5

Chapter Review

Connecting BIG ideas and Answering the Essential Questions

1 Proportionality
In the graph of a line, the ratio for the slope indicates the rate of change.

Rate of Change and Slope (Lesson 5-1)

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

Parallel and Perpendicular Lines (Lesson 5-6)
Parallel lines have the same slope. The product of the slopes of perpendicular lines is -1.

2 Functions
There are several forms for the equation of a line. Each form communicates different information. For instance, from the point-slope form, you can determine a point and the slope of a line.

Slope-Intercept Form (Lesson 5-3)

$$y = mx + b$$

Point-Slope Form (Lesson 5-4)

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

Standard Form (Lesson 5-5)

$$Ax + By = C$$

3 Modeling
You can model the trend of the real-world data in a scatter plot with the equation of a line. You can use the equation to estimate or to make predictions.

Scatter Plots and Trend Lines (Lesson 5-7)
The trend line that shows the relationship between two sets of data most accurately is called the line of best fit.

Chapter Vocabulary

- absolute value function (p. 346)
- direct variation (p. 301)
- extrapolation (p. 337)
- interpolation (p. 337)
- inverse function (p. 329)
- linear equation (p. 308)
- line of best fit (p. 339)
- negative correlation (p. 336)
- no correlation (p. 337)
- opposite reciprocals (p. 331)
- parallel lines (p. 330)
- perpendicular lines (p. 331)
- piecewise function (p. 348)
- point-slope form (p. 315)
- positive correlation (p. 336)
- rate of change (p. 294)
- residual (p. 344)
- scatter plot (p. 336)
- slope (p. 295)
- slope-intercept form (p. 308)
- standard form of a linear equation (p. 322)
- step function (p. 348)
- trend line (p. 337)
- *x*-intercept (p. 322)
- *y*-intercept (p. 308)

Choose the vocabulary term that correctly completes the sentence.

1. Estimating a value between two known values in a data set is called __?__.
2. The slope of a line models the __?__ of a function.
3. The form of a linear equation that shows the slope and one point is the __?__.
4. Two lines are perpendicular when their slopes are __?__.
5. The line that most accurately models data in a scatter plot is the __?__.

5-1 Rate of Change and Slope

Quick Review

Rate of change shows the relationship between two changing quantities. The **slope** of a line is the ratio of the vertical change (the rise) to the horizontal change (the run).

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

The slope of a horizontal line is 0, and the slope of a vertical line is undefined.

Example

What is the slope of the line that passes through the points (1, 12) and (6, 22)?

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{22 - 12}{6 - 1} = \frac{10}{5} = 2$$

Exercises

Find the slope of the line that passes through each pair of points.

6. (2, 2), (3, 1)

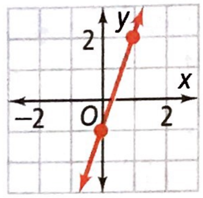
7. (4, 2), (0, 2)

8. (−1, 2), (0, 5)

9. (−3, −2), (−3, 2)

Find the slope of each line.

10.



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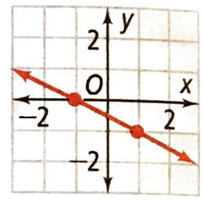


5-2 Direct Variation

Quick Review

A function represents a **direct variation** if it has the form $y = kx$, where $k \neq 0$. The coefficient k is the **constant of variation.**

Example

Suppose y varies directly with x, and $y = 15$ when $x = 5$. Write a direct variation equation that relates x and y. What is the value of y when $x = 9$?

$y = kx$	Start with the general form of a direct variation.
$15 = k(5)$	Substitute 5 for x and 15 for y.
$3 = k$	Divide each side by 5 to solve for k.
$y = 3x$	Write an equation. Substitute 3 for k in $y = kx$.

The equation $y = 3x$ relates x and y. When $x = 9$, $y = 3(9)$, or 27.

Exercises

Suppose y varies directly with x. Write a direct variation equation that relates x and y. Then find the value of y when $x = 7$.

12. $y = 8$ when $x = -4$.

13. $y = 15$ when $x = 6$.

14. $y = 3$ when $x = 9$.

15. $y = -4$ when $x = 4$.

For the data in each table, tell whether y varies directly with x. If it does, write an equation for the direct variation.

16.

x	y
−1	−6
2	3
5	12
9	24

17.

x	y
−3	7.5
−1	2.5
2	−5
5	−12.5

5-3, 5-4, and 5-5 Forms of Linear Equations

Quick Review

The graph of a linear equation is a line. You can write a linear equation in different forms.

The **slope-intercept form** of a linear equation is $y = mx + b$, where m is the slope and b is the **y-intercept**.

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

The **standard form** of a linear equation is $Ax + By = C$, where A, B, and C are real numbers, and A and B are not both zero.

Example

What is an equation of the line that has slope -4 and passes through the point $(-1, 7)$?

$y - y_1 = m(x - x_1)$	Use point-slope form.
$y - 7 = -4(x - (-1))$	Substitute $(-1, 7)$ for (x_1, y_1) and -4 for m.
$y - 7 = -4(x + 1)$	Simplify inside grouping symbols.

An equation of the line is $y - 7 = -4(x + 1)$.

Exercises

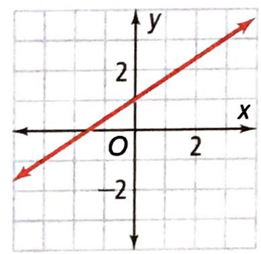
Write an equation in slope-intercept form of the line that passes through the given points.

18. $(-3, 4), (1, 4)$

19. $(3, -2), (6, 1)$

Write an equation of each line.

20.



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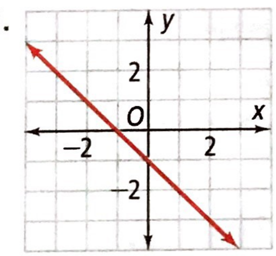


Graph each equation.

22. $y = 4x - 3$

23. $y = 2$

24. $y + 3 = 2(x - 1)$

25. $x + 4y = 10$

5-6 Parallel and Perpendicular Lines

Quick Review

Parallel lines are lines in the same plane that never intersect. Two lines are **perpendicular** if they intersect to form right angles.

Example

Are the graphs of $y = \frac{4}{3}x + 5$ and $y = -\frac{3}{4}x + 2$ *parallel*, *perpendicular*, or *neither*? Explain.

The slope of the graph of $y = \frac{4}{3}x + 5$ is $\frac{4}{3}$.

The slope of the graph of $y = -\frac{3}{4}x + 2$ is $-\frac{3}{4}$.

$$\frac{4}{3}\left(-\frac{3}{4}\right) = -1$$

The slopes are opposite reciprocals, so the graphs are perpendicular.

Exercises

Write an equation of the line that passes through the given point and is parallel to the graph of the given equation.

26. $(2, -1); y = 5x - 2$

27. $(0, -5); y = 9x$

Determine whether the graphs of the two equations are *parallel*, *perpendicular*, or *neither*. Explain.

28. $y = 6x + 2$
$18x - 3y = 15$

29. $2x - 5y = 0$
$y + 3 = \frac{5}{2}x$

Write an equation of the line that passes through the given point and is perpendicular to the graph of the given equation.

30. $(3, 5); y = -3x + 7$

31. $(4, 10); y = 8x - 1$

5-7 Scatter Plots and Trend Lines

Quick Review

A **scatter plot** displays two sets of data as ordered pairs. A **trend line** for a scatter plot shows the correlation between the two sets of data. The most accurate trend line is the **line of best fit**. To estimate or predict values on a scatter plot, you can use **interpolation** or **extrapolation**.

Example

Estimate the length of the kudzu vine in Week 3.

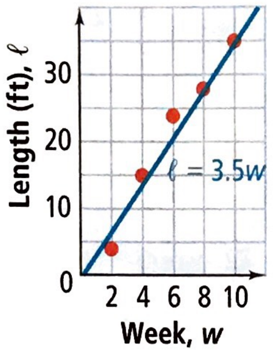
When $w = 3$, $\ell \approx 10$. So in Week 3, the length of the kudzu vine was about 10 ft.

Predict the length of the kudzu vine in Week 11.

$\ell = 3.5w$	Use the equation of the trend line.
$\ell = 3.5(11)$	Substitute 11 for *w*.
$\ell = 38.5$	Simplify.

The length of the vine in Week 11 will be about 38.5 ft.

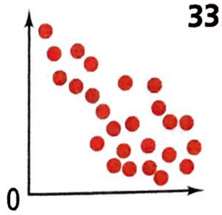
Kudzu Vine Growth



Exercises

Describe the type of correlation the scatter plot shows.

32.



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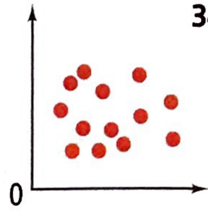

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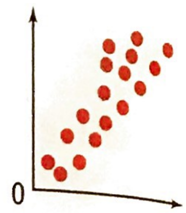


35. a. Make a scatter plot of the data below.

Heights and Arm Spans

Height (m)	1.5	1.8	1.7	2.0	1.7	2.1
Arm Span (m)	1.4	1.7	1.7	1.9	1.6	2.0

b. Write an equation of a reasonable trend line or use a graphing calculator to find the equation of the line of best fit.

c. Estimate the arm span of someone who is 1.6 m tall.

d. Predict the arm span of someone who is 2.2 m tall.

5-8 Graphing Absolute Value Functions

Quick Review

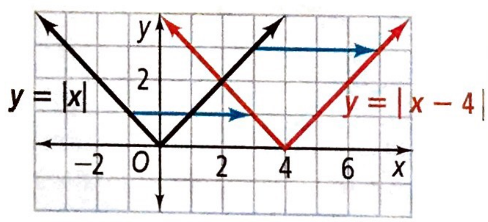
The graph of an **absolute value function** is a **V**-shaped graph that opens upward or downward.

A **translation** shifts a graph either vertically, horizontally, or both. To graph an absolute value function, you can translate $y = |x|$.

Example

Graph the absolute value function $y = |x - 4|$.

Start with the graph of $y = |x|$. Translate the graph right 4 units.



Exercises

Graph each function by translating $y = |x|$.

36. $y = |x| + 2$

37. $y = |x| - 7$

38. $y = |x + 3|$

39. $y = |x - 5|$

40. The table below shows the income tax for a single person's monthly income. Graph the step function for this information.

Tax Rates for Single Persons

If Monthly Income Is . . .	Computed Tax is . . .
\$0–\$504.00	0%
\$504.01–\$869.00	10%
\$869.01–\$3,004.00	15%
\$3,004.01–\$5,642.00	25%
\$5,642.01–\$7,038.00	30%