Scan the lesson. Predict two th
slope-intercept form of a linear

• The slope is represented by

_____

• The y-intercept is represen

point $(0, b)$ or the y-intercept. The **y-intercept** of a line is the y-coordinate
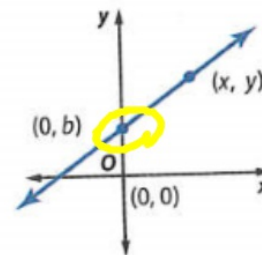of the point where the line crosses the y-axis.

Complete the steps to derive the equation for a nonproportional linear
relationship by using the slope formula.

p. 199!

$$\frac{y_2 - y_1}{x_2 - x_1} = m$$ Slope formula

$$(x_1, y_1) = (0, b)$$

$$\frac{y - b}{x - 0} = m$$ $(x_2, y_2) = (x, y)$

$$\frac{y - b}{x} = m$$ Simplify.

$$y - b = m \cdot x$$ Multiplication Property of Equality

$$y = mx + b$$ Addition Property of Equality

slope   y-intercept

$$y = mx + b$$

Slope-intercept form

Slope-Intercept Form of a Line

Nonproportional linear relationships can be written in the form $y = mx + b$. This is called the **slope-intercept form**. When an equation is written in this form, m is the slope and b is the y-intercept.

Tutor

Examples

1. **State the slope and the y-intercept of the graph of the equation $y = \frac{2}{3}x - 4$.**

   $y = \frac{2}{3}x + (-4)$ Write the equation in the form $y = mx + b$.

   $y = mx + b$ $m = \frac{2}{3}, b = -4$

   The slope of the graph is $\frac{2}{3}$, and the y-intercept is -4.

Show your work

a. $-5; 3$

b. $\frac{1}{4}; -6$

c. $-1; 5$

Got It? Do these problems to find out.

   a. $y = -5x + 3$ b. $y = \frac{1}{4}x - 6$ c. $y = -x + 5$

Examples

2. Write an equation of a line in slope-intercept form with a slope of -3 and a y-intercept of -4.

$y = mx + b$ Slope-intercept form

$y = -3x + (-4)$ Replace m with -3 and b with -4.
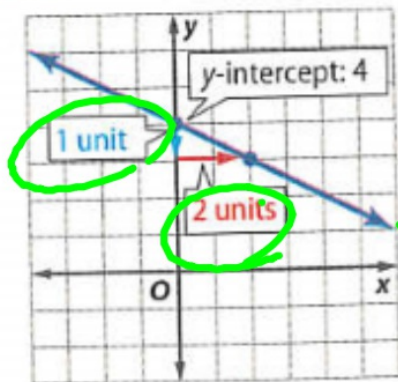
$y = -3x - 4$ Simplify.

3. Write an equation in slope-intercept form for the graph shown.

The y-intercept is 4. From $(0, 4)$, you move down 1 unit and right 2 units to another point on the line.
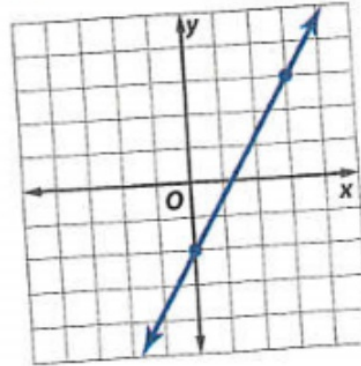
So, the slope is $-\dfrac{1}{2}$.

$y = mx + b$ Slope-intercept form

$y = -\dfrac{1}{2}x + 4$ Replace m with $-\dfrac{1}{2}$ and b with 4.

d. Write an equation in slope-intercept form for the graph shown.

e. Write an equation of a line in slope-intercept form with a slope of $\frac{3}{4}$ and a y-intercept of -3.

Show your work.

d. [   ]

e. [   ]

Interpret the y - Intercept

When an equation in slope-intercept form applies to a real-world situation, the slope represents the rate of change and the y-intercept represents the initial value.

Watch | Tutor

Real World

Examples

4. Student Council is selling T-shirts during spirit week. It costs $20 for the design and $5 to print each shirt. The cost y to print x shirts is given by $y = 5x + 20$. Graph $y = 5x + 20$ using the slope and y-intercept.

Step 1 Find the slope and y-intercept.

$$y = 5x + 20$$

slope $= 5$
y-intercept $= 20$

Step 2 Graph the y-intercept (0, 20).

Step 3 Write the slope 5 as $\frac{5}{1}$. Use it to locate a second point on the line. Go up 5 units and right 1 unit. Then draw a line through the points.

1. Liam is reading a 254-page book for school. He can read 40 pages in one hour. The equation for the number of pages he has left to read is $y = 254 - 40x$, where x is the number of hours he reads. (Examples 1, 4, and 5)

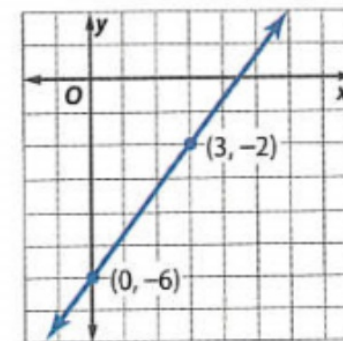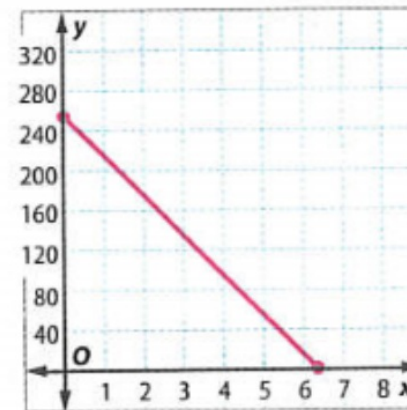a. State the slope and the y-intercept of the graph of the equation. **−40; 254**

Show your work. b. Graph the equation.

c. Interpret what the slope and the y-intercept represent.

the number of pages yet to be read decreases by 40

pages per hour; the total number of pages to read

2. Write an equation in slope intercept form for the graph shown.

(Examples 2 and 3) $y = \dfrac{4}{3}x - 6$

3. **e** **Building on the Essential Question** How does the y-intercept appear in these three representations: table, equation, and graph? **Sample answer: In a table, the y-intercept is the y-value when the x-value is 0. In an equation written in slope-intercept form, the y-intercept is the constant. On a graph, the y-intercept is the point where the line crosses the y-axis.**
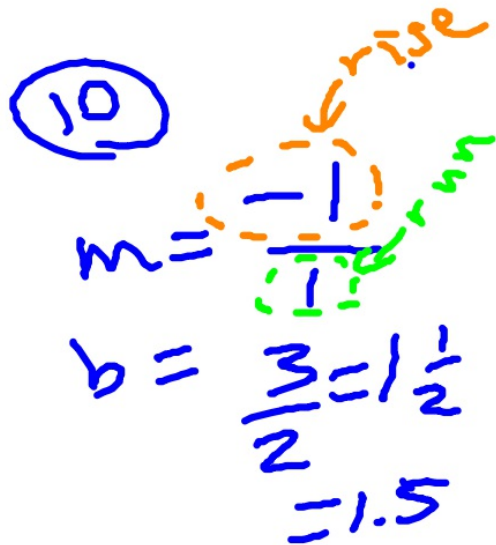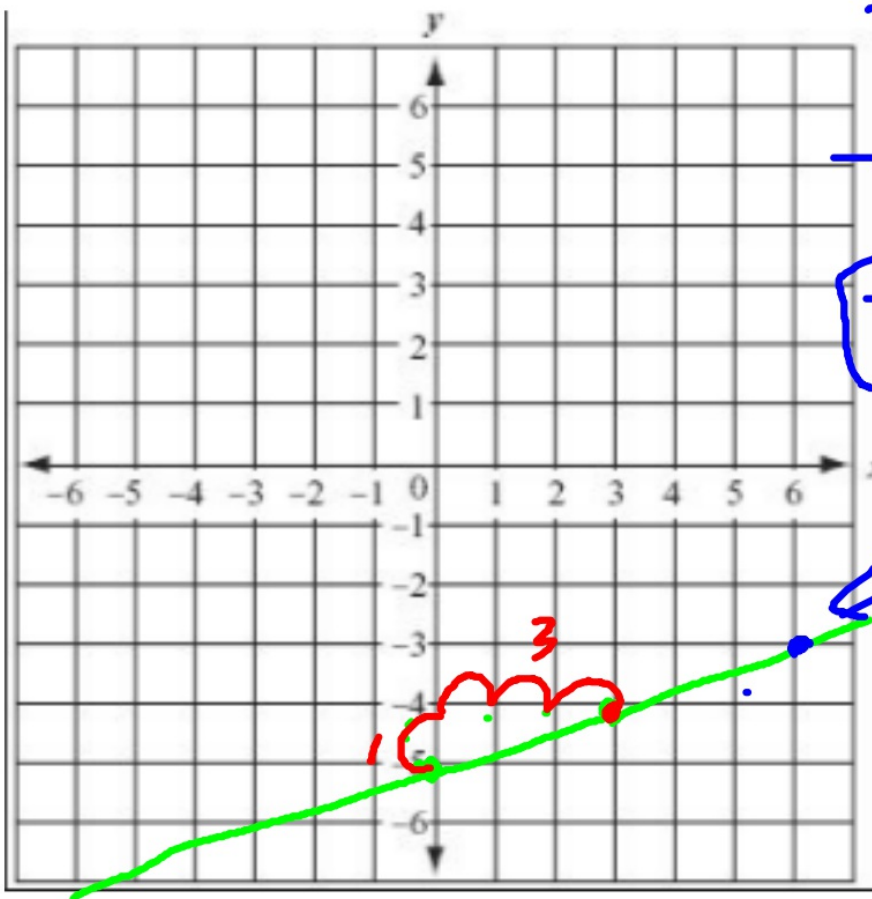
Copy and Solve. Graph each equation on a separate piece of grid paper. 9–11. See Answer Appendix.

9. $y = \frac{1}{3}x - 5$

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

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

⑨

② $m = \frac{1}{3}$ ← rise / run

① $b = -5$

$y = \frac{1}{3}x - 5$

$-3 = \frac{1}{3}(6) - 5$

$-3 = 2 - 5$

$x \quad y$

$(6, -3)$

3

Copy and Solve. Graph each equation on a separate piece of grid paper. **9–11. See Answer Appendix.**
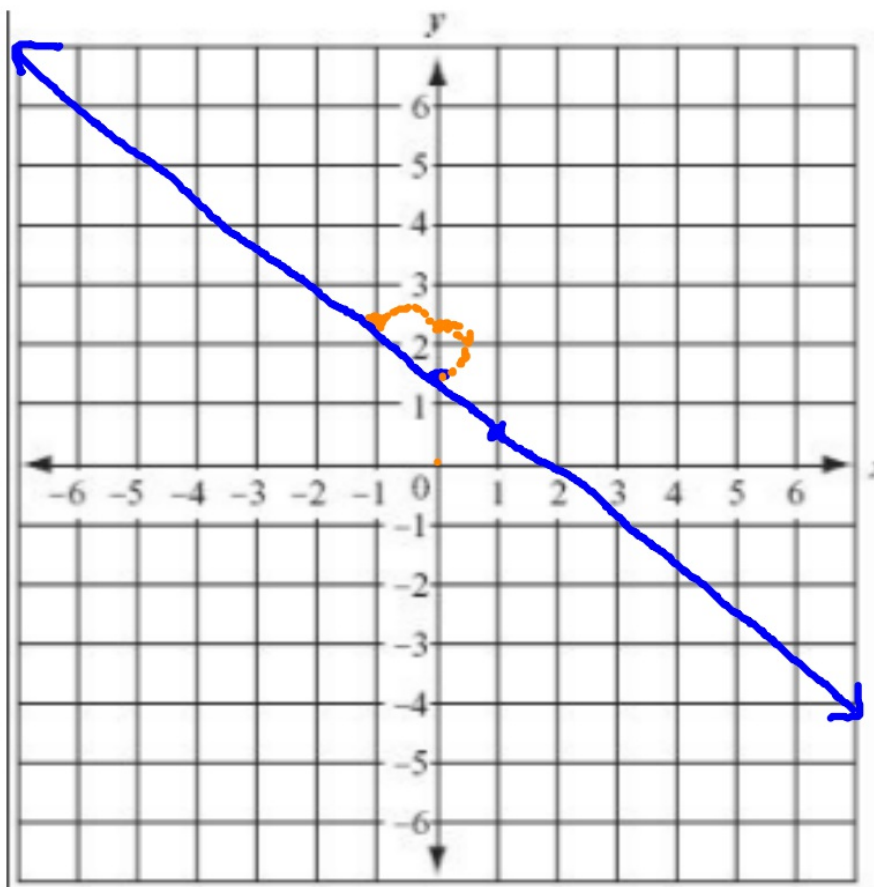
9. $y = \frac{1}{3}x - 5$

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

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

⟨10⟩

$m = \dfrac{-1 \quad \text{rise}}{1}$

$b = \dfrac{3}{2} = 1\frac{1}{2}$
$= 1.5$

$m = \dfrac{1 \quad \text{rise}}{-1}$

Independent Practice

State the slope and the y-intercept for the graph of each equation.
(Example 1)

1. $y = 3x + 4$

Show your work.

2. $y = -\frac{3}{7}x - \frac{1}{7}$
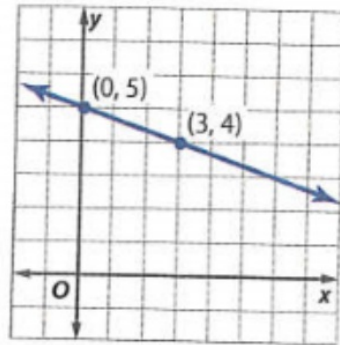
3. $3x + y = -4$

Write an equation of a line in slope-intercept form with the given slope and y-intercept. (Example 2)

4. slope: $-\frac{3}{4}$, y-intercept: -2
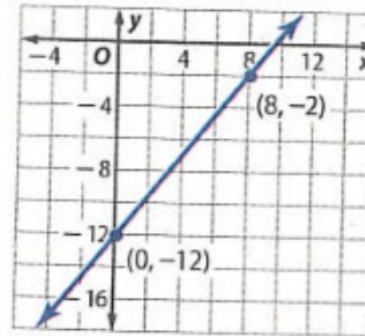
5. slope: $\frac{5}{6}$, y-intercept: 8

Write an equation in slope-intercept form for each graph shown. (Example 3)

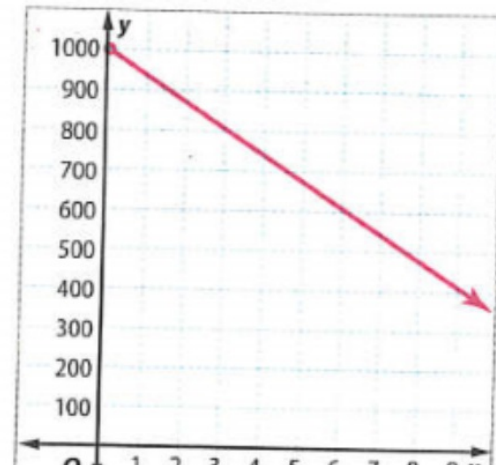**6.**

$y = -\frac{1}{3}x + 5$

(0, 5)

(3, 4)

7.


$y = \frac{5}{4}x - 12$

(8, −2)

(0, −12)

8. The Viera family is traveling from Philadelphia to Orlando for vacation. The equation $y = 1{,}000 - 65x$ represents the distance in miles remaining in their trip after x hours. (Examples 4 and 5)

   a. Graph the equation.

   b. Interpret the slope and the y-intercept. **The driving rate, 65 mph; the distance from which they began their trip, 1,000 miles.**

12. **CCSS** **Model with Mathematics** Refer to the graphic novel frame below for Exercises a–b.
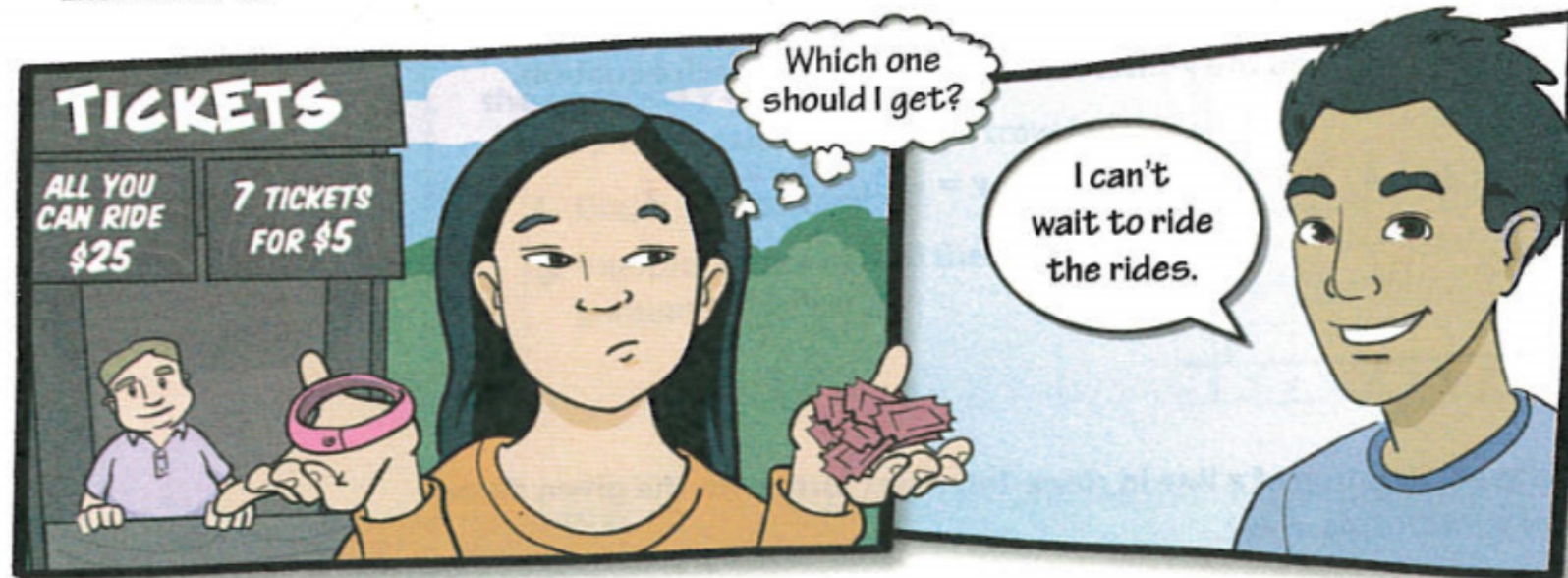
a. Write an equation in slope-intercept form for the total cost of any number of tickets at 7 tickets for $5. $y = \$0.71x$

b. Write an equation in slope-intercept form for the total cost of a wristband for all you can ride. $y = \$25$

H.O.T. Problems Higher Order Thinking

13. **CCSS** **Persevere with Problems** The x-intercept is the x-coordinate of the point where a graph crosses the x-axis. What is the slope of a line that has a y-intercept but no x-intercept? Explain. **0; Sample answer: A line that has a y-intercept but no x-intercept is a horizontal line.**

14. **CCSS** **Reason Abstractly** Write an equation of a line that does not have a y-intercept. **Sample answer: $x = 4$**

15. **CCSS** **Justify Conclusions** Suppose the graph of a line has a negative slope and a positive y-intercept. Through which quadrants does the line pass? Justify your reasoning. **Quadrants I, II, and IV; if a y-intercept is graphed at (0, b), where b is positive, and then a line is drawn through the point so that it has a negative slope, the line will pass through Quadrants I, II, and IV.**

16. **CCSS** **Make a Conjecture** Describe what happens to the graph of $y = 3x + 4$ when the slope is changed to $\frac{1}{3}$. **Sample answer: The graph becomes less steep.**