Study Guide

KeyConcepts

Slope-Intercept Form (Lessons 4-1 and 4-2)

- The slope-intercept form of a linear equation is $y = mx + b$, where m is the slope and b is the y-intercept.
- If you are given two points through which a line passes, use them to find the slope first.

Point-Slope Form (Lesson 4-3)

- The linear equation $y - y_1 = m(x - x_1)$ is written in point-slope form, where (x_1, y_1) is a given point on a nonvertical line and m is the slope of the line.

Parallel and Perpendicular Lines (Lesson 4-4)

- Nonvertical parallel lines have the same slope.
- Lines that intersect at right angles are called perpendicular lines. The slopes of perpendicular lines are opposite reciprocals.

Scatter Plots and Lines of Fit (Lesson 4-5)

- Data with two variables are called bivariate data.
- A scatter plot is a graph in which two sets of data are plotted as ordered pairs in a coordinate plane.
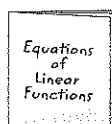
Regression and Median-Fit Lines (Lesson 4-6)

- A graphing calculator can be used to find regression lines and median-fit lines.

Inverse Linear Functions (Lesson 4-7)

- An inverse relation is the set of ordered pairs obtained by exchanging the x-coordinates with the y-coordinates of each ordered pair of a relation.
- A linear function $f(x)$ has an inverse function that can be written as $f^{-1}(x)$ and is read f of x inverse or the inverse of f of x.

FOLDABLES StudyOrganizer

Be sure the Key Concepts are noted in your Foldable.

Equations of Linear Functions

KeyVocabulary

best-fit line (p. 255)	linear interpolation (p. 249)
bivariate data (p. 247)	linear regression (p. 255)
constant function (p. 217)	line of fit (p. 248)
constraint (p. 228)	median-fit line (p. 258)
correlation coefficient (p. 255)	parallel lines (p. 239)
identity function (p. 224)	perpendicular lines (p. 240)
inverse function (p. 264)	point-slope form (p. 233)
inverse relation (p. 263)	scatter plot (p. 247)
linear extrapolation (p. 228)	slope-intercept form (p. 216)

VocabularyCheck

State whether each sentence is *true* or *false*. If *false*, replace the underlined term to make a true sentence.

1. The y-intercept is the y-coordinate of the point where the graph crosses the y-axis.

2. The process of using a linear equation to make predictions about values that are beyond the range of the data is called linear regression.

3. An inverse relation is the set of ordered pairs obtained by exchanging the x-coordinates with the y-coordinates of each ordered pair of a relation.

4. The correlation coefficient describes whether the correlation between the variables is positive or negative and how closely the regression equation is modeling the data.

5. Lines in the same plane that do not intersect are called parallel lines.

6. Lines that intersect at acute angles are called perpendicular lines.

7. A(n) constant function can generate ordered pairs for an inverse relation.

8. The range of a relation is the range of its inverse function.

9. An equation of the form $y = mx + b$ is in point-slope form.

Lesson-by-Lesson Review

4-1 Graphing Equations in Slope-Intercept Form

Write an equation of a line in slope-intercept form with the given slope and y-intercept. Then graph the equation.

10. slope: 3, y-intercept: 5

11. slope: -2, y-intercept: -9

12. slope: $\frac{2}{3}$, y-intercept: 3

13. slope: $-\frac{5}{8}$, y-intercept: -2

Graph each equation.

14. $y = 4x - 2$

15. $y = -3x + 5$

16. $y = \frac{1}{2}x + 1$

17. $3x + 4y = 8$

18. **SKI RENTAL** Write an equation in slope-intercept form for the total cost of skiing for h hours with one lift ticket.

> **Slippery Slope**
> Ski Lodge
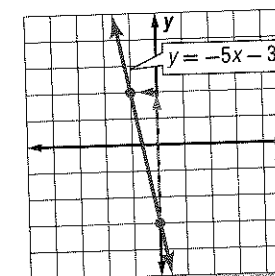> Lift Ticket $15/day
> Ski Rental $5/hour

Example 1

Write an equation of a line in slope-intercept form with slope -5 and y-intercept -3. Then graph the equation.

$y = mx + b$ Slope-intercept form

$y = -5x + (-3)$ $m = -5$ and $b = -3$

$y = -5x - 3$ Simplify.

To graph the equation, plot the y-intercept $(0, -3)$.

Then move up 5 units and left 1 unit. Plot the point. Draw a line through the two points.

4-2 Writing Equations in Slope-Intercept Form

Write an equation of the line that passes through the given point and has the given slope.

19. $(1, 2)$, slope 3

20. $(2, -6)$, slope -4

21. $(-3, -1)$, slope $\frac{2}{5}$

22. $(5, -2)$, slope $-\frac{1}{3}$

Write an equation of the line that passes through the given points.

23. $(2, -1)$, $(5, 2)$

24. $(-4, 3)$, $(1, 13)$

25. $(3, 5)$, $(5, 6)$

26. $(2, 4)$, $(7, 2)$

27. **CAMP** In 2005, a camp had 450 campers. Five years later, the number of campers rose to 750. Write a linear equation that represents the number of campers that attend camp.

Example 2

Write an equation of the line that passes through $(3, 2)$ with a slope of 5.

Step 1 Find the y-intercept.

$y = mx + b$ Slope-intercept form

$2 = 5(3) + b$ $m = 5, y = 2,$ and $x = 3$

$2 = 15 + b$ Simplify.

$-13 = b$ Subtract 15 from each side.

Step 2 Write the equation in slope-intercept form.

$y = mx + b$ Slope-intercept form

$y = 5x - 13$ $m = 5$ and $b = -13$

4-3 Writing Equations in Point-Slope Form

Write an equation in point-slope form for the line that passes through the given point with the slope provided.

28. (6, 3), slope 5

29. (−2, 1), slope −3

30. (−4, 2), slope 0

Write each equation in standard form.

31. $y - 3 = 5(x - 2)$

32. $y - 7 = -3(x + 1)$

33. $y + 4 = \frac{1}{2}(x - 3)$

34. $y - 9 = -\frac{4}{5}(x + 2)$

Write each equation in slope-intercept form.

35. $y - 2 = 3(x - 5)$

36. $y - 12 = -2(x - 3)$

37. $y + 3 = 5(x + 1)$

38. $y - 4 = \frac{1}{2}(x + 2)$

Example 3

Write an equation in point-slope form for the line that passes through (3, 4) with a slope of −2.

$y - y_1 = m(x - x_1)$ Point-slope form

$y - 4 = -2(x - 3)$ Replace m with −2 and (x_1, y_1) with (3, 4).

Example 4

Write $y + 6 = -4(x - 3)$ in standard form.

$y + 6 = -4(x - 3)$ Original equation

$y + 6 = -4x + 12$ Distributive Property

$4x + y + 6 = 12$ Add $4x$ to each side.

$4x + y = 6$ Subtract 6 from each side.

4-4 Parallel and Perpendicular Lines

Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of each equation.

39. (2, 5), $y = x - 3$

40. (0, 3), $y = 3x + 5$

41. (−4, 1), $y = -2x - 6$

42. (−5, −2), $y = -\frac{1}{2}x + 4$

Write an equation in slope-intercept form for the line that passes through the given point and is perpendicular to the graph of the given equation.

43. (2, 4), $y = 3x + 1$

44. (1, 3), $y = -2x - 4$

45. (−5, 2), $y = \frac{1}{3}x + 4$

46. (3, 0), $y = -\frac{1}{2}x$

Example 5

Write an equation in slope-intercept form for the line that passes through (−2, 4) and is parallel to the graph of $y = 6x - 3$.

The slope of the line with equation $y = 6x - 3$ is 6. The line parallel to $y = 6x - 3$ has the same slope, 6.

$y - y_1 = m(x - x_1)$ Point-slope form
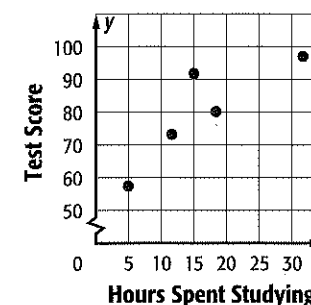
$y - 4 = 6[x - (-2)]$ Substitute.

$y - 4 = 6(x + 2)$ Simplify.

$y - 4 = 6x + 12$ Distributive Property

$y = 6x + 16$ Add 4 to each side.
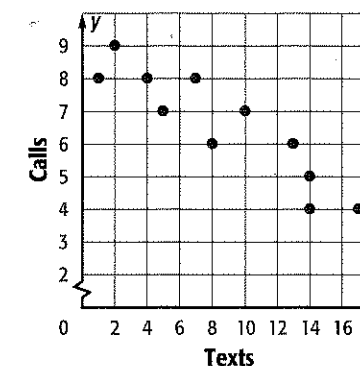
4-5 Scatter Plots and Lines of Fit

47. Determine whether the graph shows a *positive*, *negative*, or *no* correlation. If there is a positive or negative correlation, describe its meaning.

Hours Spent Studying

48. **ATTENDANCE** A scatter plot of data compares the number of years since a business has opened and its annual number of sales. It contains the ordered pairs (2, 650) and (5, 1280). Write an equation in slope-intercept form for the line of fit for this situation.

Example 6

The scatter plot displays the number of texts and the number of calls made daily. Write an equation for the line of fit.

Texts

First, find the slope using (2, 9) and (17, 4).

$m = \frac{4 - 9}{17 - 2} = \frac{-5}{15}$ or $-\frac{1}{3}$ Substitute and simplify.

Then find the y-intercept.

$9 = -\frac{1}{3}(2) + b$ Substitute.

$9\frac{2}{3} = b$ Add $\frac{2}{3}$ to each side.

Write the equation. $y = -\frac{1}{3}x + 9\frac{2}{3}$

4-6 Regression and Median-Fit Lines

49. **SALE** The table shows the number of purchases made at an outerwear store during a sale. Write an equation of the regression line. Then estimate the daily purchases on day 10 of the sale.

Days Since Sale Began	1	2	3	4	5	6	7
Daily Purchases	15	21	32	30	40	38	51

50. **MOVIES** The table shows ticket sales at a certain theater during the first week after a movie opened. Write an equation of the regression line. Then estimate the daily ticket sales on the 15th day.

Days Since Movie Opened	1	2	3	4	5	6	7
Daily Ticket Sales	85	92	89	78	65	68	55

Example 7

ATTENDANCE The table shows the annual attendance at an amusement park. Write an equation of the regression line for the data.

Years Since 2004	0	1	2	3	4	5	6
Attendance (thousands)	75	80	72	68	65	60	53

Step 1 Enter the data by pressing [STAT] and selecting the **Edit** option.

Step 2 Perform the regression by pressing [STAT] and selecting the **CALC** option. Scroll down to **LinReg (ax + b)** and press [ENTER].

Step 3 Write the equation of the regression line by rounding the a- and b-values on the screen. $y = -4.04x + 79.68$