2.2 EXERCISES

HOMEWORK KEY

◯ = **WORKED-OUT SOLUTIONS** on p. WS2 for Exs. 9, 19, and 45

★ = **STANDARDIZED TEST PRACTICE** Exs. 2, 17, 35, 36, 44, 45, and 48

SKILL PRACTICE

1. **VOCABULARY** Copy and complete: The ? of a nonvertical line is the ratio of vertical change to horizontal change.

2. ★ **WRITING** How can you use slope to decide whether two nonvertical lines are parallel? whether two nonvertical lines are perpendicular?

EXAMPLES 2 and 3 on pp. 82–83 for Exs. 3–17

FINDING SLOPE **Find the slope of the line passing through the given points. Then tell whether the line *rises*, *falls*, *is horizontal*, or *is vertical*.**

3. (2, −4), (4, −1)
4. (8, 9), (−4, 3)
5. (5, 1), (8, −4)
6. (−3, −2), (3, −2)
7. (−1, 4), (1, −4)
8. (−6, 5), (−6, −5)
9. (−5, −4), (−1, 3)
10. (−3, 6), (−7, 3)
11. (4, 4), (4, 9)
12. (5, 5), (7, 3)
13. (0, −3), (4, −3)
14. (1, −1), (−1, −4)

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ERROR ANALYSIS ***Describe*** **and correct the error in finding the slope of the line passing through the given points.**

15. (−4, −3), (2, −1)

$$m = \frac{-1-(-3)}{-4-2} = -\frac{1}{3}$$ ✗

16. (−1, 4), (5, 1)

$$m = \frac{5-(-1)}{1-4} = -2$$ ✗

17. ★ **MULTIPLE CHOICE** What is true about the line through (2, −4) and (5, 1)?

Ⓐ It rises from left to right. Ⓑ It falls from left to right.

Ⓒ It is horizontal. Ⓓ It is vertical.

EXAMPLE 4 on p. 84 for Exs. 18–23

CLASSIFYING LINES **Tell whether the lines are *parallel*, *perpendicular*, or *neither*.**

18. Line 1: through (3, −1) and (6, −4)
Line 2: through (−4, 5) and (−2, 7)

19. Line 1: through (1, 5) and (3, −2)
Line 2: through (−3, 2) and (4, 0)

20. Line 1: through (−1, 4) and (2, 5)
Line 2: through (−6, 2) and (0, 4)

21. Line 1: through (5, 8) and (7, 2)
Line 2: through (−7, −2) and (−4, −1)

22. Line 1: through (−3, 2) and (5, 0)
Line 2: through (−1, −4) and (3, −3)

23. Line 1: through (1, −4) and (4, −2)
Line 2: through (8, 1) and (14, 5)

EXAMPLE 5 on p. 85 for Exs. 24–27

AVERAGE RATE OF CHANGE **Find the average rate of change in y relative to x for the ordered pairs. Include units of measure in your answer.**

24. (2, 12), (5, 30) x is measured in hours and y is measured in dollars

25. (0, 11), (3, 50) x is measured in gallons and y is measured in miles

26. (3, 10), (5, 18) x is measured in seconds and y is measured in feet

27. (1, 8), (7, 20) x is measured in seconds and y is measured in meters

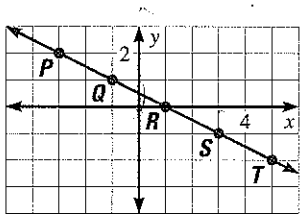
28. REASONING The Key Concept box on page 84 states that lines ℓ_1 and ℓ_2 must be nonvertical. *Explain* why this condition is necessary.

FINDING SLOPE Find the slope of the line passing through the given points.

29. $\left(-1, \frac{3}{2}\right), \left(0, \frac{7}{2}\right)$ **30.** $\left(-\frac{3}{4}, -2\right), \left(\frac{5}{4}, -3\right)$ **31.** $\left(-\frac{1}{2}, \frac{5}{2}\right), \left(\frac{5}{2}, 3\right)$

32. $(-4.2, 0.1), (-3.2, 0.1)$ **33.** $(-0.3, 2.2), (1.7, -0.8)$ **34.** $(3.5, -2), (4.5, 0.5)$

35. ★ SHORT RESPONSE Does it make a difference which two points on a line you choose when finding the slope? Does it make a difference which point is (x_1, y_1) and which point is (x_2, y_2) in the formula for slope? Support your answers using three different pairs of points on the line shown.



36. ★ OPEN-ENDED MATH Find two additional points on the line that passes through $(0, 3)$ and has a slope of -4.

CHALLENGE Find the value of k so that the line through the given points has the given slope. Check your solution.

37. $(2, -3)$ and $(k, 7)$; $m = -2$ **38.** $(0, k)$ and $(3, 4)$; $m = 1$

39. $(-4, 2k)$ and $(k, -5)$; $m = -1$ **40.** $(-2, k)$ and $(2k, 2)$; $m = -0.25$

PROBLEM SOLVING

EXAMPLE 1 on p. 82 for Exs. 41–44

41. ESCALATORS An escalator in an airport rises 28 feet over a horizontal distance of 48 feet. What is the slope of the escalator?

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42. INCLINE RAILWAY The Duquesne Incline, a cable car railway, rises 400 feet over a horizontal distance of 685 feet on its ascent to an overlook of Pittsburgh, Pennsylvania. What is the slope of the incline?

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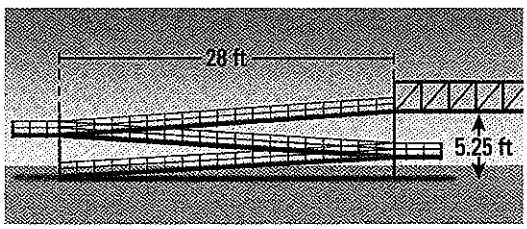
43. ROAD GRADE A road's *grade* is its slope expressed as a percent. A road rises 195 feet over a horizontal distance of 3000 feet. What is the grade of the road?

44. ★ SHORT RESPONSE The diagram shows a three-section ramp to a bridge. For a person walking up the ramp, each section has the same positive slope. *Compare* this slope with the slope that a single-section ramp would have if it rose directly to the bridge from the same starting point. *Explain* the benefits of a three-section ramp in this situation.



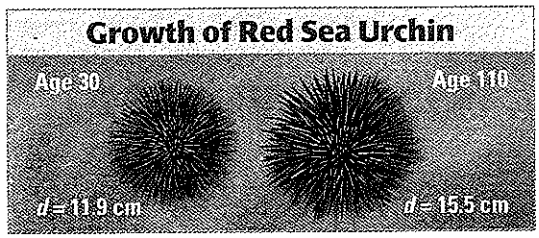
EXAMPLE 5 on p. 85 for Exs. 45–46

45. ★ MULTIPLE CHOICE Over a 30 day period, the amount of propane in a tank that stores propane for heating a home decreases from 400 gallons to 214 gallons. What is the average rate of change in the amount of propane?

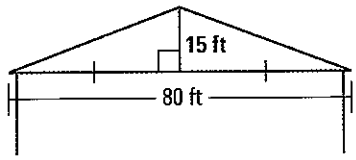
Ⓐ -6.2 gallons per day Ⓑ -6 gallons per day

Ⓒ -0.16 gallon per day Ⓓ 6 gallons per day

46. BIOLOGY A red sea urchin grows its entire life, which can last 200 years. The diagram gives information about the growth in the diameter d of one red sea urchin. What is the average growth rate of this urchin over the given period?



47. MULTI-STEP PROBLEM A building code requires the minimum slope, or *pitch*, of an asphalt-shingle roof to be a rise of 3 feet for each 12 feet of run. The asphalt-shingle roof of an apartment building has the dimensions shown.



a. Calculate What is the slope of the roof?

b. Interpret Does the roof satisfy the building code?

c. Reasoning If you answered "no" to part (b), by how much must the rise be increased to satisfy the code? If you answered "yes," by how much does the rise exceed the code minimum?

48. ★ EXTENDED RESPONSE Plans for a new water slide in an amusement park call for the slide to descend from a platform 80 feet tall. The slide will drop 1 foot for every 3 feet of horizontal distance.

a. What horizontal distance do you cover when descending the slide?

b. Use the Pythagorean theorem to find the length of the slide.

c. Engineers decide to shorten the slide horizontally by 5 feet to allow for a wider walkway at the slide's base. The plans for the platform remain unchanged. How will this affect the slope of the slide? *Explain.*

49. CHALLENGE A car travels 36 miles per gallon of gasoline in highway driving and 24 miles per gallon in city driving. If you drive the car equal distances on the highway and in the city, how many miles per gallon can you expect to average? (*Hint:* The average fuel efficiency for all the driving is the total distance traveled divided by the total amount of gasoline used.)

MIXED REVIEW

Identify the property that the statement illustrates. *(p. 2)*

50. $5(8 + 12) = 5(8) + 5(12)$

51. $(7 + 9) + 13 = 7 + (9 + 13)$

52. $4 + (-4) = 0$

53. $5 \cdot 10 = 10 \cdot 5$

54. $15 \cdot \frac{1}{15} = 1$

55. $\frac{2}{3} \cdot 1 = \frac{2}{3}$

PREVIEW
Prepare for Lesson 2.3 in Exs. 56–61.

Solve the equation for y. *(p. 26)*

56. $3x + y = 7$

57. $2x - y = 3$

58. $y - 4x = -6$

59. $2x + 3y = -12$

60. $7x - 4y = 10$

61. $-x + 2y = 9$

Solve the equation or inequality. *(p. 51)*

62. $|5 + 2x| = 7$

63. $|4x - 9| = 5$

64. $|6 - 5x| = 9$

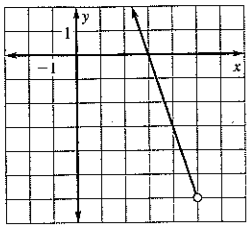
65. $|3 - 7x| < 10$

66. $|3x + 1| > 25$

67. $|3 - 4x| \geq 7$

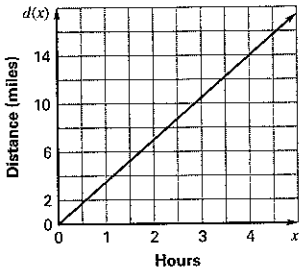
EXTRA PRACTICE for Lesson 2.2, p. 1011

ONLINE QUIZ at classzone.com

3. 

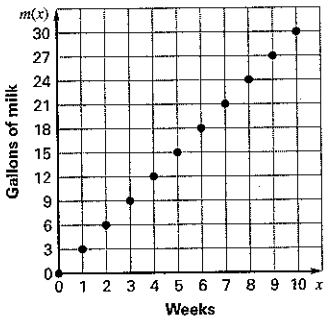
continuous; $y > -6$

5. $d(x) = 3.5x$



domain: $x \geq 0$, range: $d(x) \geq 0$; continuous

7. $m(x) = 3x$

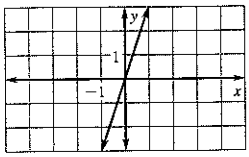


domain: whole numbers, range: multiples of 3; discrete

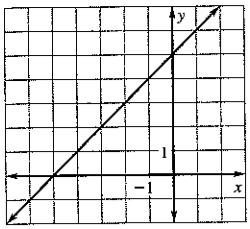
2.2 Skill Practice (pp. 86–87) **1.** slope **3.** $\frac{3}{2}$; rises **5.** $-\frac{5}{3}$; falls **7.** -4; falls **9.** $\frac{7}{4}$; rises **11.** undefined; is vertical **13.** 0; is horizontal **15.** The x and y coordinates were not subtracted in the correct order; $\frac{-1-(-3)}{2-(-4)} = \frac{1}{3}$. **19.** neither **21.** perpendicular **23.** parallel **25.** 13 mi/gal **27.** 2 m/sec **29.** 2 **31.** $\frac{1}{6}$ **33.** $-\frac{3}{2}$ **35.** No; no. *Sample answer:* The slope of $\overleftrightarrow{PQ} = \frac{2-1}{-3-(-1)} = -\frac{1}{2}$. The slope of $\overleftrightarrow{QR} = \frac{1-0}{-1-1} = -\frac{1}{2}$. The slope of $\overleftrightarrow{ST} = \frac{-1-(-2)}{3-5} = -\frac{1}{2}$.

2.2 Problem Solving (pp. 87–88) **41.** $\frac{7}{12}$ **43.** 6.5% **47. a.** $\frac{3}{8}$ **b.** yes **c.** $\frac{1}{8}$

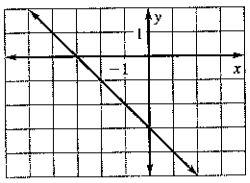
2.3 Skill Practice (pp. 93–94) **1.** slope-intercept

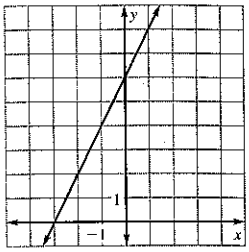
3. 

Both graphs have a y-intercept of 0, but the graph of $y = 3x$ has a slope of 3 instead of 1.

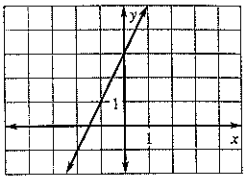
5. 

Both graphs have a slope of 1, but the graph of $y = x + 5$ has a y-intercept of 5 instead of 0.

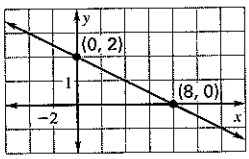
9. 

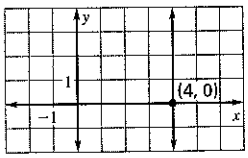
11. 

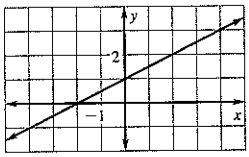
21. The slope and y-intercept were switched around.

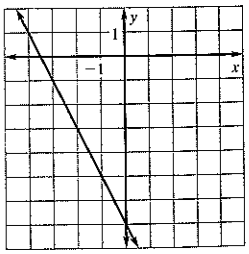


25. x-intercept: -15, y-intercept: -3 **27.** x-intercept: 5, y-intercept: -10 **29.** x-intercept: 6, y-intercept: -4.5

31. 

33. 

43. 

45. 

55. *Sample answer:* $x = 3$, $y = -2$ **57.** slope: $-\frac{A}{B}$, y-intercept: $\frac{C}{B}$