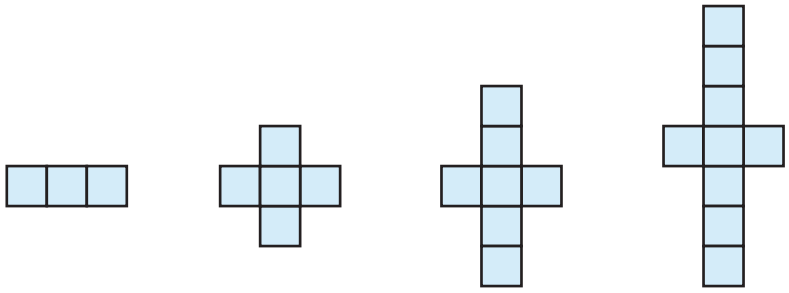


Figure 1 Figure 2 Figure 3 Figure 4

What is the rule? _____

How many squares will there be in Figure 5? _____ squares

7. Lindsey made a map of her town. Match each location below with the correct ordered pair that marks it on the coordinate plane. Not every ordered pair will be used.

Clock Tower •

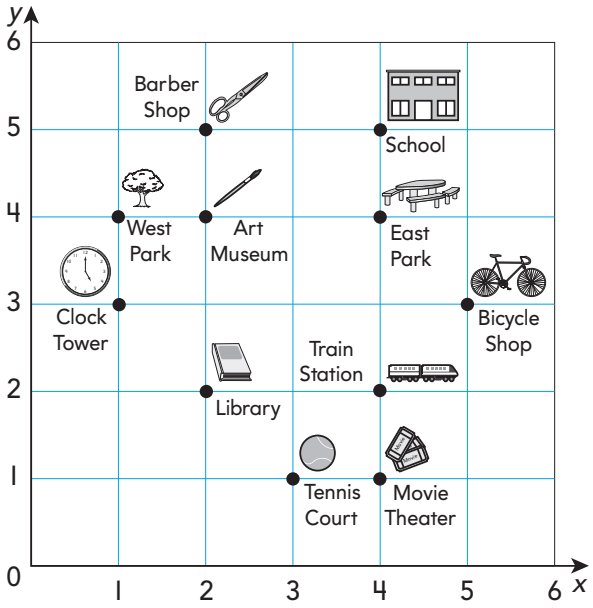
Art Museum •

East Park •

Movie Theater •

School •

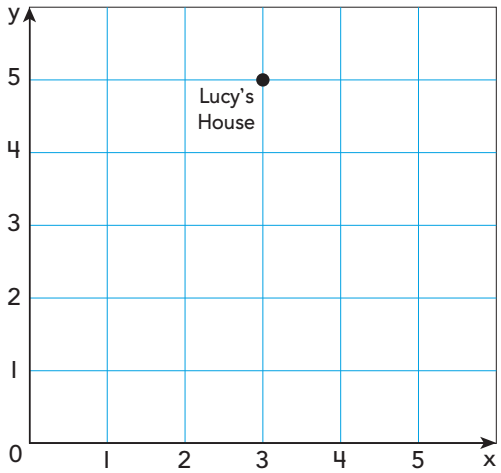
- (4, 4)
- (4, 1)
- (1, 3)
- (5, 4)
- (4, 5)
- (3, 1)
- (2, 4)
- (1, 4)
- (4, 2)



8. Lucy's house is located at the point shown on the coordinate plane. Ainsley's house is located 2 units right and 3 units down from Lucy's house. Plot a point on the coordinate plane to represent the location of Ainsley's house.

What ordered pair represents the location of Lucy's house? ☐

What ordered pair represents the location of Ainsley's house? ☐



The table shows the relationship between the number of eggs and the number of muffins.

Batches	1	2	3	4	5
Number of Eggs	2	4	6	8	10
Muffins	12	24	36	48	60

Use the table for problems 9 and 10.

9. Enter a number to complete the sentence.

Multiply the number of eggs by _____ to find the number of muffins.

10. Suppose the number of eggs is changed to 3 eggs for each batch of 12 muffins, and 48 eggs are used. How many batches and how many muffins will be made?

_____ batches and _____ muffins

11. The table shows how much a puppy weighs from 1 month old to 5 months old.

Puppy's Weight					
Age (in months)	1	2	3	4	5
Weight (in pounds)	12	18	23	31	34

What ordered pairs would you plot to show the puppy's weight on a coordinate plane? How do you think the ordered pairs would be different if the puppy's weight was measured every week instead of every month? Explain your reasoning.

Name _____

12. Randy is training for a race. She makes a table that shows how long it takes her to run different distances.

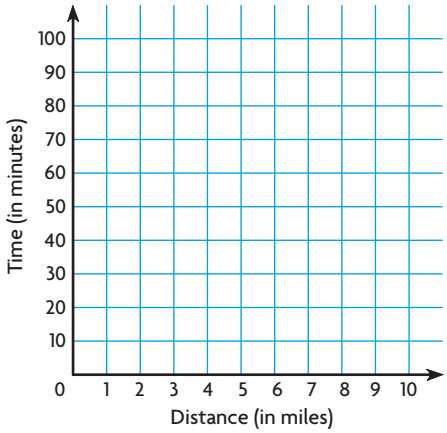
Running Time and Distance				
Distance (in miles)	1	2	3	4
Time (in minutes)	10	20	30	40

Part A

Write the number pairs as ordered pairs. Then write the rule to describe how the number pairs are related.

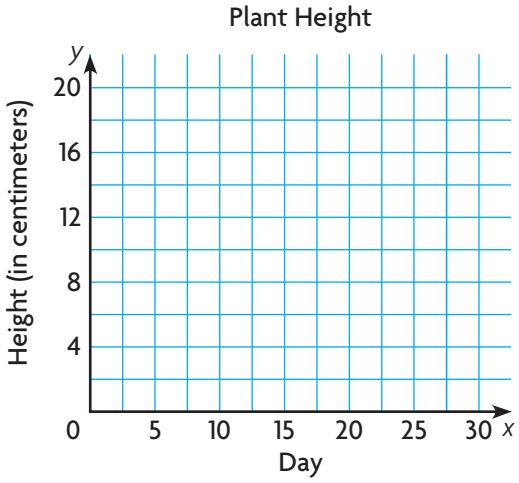
Part B

Graph the ordered pairs on the coordinate plane.



13.

Plant Height						
Day	5	10	15	20	25	30
Height (in cm)	1	3	8	12	16	19



a. Write the ordered pair for each point.

_____

_____

b. How would the ordered pairs be different if the heights of the plants were measured every 6 days for 30 days instead of every 5 days?

_____

_____

_____

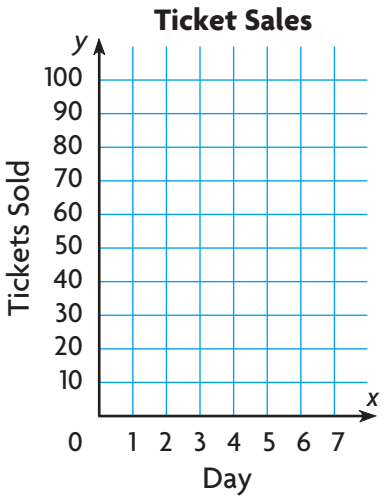
_____

_____

14. The table shows the total number of tickets sold for the school play each day for 5 days.

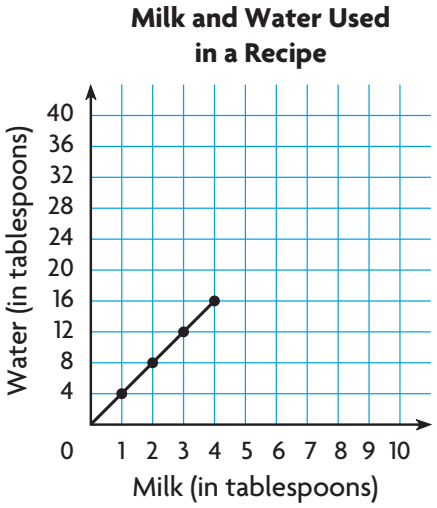
Ticket Sales					
Day	1	2	3	4	5
Tickets Sold	20	30	45	75	90

Graph the ordered pairs from the tiles on the coordinate plane.



- (1, 20)
- (2, 30)
- (3, 45)
- (4, 75)
- (5, 90)

15. The graph shows the relationship between the amounts of milk and water used in a recipe. Determine a rule that relates the amount of milk to the amount of water by writing the correct term or value from the tiles in each blank.



Subtract | Add | Multiply | Divide

1 | 2 | 4 | $\frac{1}{2}$ | $\frac{1}{4}$

Rule: _____ the amount of milk by _____.

16. Which equation describes the pattern in the table below?

Input	w	2	4	6	8
Output	c	8	16	24	32

Ⓐ $c = w \times 3$

Ⓑ $c = w \times 4$

Ⓒ $c = w + 4$

Ⓓ $w = c \times 3$