Lesson 27

DRAWING POLYGONS IN THE COORDINATE PLANE 6.G.A.3

WORDS TO KNOW

coordinate plane

vertices

INTRODUCTION

Real-World Connection

Kyle is riding his bike around town. According to his map, his house is located at $(-2, -1)$, the library is at $(-2, 4)$, his school is at $(4, 4)$, and his best friend's house is at $(4, -1)$. He started at his house, rode to the library, the school, and his friend's house. Then, he went back home. If each unit is 1 block, how many blocks did Kyle ride in all? Let's practice the skills in the **Guided Instruction** and **Independent Practice** and see how far Kyle rides at the end of the lesson!

What I Am Going to Learn

- How to draw polygons with coordinates as vertices in the coordinate plane
- How to use coordinates to find the length of sides joining points with the same first or same second coordinate

What I May Already Know 5.G.A.1, 5.G.A.2

- I know how to graph points in the first quadrant of the coordinate plane.
- I know how to represent real-world problems by graphing points in the first quadrant of the coordinate plane.

Vocabulary in Action

The **coordinate plane** can be used to draw polygons when given the coordinates of the corners, or **vertices**.

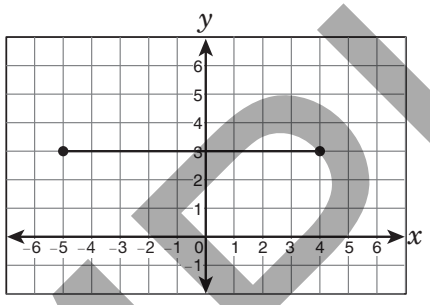
- If the *x*-coordinates of two points are the same and the *y*-coordinates are different, the line joining the two points is vertical.
- If the *y*-coordinates of two points are the same and the *x*-coordinates are different, the line joining the two points is horizontal.

You can find the length of a vertical or horizontal side of a polygon.

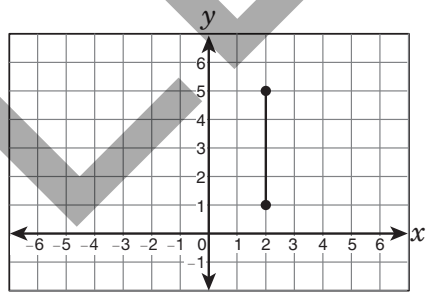
- If both coordinates are in the same quadrant, subtract the absolute value of the coordinates that are different: (5, −9) and (5, −3), $|-9| - |-3| = 6$.
- If the coordinates are in different quadrants, add the absolute value of the coordinates that are different: (−6, 7) and (4, 7), $|-6| + |4| = 10$.
- You can also count units in the coordinate plane to find distances.

EXAMPLE

Find the length of each segment.



$|-5| + |4| = 9$



$5 - 1 = 4$

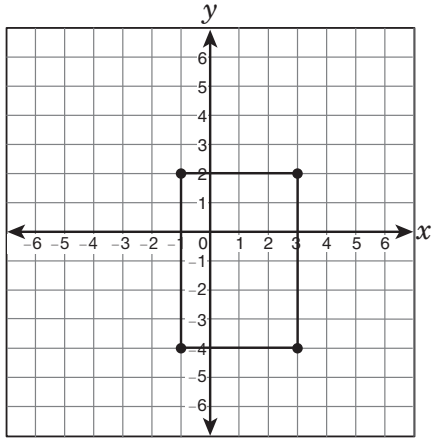
THINK ABOUT IT

Absolute value is the distance from a point to 0 on a number line. On a coordinate plane, it is the distance from the *x*-axis or *y*-axis.

You can use the distance between points to find the perimeters and areas of rectangles by using the formulas that you know.

EXAMPLE

Find the perimeter and area of each figure.



Rectangle

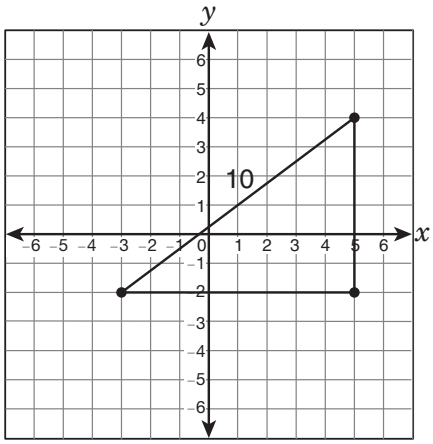
length $= |-1| + |3| = 4$
width $= |-4| + |2| = 6$

Perimeter $= 4 + 6 + 4 + 6 = 20$ units

Area $= 4 \times 6 = 24$ square units

TIPS AND TRICKS

Be sure to look carefully at the diagram for information. For sides that are not vertical or horizontal, the lengths of the sides most likely will be given in the diagram.



Triangle

base = $|-3| + |5| = 8$
height = $|-2| + |4| = 6$
long side = 10

Perimeter = $8 + 6 + 10 = 24$ units

Area = $\frac{1}{2} \times 8 \times 6 = 24$ square units

SKETCH IT

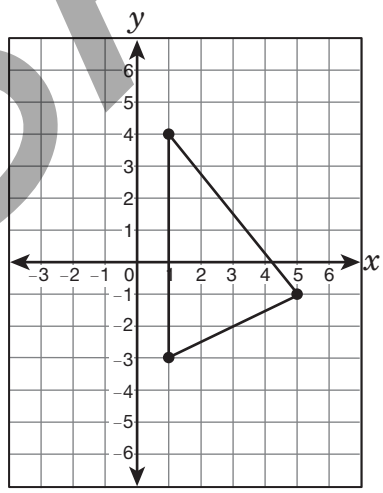
Can you draw another rectangle and another triangle that have the same area, but with one of their vertices at the origin (0, 0)?

GUIDED INSTRUCTION

1. Find the area of a triangle with vertices at (1, 4), (5, −1), and (1, −3).

Step One Plot the points on the coordinate plane.

Connect the vertices to draw the triangle.



Step Two The vertical segment is the base.

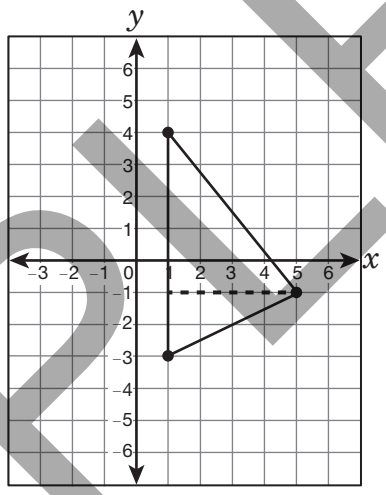
Find its length by adding the absolute values of the *y*-coordinates.

$|4| + |-3| = 7$

The base is 7 units long.

Step Three The height is perpendicular to the base.

Draw a horizontal segment from the opposite vertex to the base.



Step Four Find the height by subtracting the *x*-coordinates.

$5 - 1 = 4$

Step Five Find the area of the triangle.

$A = \frac{1}{2}bh$

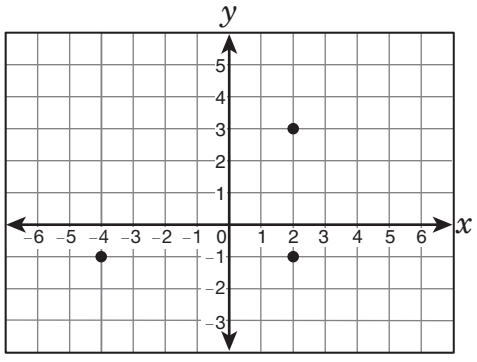
$A = \left(\frac{1}{2}\right)(7)(4)$

$A =$ ☐ square units

TIPS AND TRICKS

If you have the graph drawn, you can count the distance between points. Think about whether it is easier to count or to calculate using absolute values.

2. Find the coordinate of the fourth vertex of the rectangle formed by the points shown.



Step One The missing point must have the same *x*-coordinate as the bottom left vertex. Find the *x*-coordinate.

(−4, *y*)

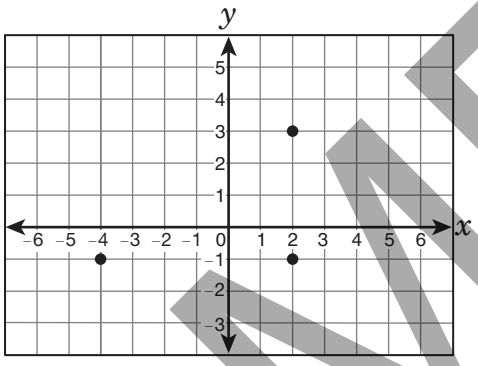
Step Two The missing point must have the same *y*-coordinate as the top right vertex. Find the *y*-coordinate.

(*x*, 3)

Step Three Find the (*x*, *y*) coordinate of the missing point.

Graph the point to check your work.

(☐)



3. Compare the distance between each set of points. Write one letter in each box.

A: (2, −3) and (2, 2)

B: (−4, 3) and (−1, 3)

C: (−3, −1) and (1, −1)

☐ < ☐ < ☐

HINT, HINT

Find the distance between the coordinates that are *different* OR sketch your own graph of each set of points!

How Am I Doing?

What questions do you have?

What method would you use to find length of a city block if the city block were plotted on a coordinate graph as a segment with endpoints at (0, −4) and (0, 6)?

What information would you need to know or find out to find the area of a rectangular plot of land drawn on the coordinate plane?

Color in the traffic signal that shows how you are doing with the skill.

INDEPENDENT PRACTICE

Answer the questions.

1. What is the distance between $(-2, -3)$ and $(-7, -3)$?

   Ⓐ 0
   Ⓑ 5
   Ⓒ 6
   Ⓓ 9

2. Which distances between the points are less than 5 units? Select **two** answers.

   Ⓐ $(-1, 3)$ and $(4, 3)$
   Ⓑ $(-3, 2)$ and $(-3, -1)$
   Ⓒ $(-2, 0)$ and $(4, 0)$
   Ⓓ $(2, -1)$ and $(2, -5)$

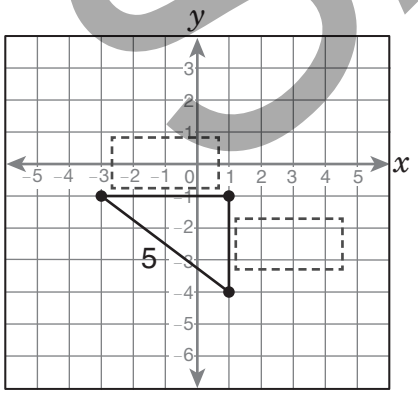
HINT, HINT

The question asks for distances less than 5 units. Think about what would happen if the distance is exactly 5 units.

3. Use the numbers in the box to label the dimensions of the triangle below and find the perimeter and area.

   Numbers can be used more than once. Write each number in the appropriate box.

2	3	4	5	6	7	12	13



Perimeter = ☐ units

Area = ☐ square units

WORK SPACE

4. Compare the distance between each set of points. Write the letters in each box.

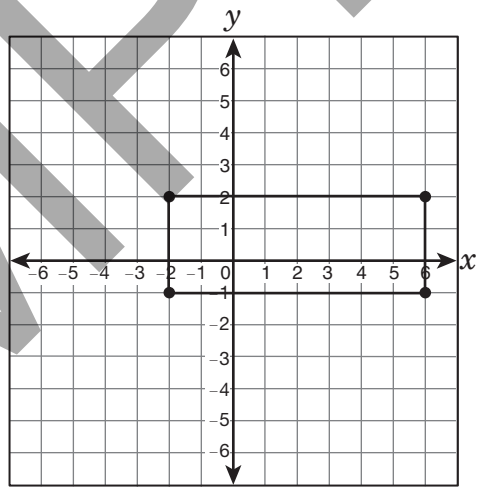
A: (−2, −1) and (−2, 5)

B: (1, 2) and (1, −3)

C: (−2, 4) and (5, 4)

[ ] < [ ] < [ ]

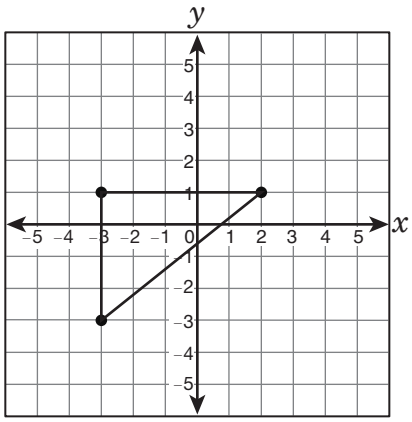
5. Circle the number that correctly completes the statement.



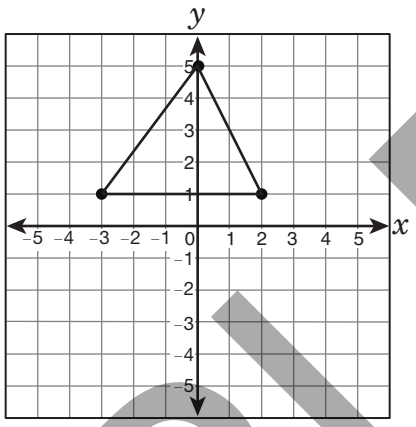
The perimeter of the rectangle is [11 / 12 / 22 / 24] units.

6. A triangle has its base at vertices (−3, 1) and (2, 1) and has a height of 4 units. Which of these are possible drawings of this triangle? Select the **three** correct answers.

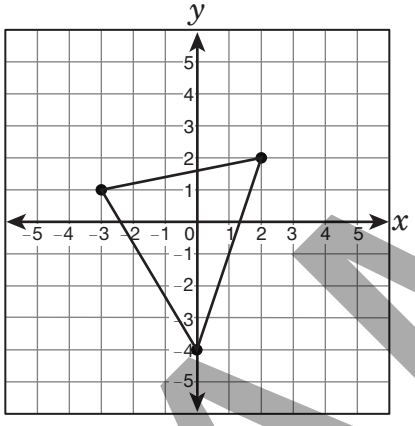
Ⓐ



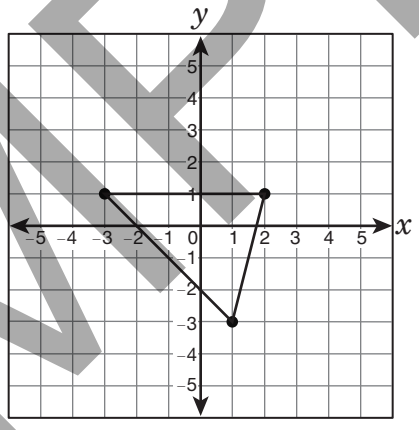
Ⓑ



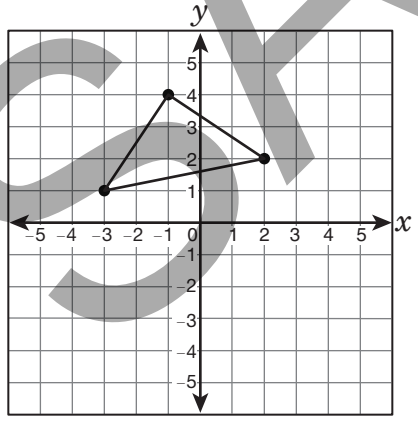
Ⓒ



Ⓓ



Ⓔ

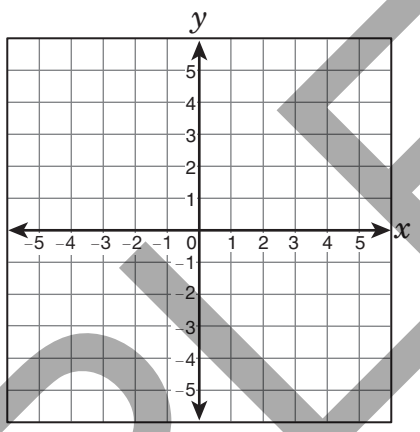


WORK SPACE

7. Part A

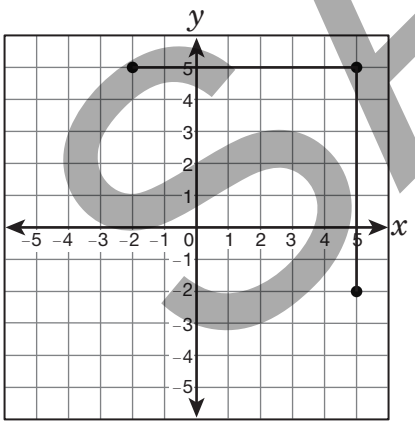
Use the grid to draw a polygon with vertices at the following coordinates:

(1, −3), (4, −3), (1, 4), (4, 4)



Part B

Find the area of the rectangle. Explain your answer.



8.

The city council is planning to build a new rectangular-shaped park. The coordinates for three of the corners have been located. Explain how to find the coordinates of the final vertex.

EXIT TICKET

6.G.A.3

Now that you have mastered drawing polygons in the coordinate plane, let's solve the problem in the **Real-World Connection**.

Kyle is riding his bike around town. According to his map, his house is located at $(-2, -1)$, the library is at $(-2, 4)$, his school is at $(4, 4)$, and his best friend's house is at $(4, -1)$. He started at his house, rode to the library, the school, and his friend's house. Then, he went back home.

If each unit is 1 block, how many blocks did Kyle ride in all?