

2-4

Parallel and
Perpendicular
Lines EXPLORE & REASON

Graph these three equations using a graphing calculator.



```
Plot1 Plot2 Plot3
Y1=3X+1
Y2=3X+2
Y3=3X+4
Y4=
Y5=
Y6=
Y7=
```

A. **Look for Relationships** Choose any two of the lines you graphed. How are they related to each other? © MP.7

B. Does your answer to Part A hold for any two lines? Explain.

C. Write another set of three or more equations that have the same relationships as the first three equations.

HABITS OF MIND

Look for Relationships What concepts have you learned previously that were useful in analyzing this problem? © MP.7

**EXAMPLE 1** **Try It! Write an Equation of a Parallel Line Parallel to a Given Line**

1. Write the equation of the line in slope-intercept form that passes through the point $(-3, 5)$ and is parallel to $y = -\frac{2}{3}x$.

EXAMPLE 2 **Try It! Understand the Slopes of Perpendicular Lines**

2. Why does it make sense that the slopes of perpendicular lines have opposite signs?

EXAMPLE 3 **Try It! Write an Equation of a Line Perpendicular to a Given Line**

3. Write the equation of the line that passes through the point $(4, 5)$ and is perpendicular to the graph of $y = 2x - 3$.

HABITS OF MIND

Communicate Precisely Why do you have to use the term “nonvertical” when working with parallel and perpendicular lines? © MP.6

**EXAMPLE 4** **Try It! Classify Lines**

4. Are the graphs of the equations *parallel*, *perpendicular*, or *neither*?

a. $y = 2x + 6$ and $y = \frac{1}{2}x + 3$

b. $y = -5x$ and $25x + 5y = 1$

EXAMPLE 5 **Try It! Solve a Real-World Problem**

5. The equation $y = 2x + 7$ represents the North Path on a map.

a. Find the equation for a path that passes through the point (6, 3) and is parallel to the North Path.

b. Find the equation for a path that passes through the same point but is perpendicular to North Path.

HABITS OF MIND

Use Structure Explain the advantages of using the slope-intercept form of an equation when determining if two lines are perpendicular or parallel to each other. © MP.7

Do You UNDERSTAND?

- ESSENTIAL QUESTION** How can the equations of lines help you identify whether the lines are *parallel*, *perpendicular*, or *neither*?
- Error Analysis** Dwayne stated that the slope of the line perpendicular to $y = -2x$ is 2. Describe Dwayne's error. © MP.3
- Vocabulary** Describe the difference between the slopes of two parallel lines and the slopes of two perpendicular lines.
- Use Structure** Is there one line that passes through the point $(3, 5)$ that is parallel to the lines represented by $y = 2x - 4$ and $y = x - 4$? Explain. © MP.7

Do You KNOW HOW?

The equation $y = -\frac{3}{4}x + 1$ represents a given a line.

- Write the equation for the line that passes through $(-4, 9)$ and is parallel to the given line.
- Write the equation for the line that passes through $(6, 6)$ and is perpendicular to the given line.

Are the graphs of the equations parallel, perpendicular, or neither?

7. $x - 3y = 6$ and $x - 3y = 9$

8. $y = 4x + 1$ and $y = -4x - 2$

- What equation represents the road that passes through the point shown and is perpendicular to the road represented by the red line?

