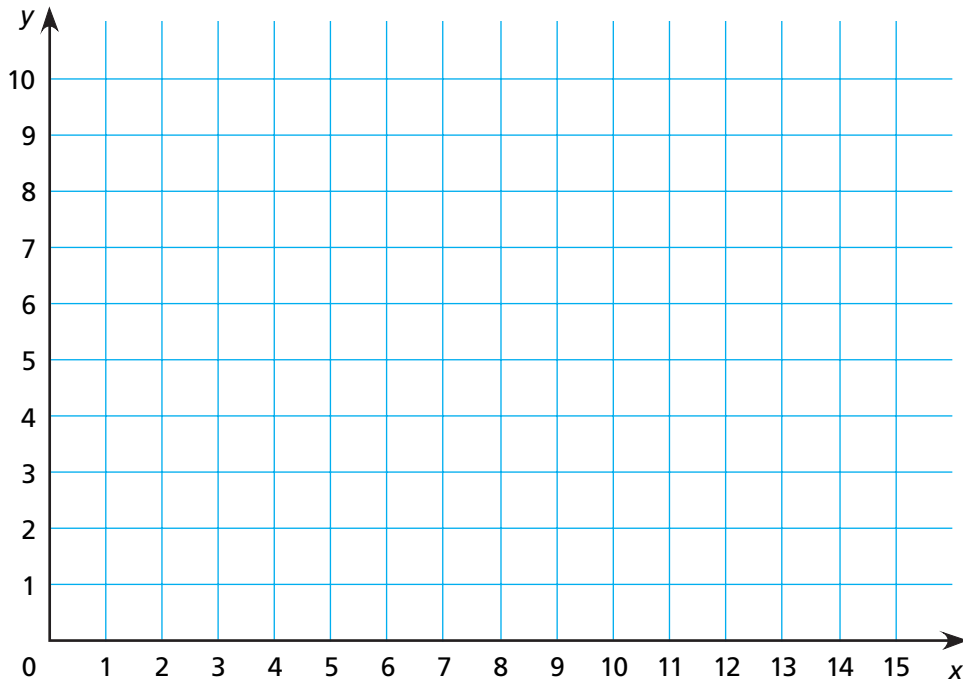


# Making Figures on a Coordinate Grid

NCTM Standards 2, 3, 7, 9, 10

- 1 Plot each point, label it, and then connect  $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$ .

Name	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Coordinates	(1,1)	(2,5)	(3,3)	(5,2)



- 2 Complete the table using the rule given.

Name	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Coordinates ( $x,y$ )	(1,1)	(2,5)	(3,3)	(5,2)
New Ordered Pairs: Double Each Coordinate ( $2x,2y$ )				

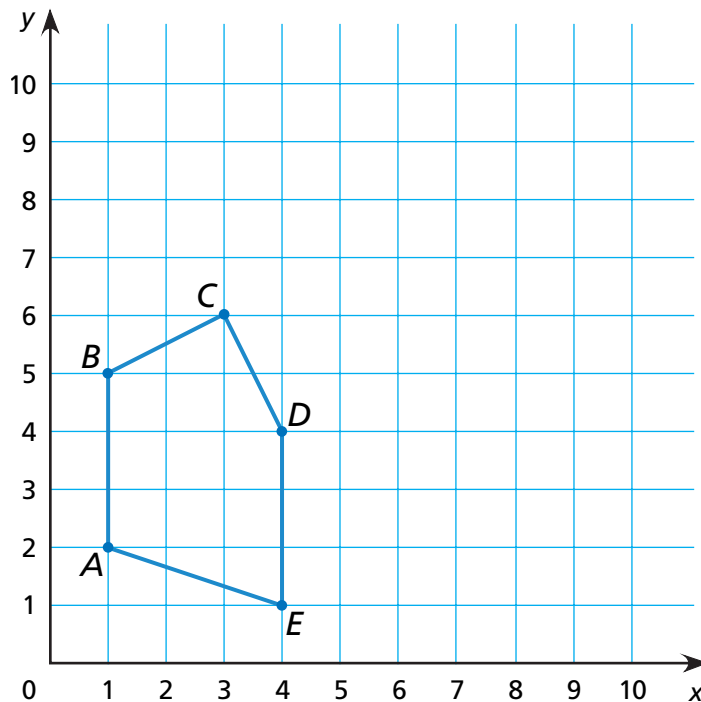
- 3 Plot the points that have the new coordinates. Connect the new points the same way:  $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$ .

**For 4 and 5, use the grid.**

- 4** Use the table to record the coordinates of the vertices of the figure shown on the grid. Then follow the rule to produce five new ordered pairs.

Name	A	B	C	D	E
Coordinates (x,y)					
New Ordered Pairs: Add 4 to each coordinate (x + 4, y + 4)					

- 5** Plot the points for the new coordinates. Connect the points in the same way the original points were connected.



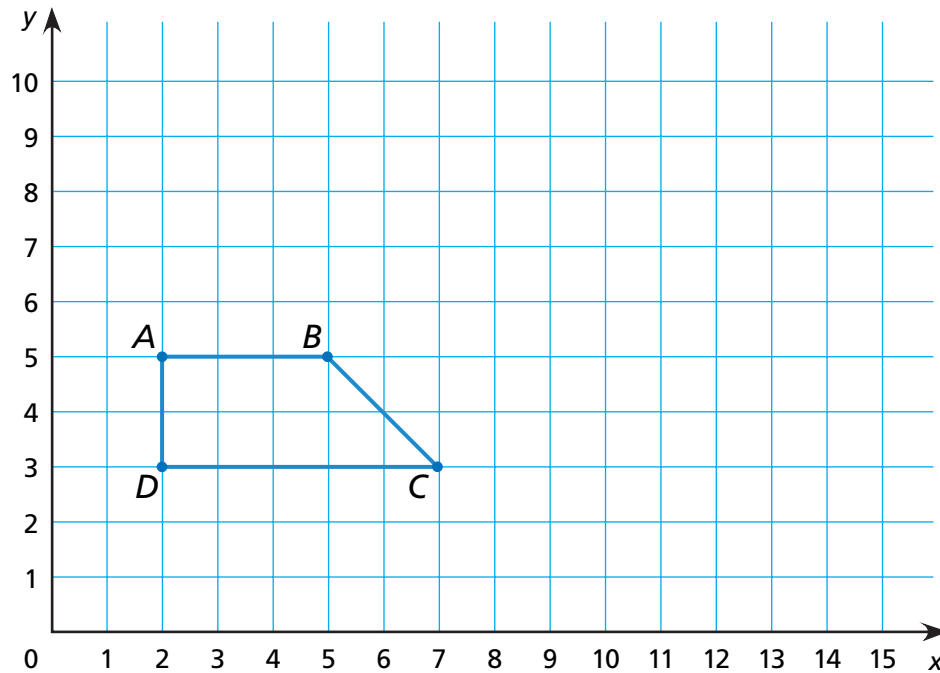
- 6 Challenge** Find a rule and complete the table. Then write the rule using shorthand notation.

Original Ordered Pairs (x,y)	(4,4)	(4,7)	(6,8)	(6,6)	(5,6)	(5,7)
New Ordered Pairs	(6,1)	(6,4)	(8,5)	(8,3)		

Rule: \_\_\_\_\_ , \_\_\_\_\_

# Translating Figures on a Grid

NCTM Standards 2, 3, 7, 8, 10



- 1 Record the coordinates of the vertices of the original trapezoid.

A	B	C	D

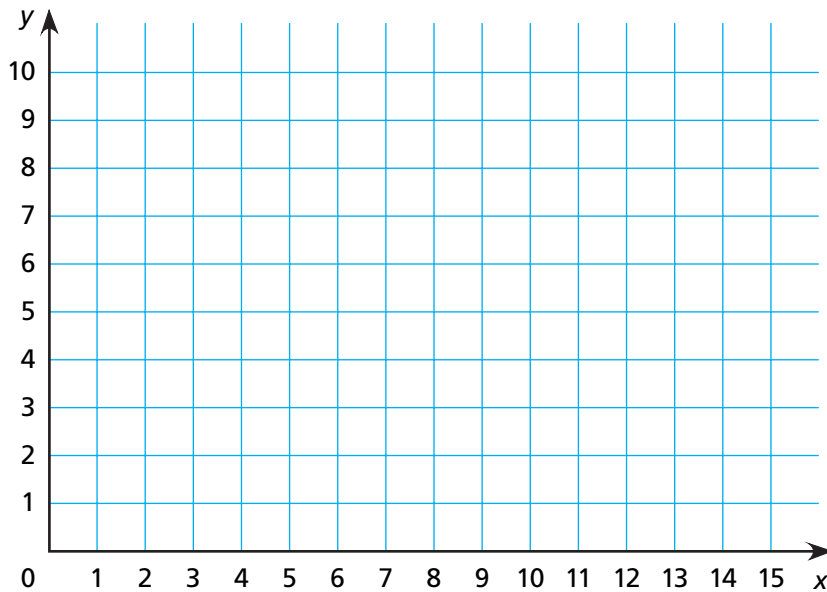
- 2 Translate the trapezoid 6 spaces to the right (east) and draw the result.

- 3 Record the new coordinates.

A'	B'	C'	D'

- 4 What is the rule?

Rule:  $(x,y)$  becomes  $(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ .



5 On the grid above, draw and label these points.

<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>
(6,10)	(8,8)	(6,6)	(4,8)

6 Then draw these line segments.  
 $\overline{LM}$ ,  $\overline{MN}$ ,  $\overline{NO}$ ,  $\overline{OL}$

7 Translate the figure 5 spaces to the right (east), and then 4 spaces down (south). Draw the new figure.

<i>L'</i>	<i>M'</i>	<i>N'</i>	<i>O'</i>

8 What is the rule for this translation?

Rule:  $(x,y)$  becomes (\_\_\_\_\_, \_\_\_\_\_).



9 **Challenge** Describe how a figure moves if the coordinates of every vertex  $(x,y)$  change to  $(x - 3, y + 4)$ .

\_\_\_\_\_

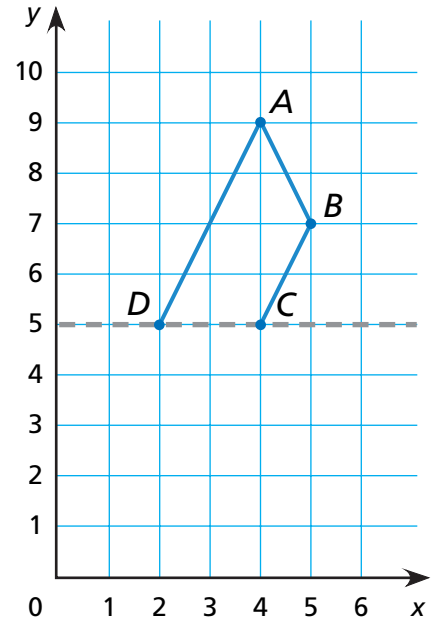
# Reflecting Figures on a Grid

NCTM Standards 3, 7, 8, 9, 10

**Complete the table below for the figure and its reflection.**

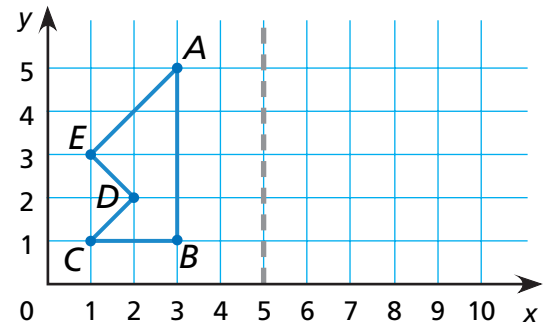
- 1 Record the coordinates of each vertex of the original figure.
- 2 Reflect the figure over the dotted horizontal line.
- 3 Record the coordinates of the corresponding vertices of the reflected image.

Vertices	Original Figure	Reflected Image
<i>A</i>		
<i>B</i>		
<i>C</i>		
<i>D</i>		



**Complete the table below for the figure and its reflection.**

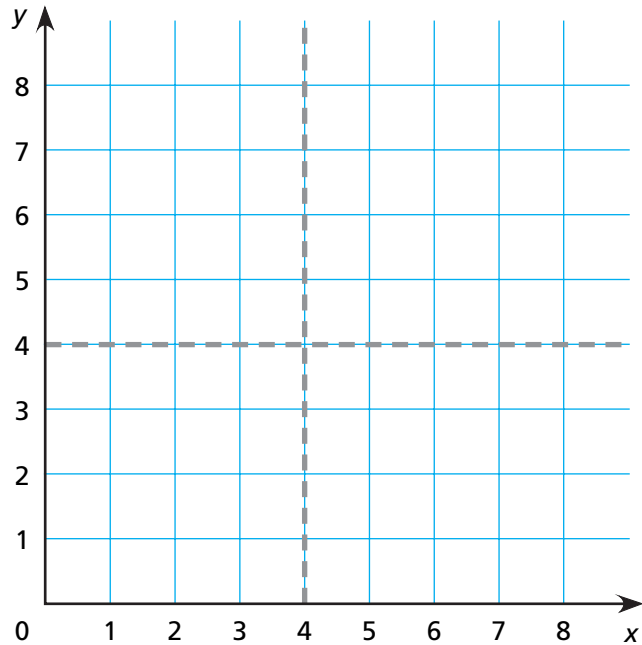
- 4 Record the coordinates for each vertex of the original figure.
- 5 Reflect the figure over the dotted vertical line.
- 6 Record the coordinates of each vertex of the reflected image.



Vertices	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Original Figure					
Reflected Image					

For 7–12, use the table and the grid to help you draw and reflect the figures.

Vertices	Figure 1	Figure 2	Figure 3
A	(1,4)		
B	(1,7)		
C	(2,7)		
D	(2,5)		
E	(4,5)		
F	(4,4)		



7 Plot the vertices of Figure 1. Label each vertex with its letter.

8 Use a straightedge to connect the vertices.  
 $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E \rightarrow F \rightarrow A$ . Label Figure 1.

9 Reflect Figure 1 over the dotted vertical line and draw the result. Label this Figure 2.

10 Record the coordinates of each vertex for Figure 2 in the table. List each reflected vertex next to the original vertex of Figure 1.

11 Reflect Figure 2 over the dotted horizontal line, draw the result, and label it Figure 3.

12 Then write the coordinates of each reflected vertex of Figure 3 next to the original vertex in Figure 2.



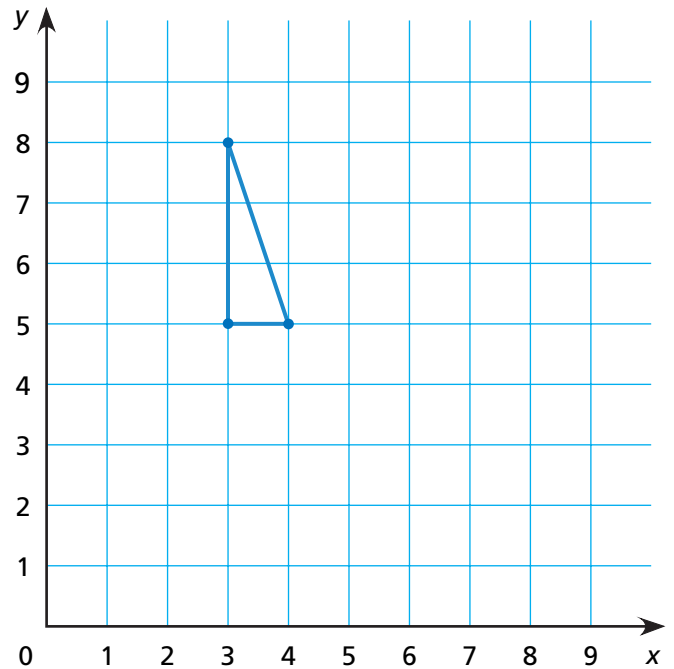
13 **Challenge** Predict the result of first reflecting Figure 3 over the dotted vertical line, and then reflecting that image over the dotted horizontal line.

\_\_\_\_\_

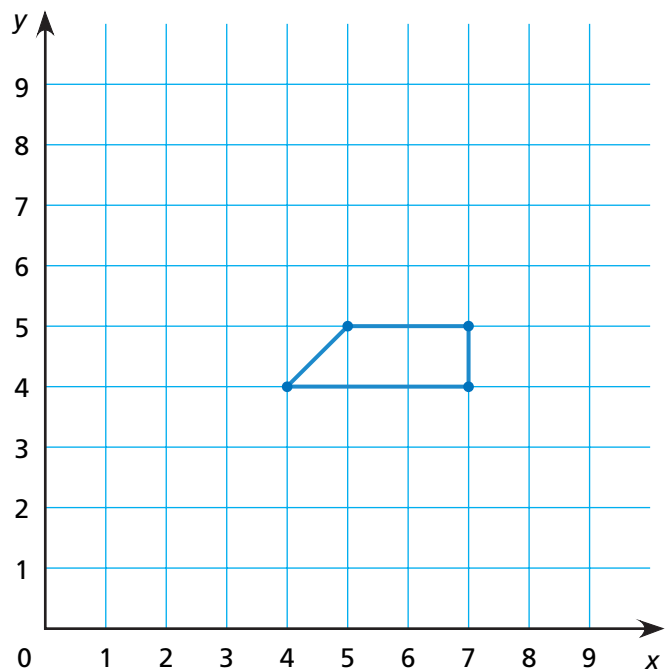
# Rotating Figures on a Grid

NCTM Standards 3, 7, 10

- 1 Rotate the triangle  $180^\circ$  counterclockwise around the point  $(4,5)$ . Draw the result.



- 2 Rotate the trapezoid  $90^\circ$  counterclockwise around the point  $(4,4)$ . Draw the result.

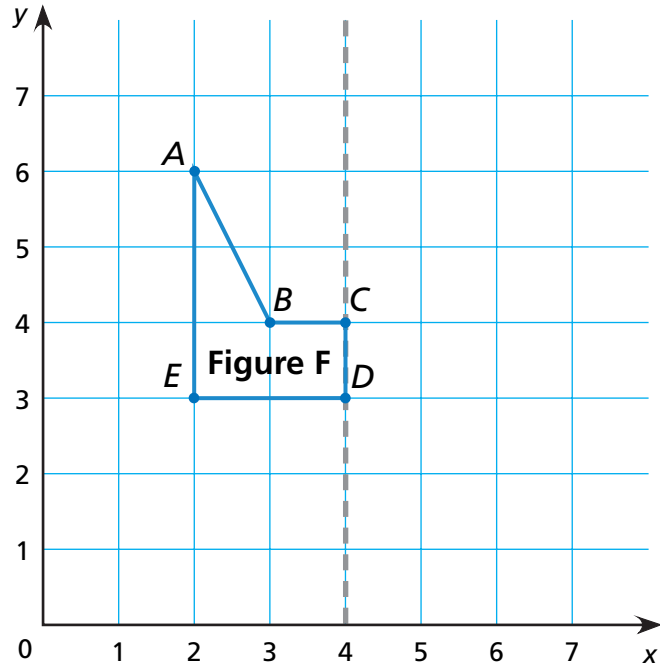


3 Rotate Figure F  $180^\circ$  around the point  $(4,3)$ . Label the rotated image Figure G.

4 Reflect Figure G over the dotted vertical line. Label the reflected image Figure H.

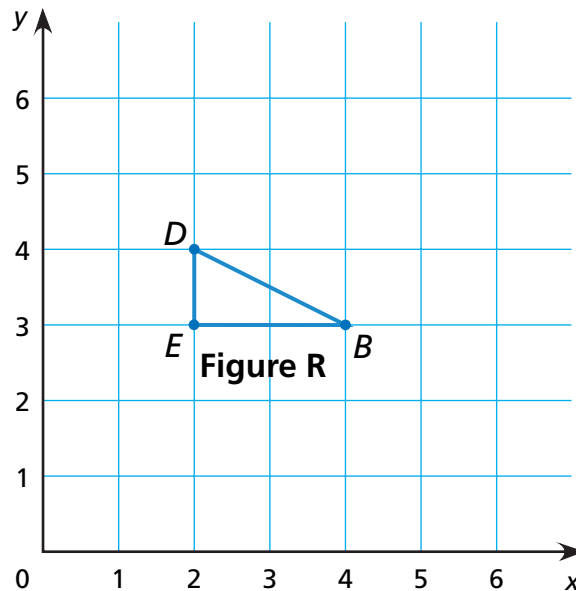
5 Record the coordinates of each vertex of Figure F and the corresponding points on Figures G and H.

	F	G	H
A	$(2,6)$		
B			
C			
D			
E			



6 Rotate Figure R  $270^\circ$  counterclockwise around point  $(5,3)$ . (Note that this point is not part of Figure R!)

Label the rotated image Figure S.



7 **Challenge** Look at Problem 6. What other rotation around the point  $(5,3)$  could produce Figure S?

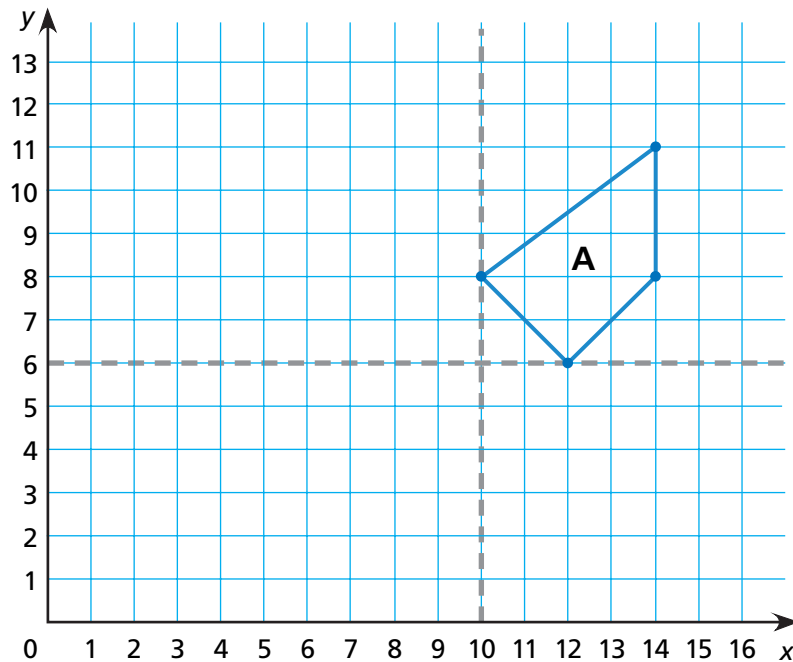
(Hint: Reverse the direction of rotation.)

\_\_\_\_\_



# More About Transformations

NCTM Standards 3, 7, 8, 10



List the vertices of Figure A. Draw and label Figures B and C, and fill in the tables of corresponding vertices.

1 Figure A:

A	(10,8)			
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2 Figure B:  
Reflect Figure A across the horizontal dotted line.

B				
---	--	--	--	--

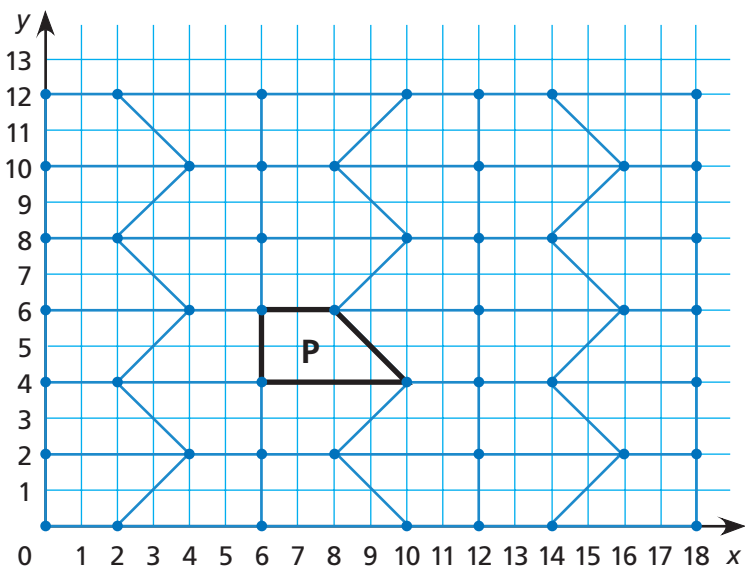
3 Figure C:  
Reflect Figure B across the vertical dotted line.

C				
---	--	--	--	--

4 Describe a single transformation to turn Figure A into Figure C.

\_\_\_\_\_

**This is a tessellation of a quadrilateral. All of the figures in it are congruent to Figure P.**



**5** List the coordinates of each vertex of Figure P in the table.

**6** Find as many examples of a translation of Figure P as you can, and label each of them S (for slide). Choose one of them and record the coordinates of its vertices in the table.

**7** Find as many examples of a reflection of Figure P as you can, and label each of them R. Choose one and fill in the table.

**8** Find as many examples of a rotation for Figure P as you can, and label each of them T (for turn). Choose one and fill in the table.

P				
S				
R				
T				



**9 Challenge** Find one of the quadrilaterals that you have not marked, and label it Q. Describe a transformation—or a combination of at most two transformations—that transform Figure P to Figure Q. Describe what you did.

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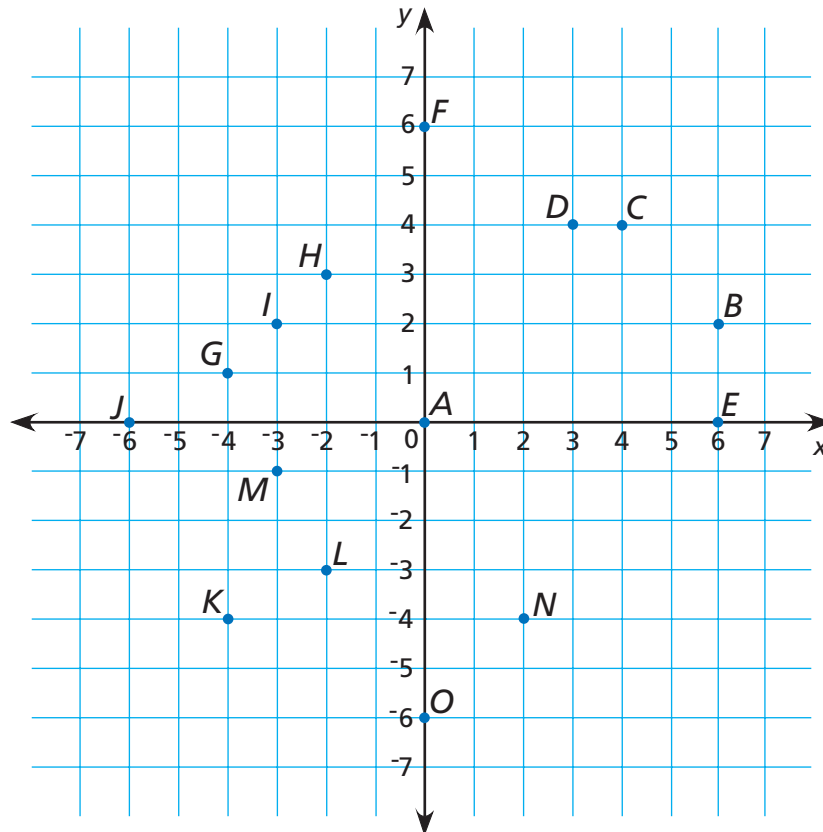


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# Graphing with Negative Numbers

NCTM Standards 3, 7, 8, 10

- 1 Write the coordinates for each labeled point, or locate and label the point.



A \_\_\_\_\_

F \_\_\_\_\_

K \_\_\_\_\_

P Find (2,6) and label it P.

B \_\_\_\_\_

G \_\_\_\_\_

L \_\_\_\_\_

Q Find (4,-4) and label it Q.

C \_\_\_\_\_

H \_\_\_\_\_

M \_\_\_\_\_

R Find (-5,-2) and label it R.

D \_\_\_\_\_

I \_\_\_\_\_

N \_\_\_\_\_

S Find (-1,4) and label it S.

E \_\_\_\_\_

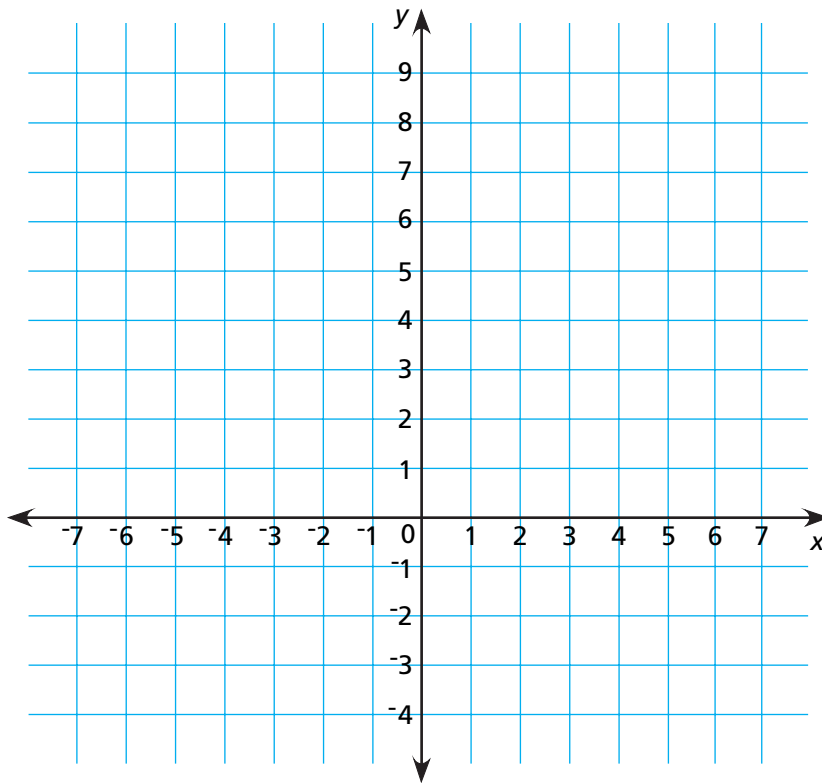
J \_\_\_\_\_

O \_\_\_\_\_

**2** Graph the points in each list. Use the pattern that you see to find the missing coordinates, and graph those points too.

**A**  $(4, -3)$ ,  $(3, -1)$ ,  $(2, \underline{\quad})$ ,  $(1, \underline{\quad})$ ,  $(0, \underline{\quad})$ ,  $(-1, \underline{\quad})$ ,  $(\underline{\quad}, 9)$

**B**  $(6, 3)$ ,  $(4, 2)$ ,  $(2, 1)$ ,  $(0, \underline{\quad})$ ,  $(\underline{\quad}, -1)$ ,  $(-4, \underline{\quad})$ ,  $(\underline{\quad}, \underline{\quad})$



Which point is in both sets of points? \_\_\_\_\_

**Challenge** Choose the phrase that correctly completes the statement.

**3** When two different points have the same  $x$ -coordinate, the line that connects them . . .

- A. must be vertical.
- B. must be horizontal.
- C. cannot be either vertical or horizontal.
- D. can go in any direction.

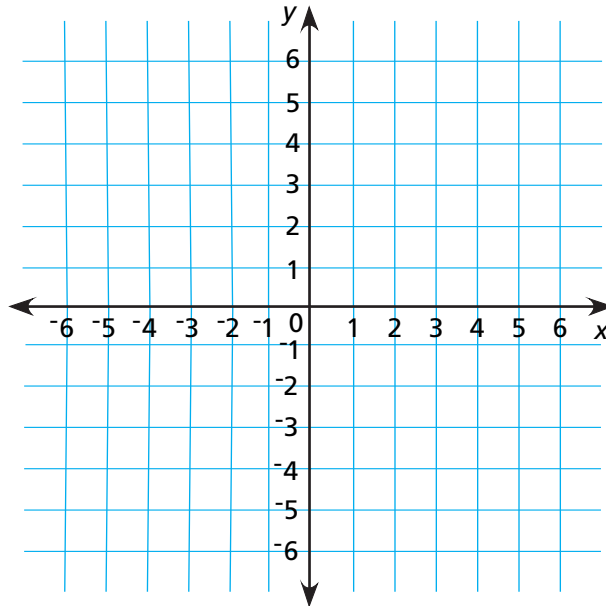
**4** When two different points have the same  $y$ -coordinate, the line that connects them . . .

- A. must be vertical.
- B. must be horizontal.
- C. cannot be either vertical or horizontal.
- D. can go in any direction.

# Moving on a Coordinate Grid

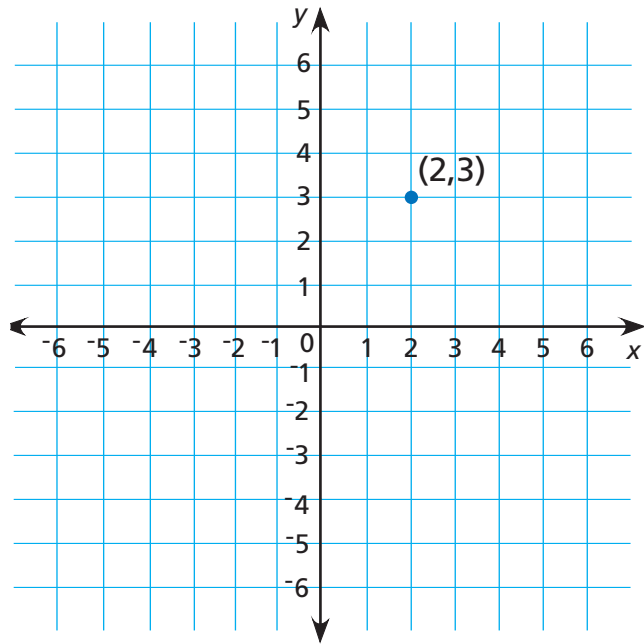
NCTM Standards 3, 7, 8, 10

Follow the directions to locate and label each point on the grid.



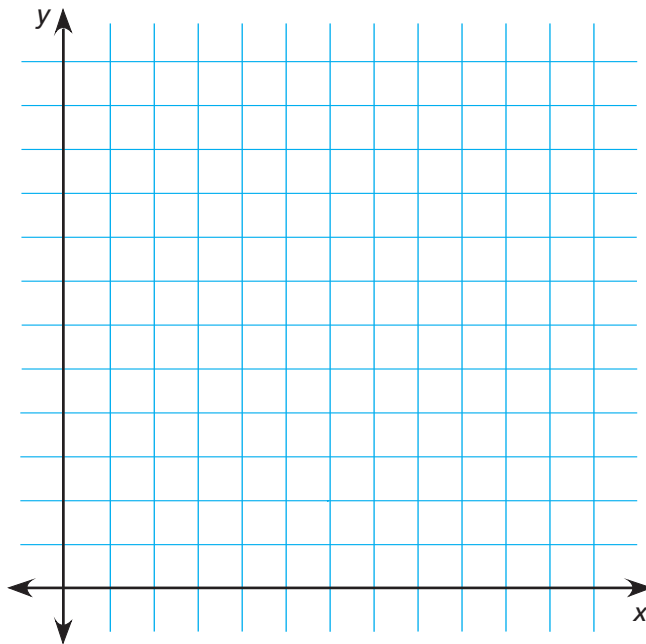
- 1 Find  $(6, -5)$  on the graph and label it **A**.  
\_\_\_\_\_
- 2 Translate (slide) **A** left two spaces and up one space.  
Label the new point **B**. What are the coordinates of **B**? \_\_\_\_\_  
\_\_\_\_\_
- 3 Translate **B** left two spaces and up one space.  
Label this point **C**. What are the coordinates of **C**? \_\_\_\_\_  
\_\_\_\_\_
- 4 Translate **C** left two spaces and up one space.  
Label this point **D**. What are the coordinates of **D**? \_\_\_\_\_  
\_\_\_\_\_
- 5 Translate **D** left two spaces and up one space.  
Label this point **E**. What are the coordinates of **E**? \_\_\_\_\_  
\_\_\_\_\_
- 6 Translate **E** left two spaces and up one space.  
Label this point **F**. What are the coordinates of **F**? \_\_\_\_\_  
\_\_\_\_\_
- 7 Translate **F** left two spaces and up one space.  
Label this point **G**. What are the coordinates of **G**? \_\_\_\_\_  
\_\_\_\_\_


- 8 Find as many points as you can for which the sum of the horizontal and vertical coordinates is 5. Label each point with its coordinates.



### Challenge

- 9 Find as many points as you can for which the product of the horizontal and vertical coordinates is 24. Label each point with its coordinates.



-  10 Describe the graph of all the points with a horizontal coordinate equal to zero.

Points on \_\_\_\_\_

# Graphing Data

NCTM Standards 5, 6, 7, 9, 10

This pictograph shows the number of hits in one season for the starting players on the Anytown Aardvarks.

- 1 How many hits did Abbot get?

\_\_\_\_\_

- 2 How many hits did Axe get?

\_\_\_\_\_

- 3 Which player(s) had exactly 50 hits for the season?

\_\_\_\_\_

- 4 How many players had more than 30 hits?

\_\_\_\_\_

- 5 Who had the most hits?

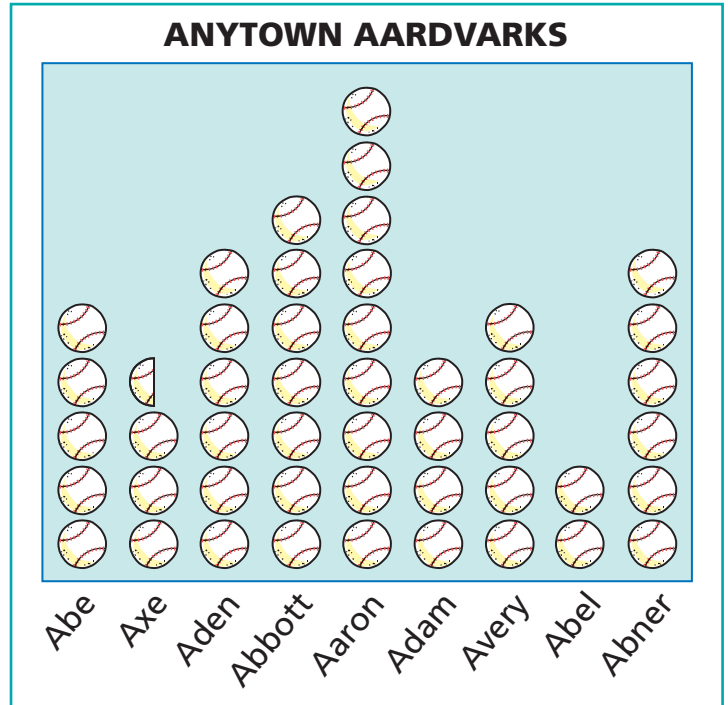
\_\_\_\_\_

How many? \_\_\_\_\_ This is the **maximum** for the set of data.

- 6 Who had the fewest hits? \_\_\_\_\_

How many? \_\_\_\_\_ This is the **minimum** for the set of data.

- 7 What is the difference between the maximum number of hits and the minimum number of hits? \_\_\_\_\_  
This is the **range** for the set of data.

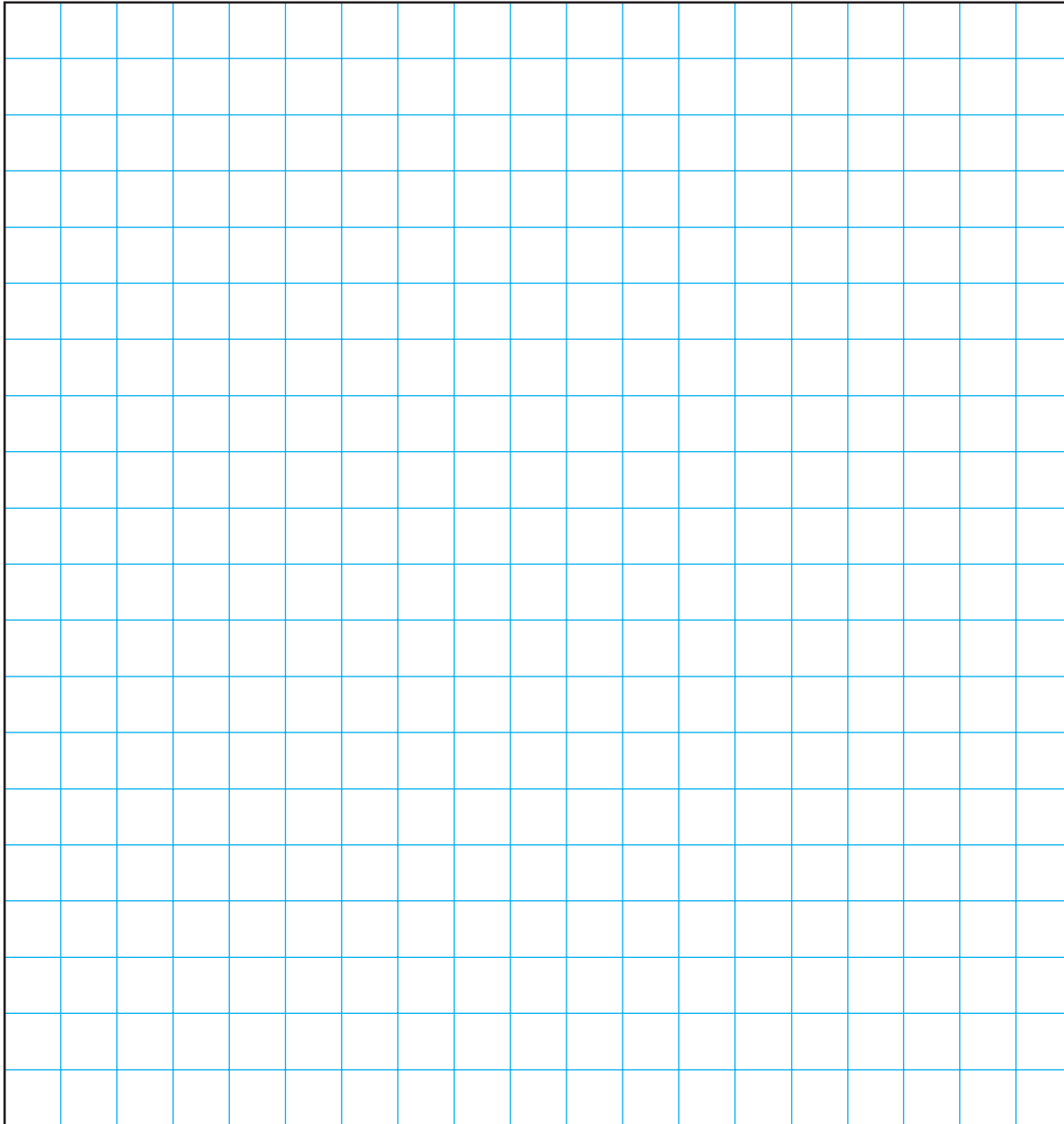


Key: Each  represents 10 hits.

This list of data shows the number of home runs in one season for all of the players on the Anytown Aardvarks team.

10, 21, 9, 20, 13, 34, 12, 7, 12, 7, 2, 1, 8, 4, 10, 0, 0, 2, 1, 1, 4

8 Make a graph of this set of data. Write a title and any necessary labels.



9 **Challenge** Complete the sentence.

Ten of the Anytown Aardvarks got more than  home runs.



# What is Typical?

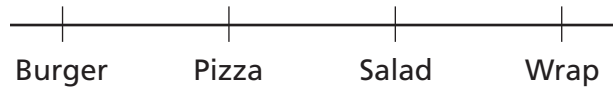
NCTM Standards 1, 5, 6, 7, 8, 9, 10

**Before opening a restaurant, Charlie conducted a survey to determine what type of food to serve, and to what age group of the population.**

- 1 Use the results of his survey to complete the graph.

FOOD PREFERENCES	
Age	Preference
10	Burger
21	Pizza
8	Wrap
18	Pizza
25	Salad
37	Salad
51	Wrap
15	Salad
28	Salad
49	Burger
12	Burger
8	Burger
14	Salad


**FOOD PREFERENCES**



- 2 Which food item is the mode? \_\_\_\_\_

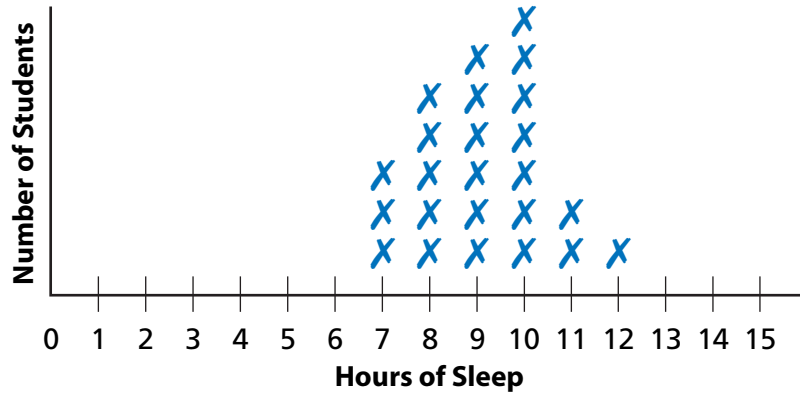
- 3 Arrange the ages in order from least to greatest.
- \_\_\_\_\_

- 4 What is the median age of respondents? \_\_\_\_\_

- 5  Charlie only wants to offer three items on his menu. Which item do you think he should not include?
- \_\_\_\_\_
- \_\_\_\_\_

Use the graphs to answer the questions.

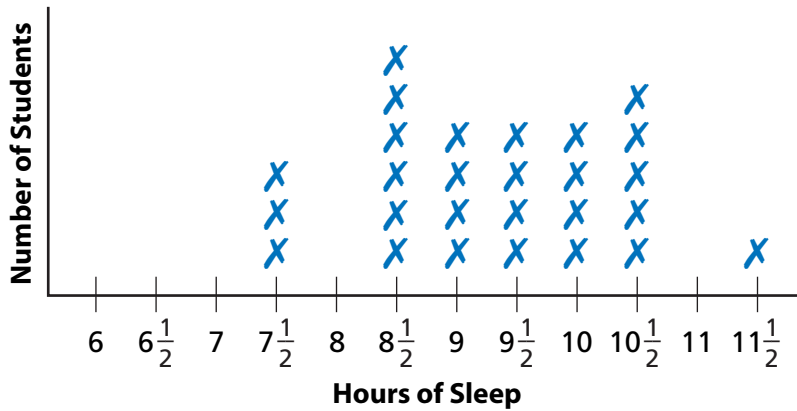
**MR. B'S FIRST 5TH GRADE SLEEP SURVEY**



- 6 What is the minimum number of hours of sleep reported? \_\_\_\_\_
- 7 What is the maximum number of hours of sleep reported? \_\_\_\_\_
- 8 What is the range of hours of sleep for these students? \_\_\_\_\_
- 9 What is the mode? \_\_\_\_\_
- 10 What is the median? \_\_\_\_\_

A new graph was made to be more specific about the amount of time students spent sleeping.

**MR. B'S SECOND 5TH GRADE SLEEP SURVEY**



- 11 What is the range of hours of sleep now? \_\_\_\_\_
- 12 What is the mode? \_\_\_\_\_
- 13 What is the median? \_\_\_\_\_

**14 Challenge** Explain whether the old or new mode or median is more accurate.

\_\_\_\_\_

\_\_\_\_\_

# Another Way of Describing What's Typical

NCTM Standards 1, 5, 6, 7, 8, 9, 10

The table shows the populations of the nine states in the United States that have the greatest populations. Use the table to answer the questions below. You may use a calculator to help you.

The Nine States with Greatest Population from the 2004 U.S. Census			
Estimated Total Population of These Nine States on July 1, 2004: 150,529,014			
State	Population	State	Population
California	35,893,799	New York	19,227,088
Florida	17,397,161	Ohio	11,459,011
Georgia	8,829,383	Pennsylvania	12,406,292
Illinois	12,713,634	Texas	22,490,022
Michigan	10,112,620		

- Which state has the greatest population? \_\_\_\_\_  
What is the population of that state? \_\_\_\_\_
- Which of these states has the least population? \_\_\_\_\_  
What is the population of that state? \_\_\_\_\_
- What is the range of populations for these states? \_\_\_\_\_
- Which state has the median population for these states? \_\_\_\_\_
- About what is the mean population for these states?  
(Hint: The addition has already been done for you!) \_\_\_\_\_
- If you were to survey all the people who live in these states about which state they live in, what would be the mode? \_\_\_\_\_

Surprisingly, Mario and Marsy had the same four test scores: 85, 90, 80, 100. Their teacher told them that these four scores and a score for homework would be used to determine their report card marks. Mario's homework score was 70 and Marsy's was 45.

7 If Mario and Marsy's teacher uses the median score to determine their grades, what will each student's score be?


Mario: \_\_\_\_\_

Marsy: \_\_\_\_\_

8 If their teacher uses the mean score to determine their grades, what will each student's score be?

Mario: \_\_\_\_\_

Marsy: \_\_\_\_\_

 9 Do you think the median or mean best reflects their performances? Explain.

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**10 Challenge** Find nine numbers that have:

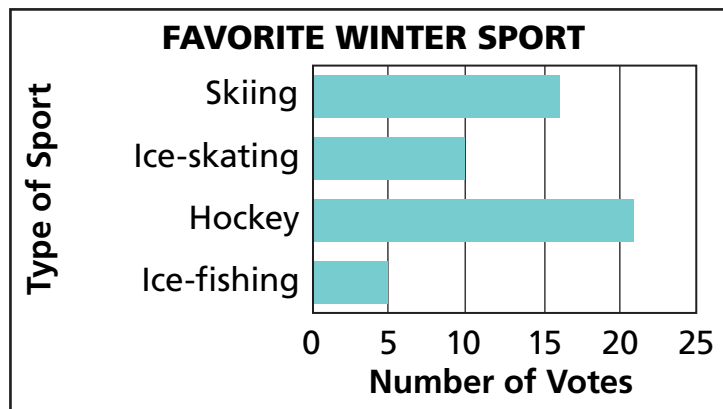
- a mean of 5, but not a median of 5. \_\_\_\_\_
- a median of 5, but not a mean of 5. \_\_\_\_\_

# Reading Graphs and Tables

NCTM Standards 5, 6, 8, 9, 10

For each graph, answer as many questions as you can. If the graph does not provide a way to figure out the answer, write "cannot tell."

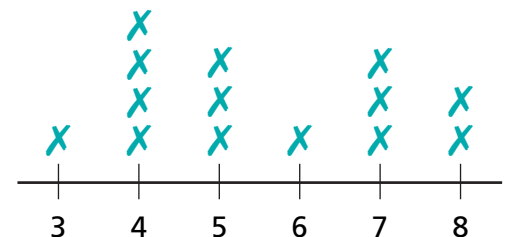
Some fifth graders in Canada were surveyed about their favorite winter sport.



- How many students were surveyed? \_\_\_\_\_
- What choice is the mode? \_\_\_\_\_
- The Sports Federation wanted to know how much more popular the most popular sport is than the least popular sport. What is the range of the number of votes? \_\_\_\_\_

Some fifth graders compared the number of letters in their first names.

## NUMBER OF LETTERS IN FIRST NAMES

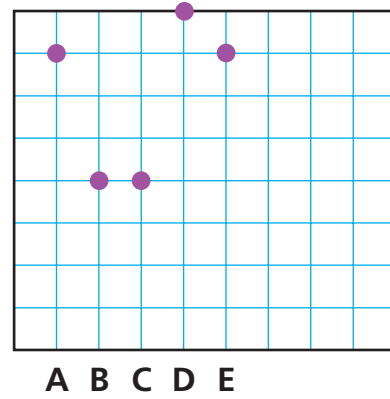


- How many names are names of girls? \_\_\_\_\_
- What is the median number of letters? \_\_\_\_\_
- How many students' names were used? \_\_\_\_\_
- The mean number of letters is between \_\_\_\_\_ letters and \_\_\_\_\_ letters.
- What number of letters is the mode? \_\_\_\_\_

Match each table to its corresponding graph.

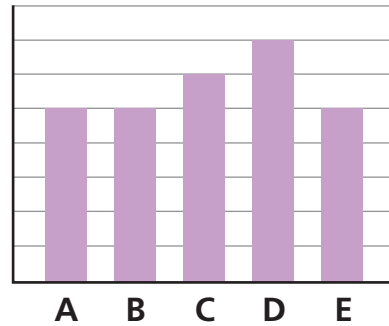
9

A	12
B	8
C	7
D	10
E	5



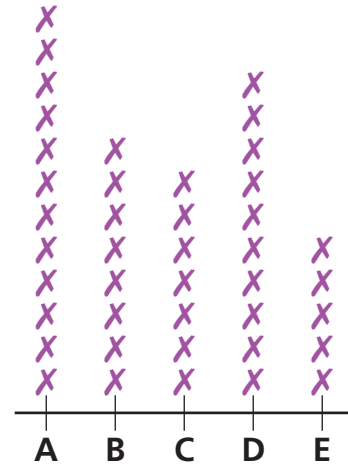
10

A	B	C	D	E
5	5	6	7	5



11

A	1	7
B	2	4
C	3	4
D	4	8
E	5	7



**12 Challenge** A city is adding lanes to their main highway. They found that there is mean of 1,075 cars per day on that highway, the median car passes through town at 3 P.M., and that the mode travel time is 5 P.M. Which piece of information will be most useful for deciding when to do construction?

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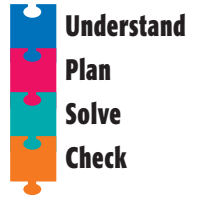


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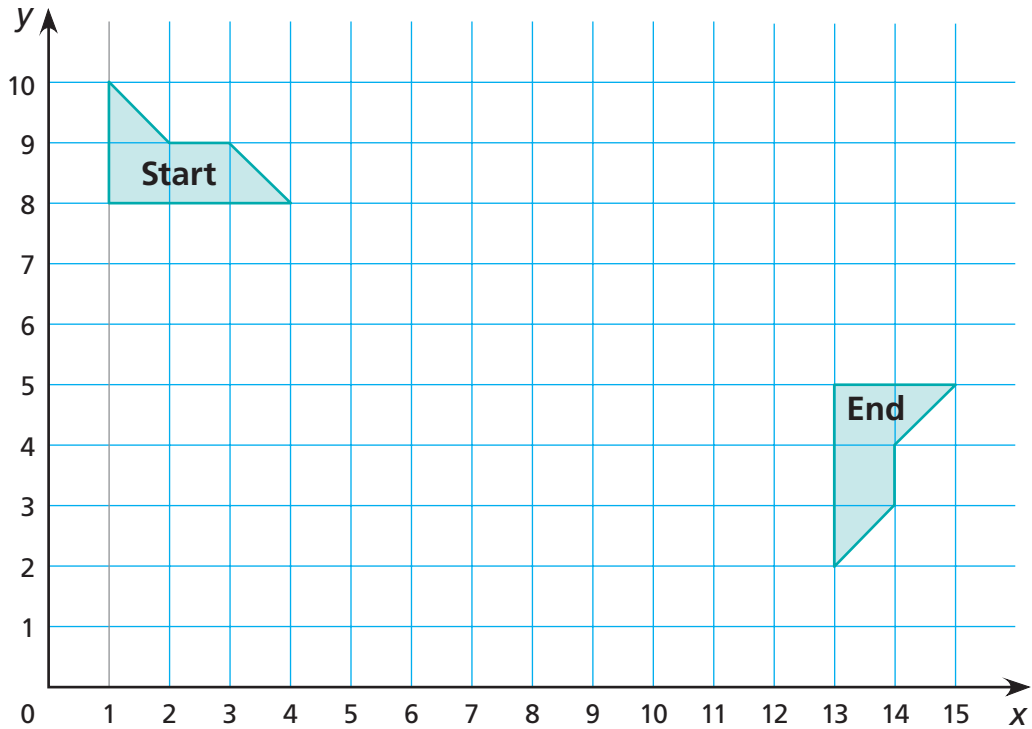
# Problem Solving Strategy

## Act It Out

NCTM Standards 3, 6, 8, 9, 10



Katy is writing a computer game about flying a spacecraft. How could she get the spacecraft from the starting position to its ending position using only 2 transformations?



Transformation 1:

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Transformation 2:

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# Problem Solving Test Prep

Choose the correct answer.

- 1 The population of a large city is 1,593,482. What will the population be when there are 10,000 more people?
- A. 1,693,482
  - B. 1,613,482
  - C. 1,603,482
  - D. 1,594,482

- 2 Diagonals drawn from the same vertex cut a polygon into triangles. How many triangles can be made this way from a 20-sided polygon?

5 sides



6 sides



7 sides

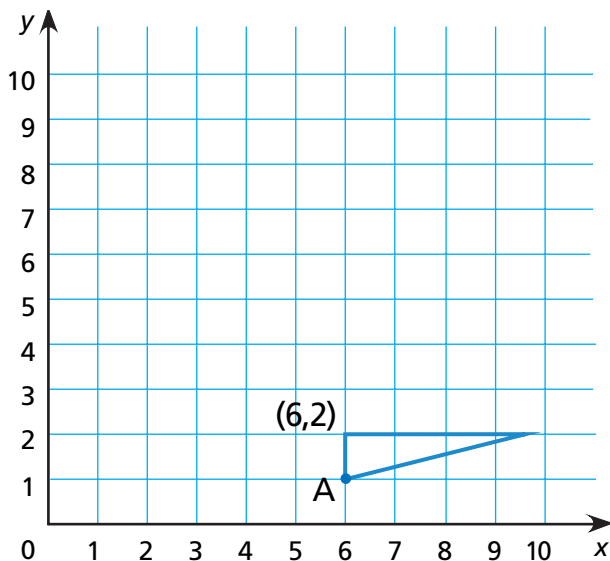


- A. 15
- B. 16
- C. 17
- D. 18

## Show What You Know

Solve each problem. Explain your answer.

- 3 Draw the results of rotating the triangle  $90^\circ$  counterclockwise around the point  $(6,2)$ . Then translate the result 5 units left. What are the coordinates of Point A in the final image?



- 4 William is making packages of pens and pencils for the school store. He has 48 pens and 60 pencils. Each package will have the same number of items and will have either pens or pencils, but never both.

- A In how many different ways can he make the packages?

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- B If he puts the largest number of pens or pencils in each package, how many packages will he have made in all? Explain.

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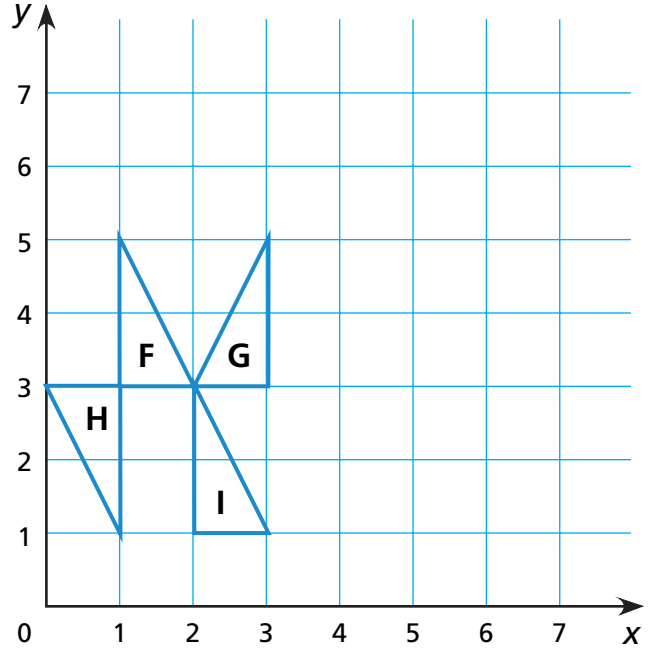


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For 1–4, list the vertices of each figure. *Lessons 2–5*

1 F	2 G	3 H	4 I
(1,3)			



- Which figure is a translation of Figure F? \_\_\_\_\_
- Which figure is a reflection of Figure F? \_\_\_\_\_
- Which figure is a rotation of Figure F? \_\_\_\_\_
- Translate Figure G two spaces to the right and one space up, draw the result, and label it Q.
- Reflect Figure I over a vertical line that goes through point (3,0). Draw the result and label it R.

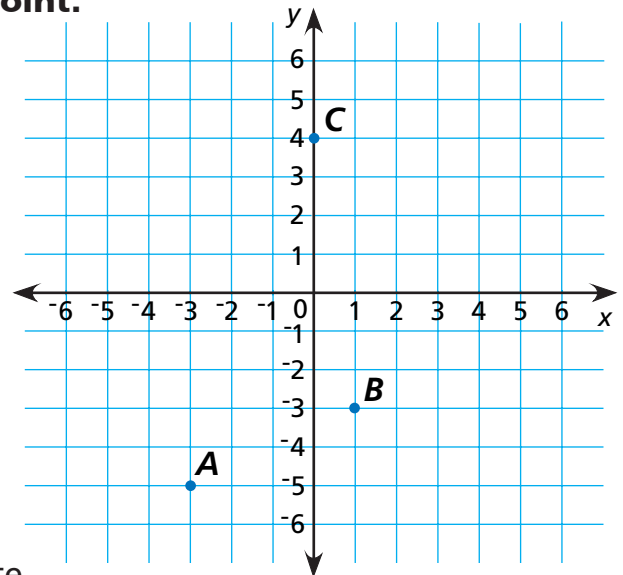
For 10–16, use the grid. *Lessons 1–7*

Write the coordinates for each labeled point.

- Point A \_\_\_\_\_
- Point B \_\_\_\_\_
- Point C \_\_\_\_\_

Plot each point on the grid.

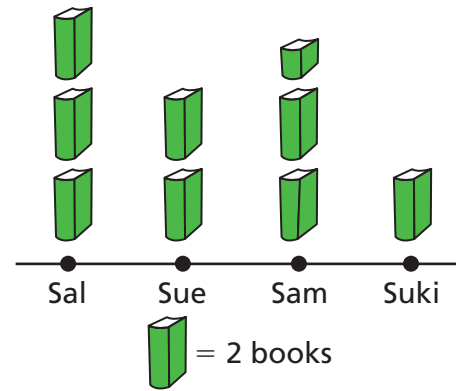
- Find (3, -2) and label it D.
- Find (-2, 4) and label it E.
- Find (-4, 0) and label it F.
- Find four points where the horizontal coordinate is double the vertical coordinate. Label each of these points with its coordinate pair.



For 17–20, use the graph.

- 17 How many books were read? \_\_\_\_\_
- 18 How many books did Sam read? \_\_\_\_\_
- 19 What is the range of books read? \_\_\_\_\_
- 20 What is the median number of books read? \_\_\_\_\_

BOOKS READ IN A MONTH



The table shows Morgan's spelling scores for 8 weeks.

MORGAN'S SPELLING SCORES

Week	1	2	3	4	5	6	7	8
Score	83	72	96	72	72	91	95	83

- 21 Make a frequency graph of her scores.

\_\_\_\_\_

Find these data measures.

- 22 range: \_\_\_\_\_
- 23 mode: \_\_\_\_\_
- 24 median: \_\_\_\_\_
- 25 mean: \_\_\_\_\_

Solve the problem. Lesson 12

- 26 Beth made a design to use as a border around the ceiling of her bedroom. To make the design she started with the figure on the grid. She reflected the figure over the vertical dotted line.

- A Draw the new figure on the grid.
- B Which vertex on the new figure corresponds to the vertex at (1,1) on the original figure?

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