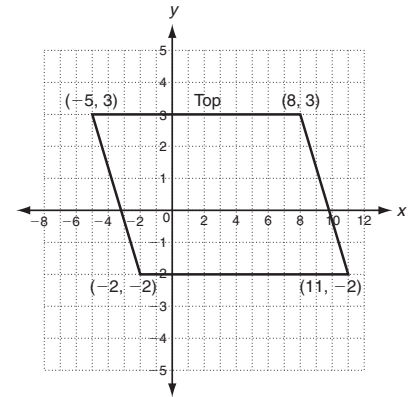


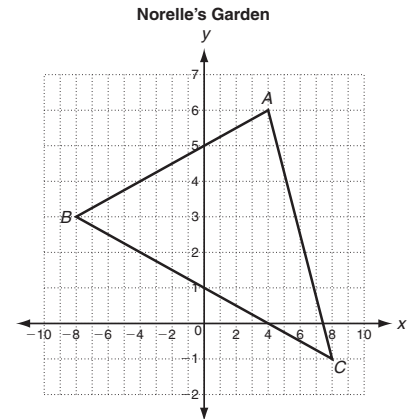
LESSON **5-8** **Problem Solving**
Slopes of Parallel and Perpendicular Lines

Write the correct answer.

1. Hamid is making a stained-glass window. He needs a piece of glass that is a perfect parallelogram. Hamid lays a piece of glass that he has cut on a coordinate grid. Show that the glass is in the shape of a parallelogram.



2. Norelle's garden is shown at right. Is her garden in the shape of a right triangle? Justify your answer.



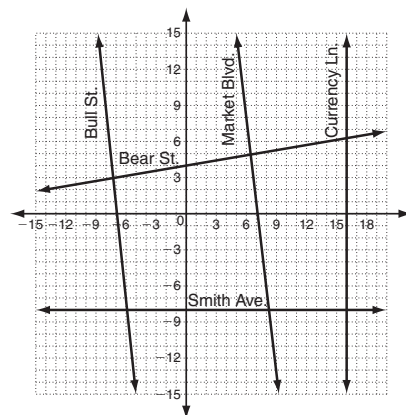
The graph shows a street map. Use it to answer questions 3–5.

3. The district plans to add Industrial Road next year. It will run perpendicular to Smith Ave. and pass through $(-14, 2)$. What equation will describe the location of Industrial Road?

- A** $y = 14 - x$ **C** $y = -14$
B $y = x - 14$ **D** $x = -14$

4. In two years, the business district plans to add Stock Street. It will run parallel to Market Blvd. and pass through $(-1, 5)$. What equation will describe the location of Stock Street?

- F** $y = -7x + 12$ **H** $y = \frac{1}{7}x + \frac{34}{7}$
G $y = -7x - 2$ **J** $y = \frac{1}{7}x + \frac{36}{7}$



5. What is the slope of a street parallel to Bear Street?

- A** -7 **C** $\frac{1}{7}$
B $-\frac{1}{7}$ **D** 7

LESSON **Reteach**

5-3 Slopes of Parallel and Perpendicular Lines (continued)

Write an equation in slope-intercept form for the line that passes through (2, 4) and is parallel to $y = 3x + 2$.

Step 1: Find the slope of the line. The slope is 3.

Step 2: Write the equation in point-slope form.

$$y - y_1 = m(x - x_1)$$

$$y - 4 = 3(x - 2)$$

Step 3: Write the equation in slope-intercept form.

$$y - 4 = 3(x - 2)$$

$$y - 4 = 3x - 6$$

$$+ 4 \quad + 4$$

$$y = 3x - 2$$

Write an equation in slope-intercept form for the line that passes through (2, 5) and is perpendicular to $y = \frac{2}{3}x + 2$.

Step 1: Find the slope of the line and the slope for the perpendicular line.

The slope is $\frac{2}{3}$. The slope of the perpendicular line will be $-\frac{3}{2}$.

Step 2: Write the equation (with the new slope) in point-slope form.

$$y - y_1 = m(x - x_1)$$

$$y - 5 = -\frac{3}{2}(x - 2)$$

Step 3: Write the equation in slope-intercept form.

$$y - 5 = -\frac{3}{2}(x - 2)$$

$$y - 5 = -\frac{3}{2}x + 3$$

$$+ 5 \quad + 5$$

$$y = -\frac{3}{2}x + 8$$

Write the slope of a line that is parallel to, and perpendicular to, the given line.

3. $y = 6x - 3$ parallel: $\frac{6}{1}$ perpendicular: $-\frac{1}{6}$

4. $y = \frac{4}{3}x - 1$ parallel: $\frac{4}{3}$ perpendicular: $-\frac{3}{4}$

5. Write an equation in slope-intercept form for the line that passes through (6, 5) and is parallel to $y = -x + 4$.

$$y = -x + 11$$

6. Write an equation in slope-intercept form for the line that passes through (8, -1) and is perpendicular to $y = -4x - 7$.

$$y = \frac{1}{4}x - 3$$

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LESSON **Challenge**

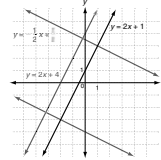
5-3 Constructing Polygons Using Parallel and Perpendicular Lines

Two facts about parallel and perpendicular lines are summarized below.

If two nonvertical lines are parallel, then their slopes are equal.

If two nonvertical lines are perpendicular, then their slopes are negative reciprocals of one another.

You can use these facts if you want to construct special polygons on the coordinate plane.



In Exercises 1–4, use the grid and the graph of $y = 2x + 1$.

- a. Write an equation in slope-intercept form for the line parallel to the graph of $y = 2x + 1$ and having a y -intercept of 4. $y = 2x + 4$

b. Graph your equation on the grid at right above.
- a. Find the y -coordinate of the point on the graph of $y = 2x + 1$ for which $x = -2$. -3

b. Find an equation for the line containing the point found in Part a and perpendicular to the graph of $y = 2x + 1$

c. Graph your equation from Part b on the grid at right above.

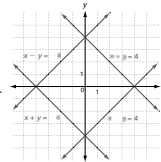
$$y = -\frac{1}{2}x - 4$$

- a. Find the y -coordinate of the point on the graph of $y = 2x + 1$ for which $x = 1$. 3

b. Find an equation for the line containing the point found in Part a and perpendicular to the graph of $y = 2x + 1$.

$y = -\frac{1}{2}x + \frac{7}{2}$

c. Graph your equation from Part b on the grid at right above.
- Identify the polygon that you formed. Explain your response. **It is a rectangle because it has four right angles.**



In Exercises 5 and 6, use the grid at right.

- Suppose that you want to make a square using the graph of $x + y = 4$ to help determine one side of the square. Write equations in standard form to determine a square with corners at (4, 0), (0, 4), (-4, 0) and (0, -4). $x - y = -4$; $x + y = -4$; $x - y = 4$;
- On the grid at right, graph each of the equations that you wrote $x + y = 4$

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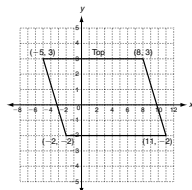
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LESSON **Problem Solving**

5-3 Slopes of Parallel and Perpendicular Lines

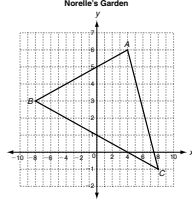
Write the correct answer.

1. Hamid is making a stained-glass window. He needs a piece of glass that is a perfect parallelogram. Hamid lays a piece of glass that he has cut on a coordinate grid. Show that the glass is in the shape of a parallelogram.



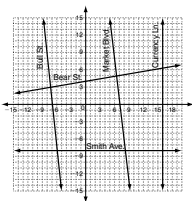
The top and bottom are parallel because they are both horizontal. The sides are parallel because they both have a slope of $-\frac{5}{3}$. It is a parallelogram because both pairs of opposite sides are parallel.

2. Norelle's garden is shown at right. Is her garden in the shape of a right triangle? Justify your answer.



The slope of AB is $\frac{1}{4}$, the slope of AC is $-\frac{7}{4}$, and the slope of BC is $-\frac{1}{4}$. None of the slopes have a product of -1 so no sides are perpendicular.

The graph shows a street map. Use it to answer questions 3–5.



- The district plans to add Industrial Road next year. It will run perpendicular to Smith Ave. and pass through (-14, 2). What equation will describe the location of Industrial Road?

A $y = 14 - x$ C $y = -14$
 B $y = x - 14$ D $x = -14$
- In two years, the business district plans to add Stock Street. It will run parallel to Market Blvd. and pass through (-1, 5). What equation will describe the location of Stock Street?

F $y = -7x + 12$ H $y = \frac{1}{7}x + \frac{34}{7}$
 G $y = -7x - 2$ J $y = \frac{1}{7}x + \frac{36}{7}$

- What is the slope of a street parallel to Bear Street?

A -7 C $\frac{1}{7}$
 B $-\frac{1}{7}$ D 7

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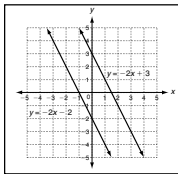
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LESSON **Reading Strategies**

5-3 Compare and Contrast

Parallel Lines

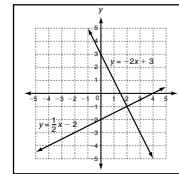
Parallel lines never intersect.



The slopes of parallel lines are the same.

Perpendicular Lines

Perpendicular lines intersect to form right angles.



The slopes of perpendicular lines have a product of -1 .

Contrast

Compare

Both parallel and perpendicular lines can be identified by their equations.

Both parallel and perpendicular lines have applications in geometry.

Possible answers are given for 1 and 2.

- Write an equation of a line parallel to $y = 3x + 4$. $y = 3x + 3$
- Write an equation of a line perpendicular to $y = 3x + 4$. $y = -\frac{1}{3}x + 3$

A(9, -4), B(-3, 0) and C(1, 4) are the vertices of a triangle.

- Find the slope of \overline{AB} . $-\frac{1}{3}$
- Find the slope of \overline{BC} . 1
- Find the slope of \overline{AC} . -1 yes; \overline{BC} and \overline{AC} are perpendicular because $1(-1) = -1$.
- Is ABC a right triangle? Why? $1(-1) = -1$.

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