# 5.4 Exercises

## Concept Check

**Fill-in-the-Blank.** Complete each sentence using information found in this section.

1. Perpendicular lines have slopes that are _____ _____ of each other.
2. The point-slope form for an equation is _____.
3. Parallel lines have the _____ slope.
4. Lines represented by the equation $Ax + By = C$ are in _____ form.
5. In the equation $y - y_1 = m(x - x_1)$, $m$ represents the _____.
6. _____ lines are of the form $x = a$.

**True/False.** Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. Given two perpendicular lines (neither of which have slope 0), we know that one has a positive slope and the other has a negative slope.
8. If Line 2 is parallel to Line 3, then the slope of Line 2 equals the slope of Line 3.
9. A line perpendicular to a horizontal line has a slope that is undefined.
10. All pairs of lines are either parallel or perpendicular.

## Practice

Find **a.** the slope, **b.** a point on the line, and **c.** the graph of the line for the following equations in point-slope form.

1. $y - 1 = 2(x - 3)$
2. $y - 4 = \frac{1}{2}(x - 1)$
3. $y + 2 = -5(x)$
4. $y = -(x + 8)$
5. $y - 3 = -\frac{1}{4}(x + 2)$
6. $y + 6 = \frac{1}{3}(x - 7)$

Find an equation in standard form for the line passing through the given point with the given slope. Graph the line. See Examples 1 and 2.

7. $(-2, 1)$; $m = -2$
8. $(3, 4)$; $m = 3$
9. $(5, -2)$; $m = 0$
10. $(0, 0)$; $m = -3$
11. $(-3, 6)$; $m = \frac{1}{2}$
12. $(-3, -1)$; $m$ is undefined
13. $(7, 10)$; $m = \frac{3}{5}$
14. $(-1, -1)$; $m = -\frac{1}{4}$
15. $\left(-2, \frac{1}{3}\right)$; $m = \frac{2}{3}$
16. $\left(\frac{5}{2}, \frac{1}{2}\right)$; $m = -\frac{4}{3}$

Find an equation in slope-intercept form for the line passing through the two given points. See Example 3.

**17.** $(-5,2);(3,6)$

**18.** $(-3,4);(2,1)$

**19.** $(-5,1);(2,0)$

**20.** $(-4,-4);(3,1)$

**21.** $(0,2);\left(1,\frac{3}{4}\right)$

**22.** $\left(\frac{5}{2},0\right);\left(2,-\frac{1}{3}\right)$

**23.** $(2,-5);(4,-5)$

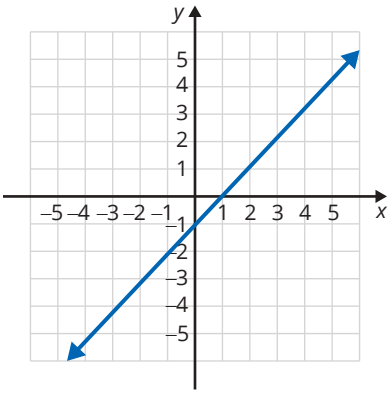
**24.** $(0,4);\left(1,\frac{1}{2}\right)$

**25.** $(-2,6);(3,1)$

**26.** $(8,2);(0,0)$

Find an equation in standard form for each line shown. See Example 4.

**27.**

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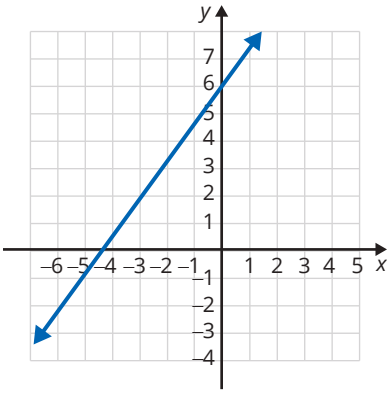


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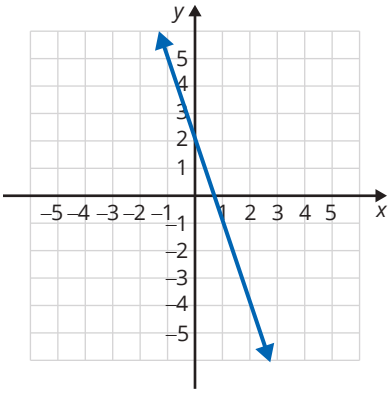


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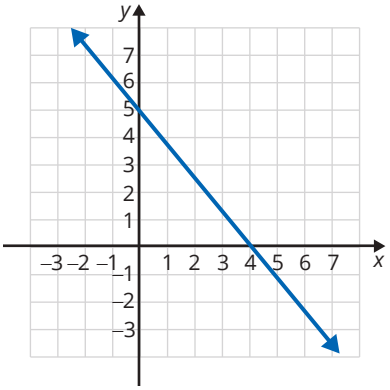


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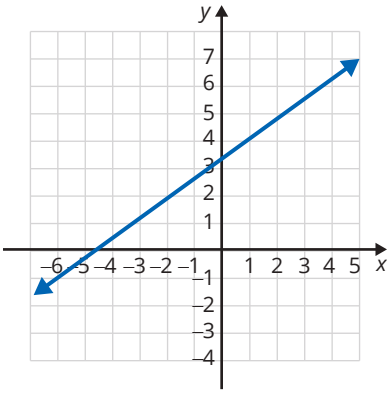


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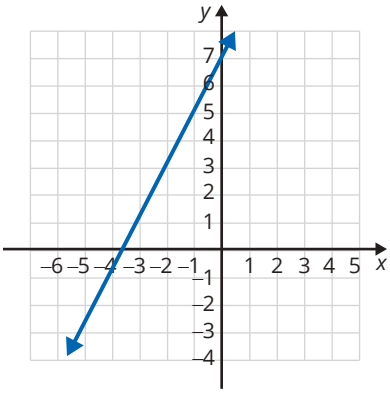

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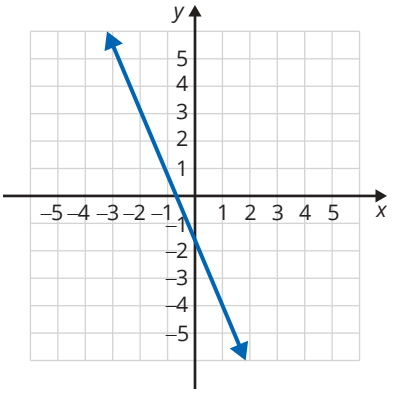
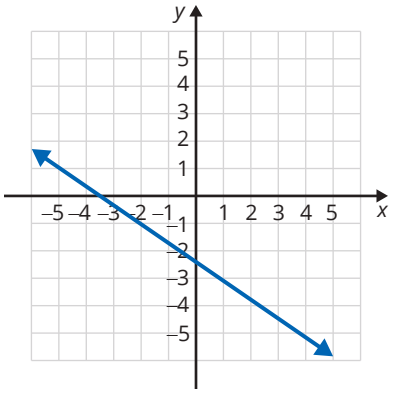



**34.**




Find an equation in slope-intercept form that satisfies each set of conditions. See Examples 5 and 6.

**35.** Find an equation for the horizontal line through the point $(-2, 6)$.

**36.** Find an equation for the vertical line through the point $(-1, -4)$.

**37.** Write an equation for the line parallel to the $x$-axis and containing the point $(2, 7)$.

**38.** Find an equation for the line parallel to the $y$-axis and containing the point $(2, -4)$.

**39.** Find an equation for the line perpendicular to $x = 4$ and that passes through $(-1, 7)$.

**40.** Find an equation for the line parallel to the line $-6y = 1$ and containing the point $(-3, 2)$.

**41.** Write an equation for the line parallel to the line $2x - y = 4$ and containing the origin. Graph both lines.

**42.** Find an equation for the line parallel to $7x - 3y = 1$ and containing the point $(1, 0)$. Graph both lines.

**43.** Write an equation for the line parallel to $5x = 7 + y$ and through the point $(-1, -3)$. Graph both lines.

**44.** Write an equation for the line that contains the point $(2, 2)$ and is perpendicular to the line $4x + 3y = 4$. Graph both lines.

**45.** Find an equation for the line that passes through the point $(4, -1)$ and is perpendicular to the line $5x - 3y + 4 = 0$. Graph both lines.

**46.** Write an equation for the line that is perpendicular to $8 - 3x - 2y = 0$ and passes through the point $(-4, -2)$.

**47.** Write an equation for the line through the origin that is perpendicular to $3x - y = 4$.

**48.** Find an equation for the line that is perpendicular to $2x + y = 5$ and that passes through $(6, -1)$.

**49.** Write an equation for the line that is perpendicular to $2x - y = 7$ and has the same $y$-intercept as $x - 3y = 6$.

**50.** Find an equation for the line with the same $y$-intercept as $5x + 4y = 12$ and that is perpendicular to $3x - 2y = 4$.

**51.** Show that the points $A(-2, 4)$, $B(0, 0)$, $C(6, 3)$, and $D(4, 7)$ are the vertices of a rectangle. (Plot the points and show that opposite sides are parallel and that adjacent sides are perpendicular.)

**52.** Show that the points $A(0, -1)$, $B(3, -4)$, $C(6, 3)$, and $D(9, 0)$ are the vertices of a parallelogram. (Plot the points and show that opposite sides are parallel.)

Determine whether each pair of lines is **a.** parallel, **b.** perpendicular, or **c.** neither. Graph both lines. (**Hint:** Write the equations in slope-intercept form and then compare slopes.)

**53.** $\begin{cases} y = -2x + 3 \\ y = -2x - 1 \end{cases}$

**54.** $\begin{cases} y = 3x + 2 \\ y = -\frac{1}{3}x + 6 \end{cases}$

**55.** $\begin{cases} 4x + y = 4 \\ x - 4y = 8 \end{cases}$

**56.** $\begin{cases} 2x + 3y = 5 \\ 3x + 2y = 10 \end{cases}$

**57.** $\begin{cases} 2x + 2y = 9 \\ 2x - y = 6 \end{cases}$

**58.** $\begin{cases} 3x - 4y = 16 \\ 4x + 3y = 15 \end{cases}$

## Applications

Solve.

**59.** The cost for an airline to fly from Raleigh, NC, to Nashville, TN, is $5000. The airline charges $100 for the one-way ticket from Raleigh to Nashville.

**a.** Find an equation for the profit $P$ made by the airline on this one-way flight if they sell $t$ tickets.

**b.** Use the equation found in part a. to determine the number of tickets that must be sold for the airline to "break even;" that is, for the profit to be equal to 0?

**60.** A scrapbooking club offers a monthly sticker subscription that is $9.95 for any selection of 100 stickers, then charges $0.10 for each additional sticker over 100.

**a.** Write an equation for the total bill, $b$, in a month in which you order $s$ stickers (where $s$ is at least 100).

**b.** Jenny's bill last month was $27.85. How many stickers did she order?

**61.** Betsy earns 10 hours of paid time off (PTO) per month and the accumulated hours rollover each month. Two months into the current year, she has accumulated a total of 80 hours of PTO. Let $y$ be the number of PTO hours accumulated and $x$ be the number of months.

**a.** Graph the line that represents her projected PTO accumulation for the current calendar year if she does not use any PTO. (Graph should specify that $x$-axis is months and $y$-axis is hours of PTO.)

**b.** Write the equation in point-slope form that represents Betsy's projected PTO accumulation.

**62.** The price $p$ of a college textbook increases as the number of pages $n$ increases. In fact, the price increases $20 for every 100 pages that are added to the textbook.

**a.** Assuming there are no "fixed" costs, find an equation for the price of a textbook in terms of the number of pages.

**b.** Use the equation found in part a. to approximate the price of a 560-page textbook.

**63.** A taxi charges a fare of $5.00 plus $0.25 per eighth of a mile for a ride.

**a.** Find an equation for the fare $f$ in terms of the number of miles $m$.

**b.** Use the equation found in part a. to determine the cost for a 15-mile ride.

**64.** Natalie invested some money in a simple interest savings fund. After 2 years, she earned \$120 in interest. After 5 years, she earned \$300 in interest.

**a.** Write two ordered pairs from the information given where $x$ represents the time in years and $y$ represents the amount of interest earned.

**b.** Find the slope of the line which contains the two ordered pairs from part a.

**c.** Write the point-slope equation that models the situation.

**d.** Rewrite this equation in $y = mx + b$ form.

**65.** An archaeology crew finds the foundation of a house during a dig. The corners of the foundations are plotted on their grid map at the following points: $(1, 7)$, $(3, 2)$, $(9, 4)$, and $(7, 9)$.

**a.** Plot the points on the coordinate plane.

**b.** Find the slope of each side of the foundation.

**c.** Are any of the sides parallel? If so, which sides?

**d.** Are any of the sides perpendicular to each other? If so, which sides?

**e.** Is the foundation in the form of a geometric shape? If so, which shape

## Writing & Thinking

**66.** Ramps for persons with disabilities are now built into most buildings and walkways. (If ramps are not present in a building, then there must be elevators.) What do you think that the slope of a ramp should be in order to be considered accessible? Look in your library or contact your local building permit office to find the recommended slope for such ramps.