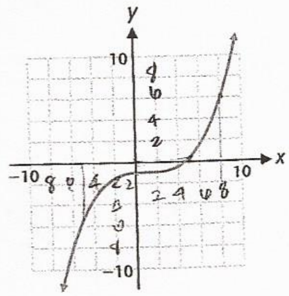
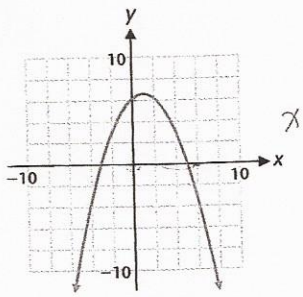
In Problems 31–34, use the graph to estimate to the nearest integer the missing coordinates of the indicated points. (Be sure you find all possible answers.)

31. (A) (8, ?) (B) (−5, ?) (C) (0, ?)
(D) (?, 6) (E) (?, −5) (F) (?, 0)

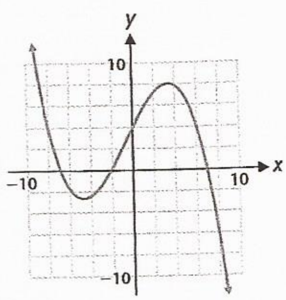


32. (A) (3, ?) (B) (−5, ?) (C) (0, ?)
(D) (?, 3) (E) (?, −4) (F) (?, 0)

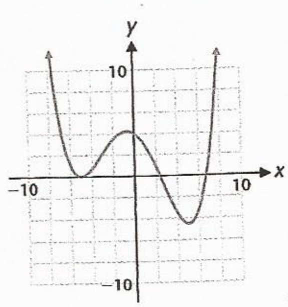


x y

33. (A) (1, ?) (B) (−8, ?) (C) (0, ?)
(D) (?, −6) (E) (?, 4) (F) (?, 0)

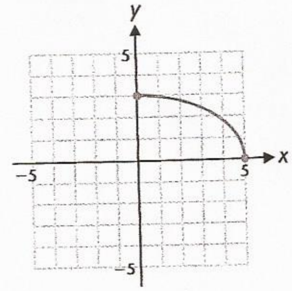


34. (A) (6, ?) (B) (−6, ?) (C) (0, ?)
(D) (?, −2) (E) (?, 1) (F) (?, 0)

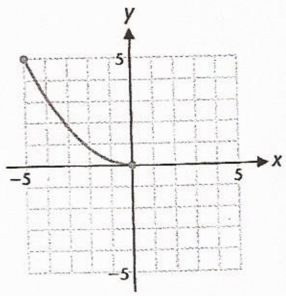


The figures in Problems 35 and 36 show a portion of a graph. Extend the given graph to one that exhibits the indicated type of symmetry.

35. (A) x axis only
(B) y axis only
(C) origin only
(D) x axis, y axis, and origin



36. (A) x axis only
(B) y axis only
(C) origin only
(D) x axis, y axis, and origin



Test each equation in Problems 37–46 for symmetry with respect to the x axis, the y axis, and the origin. Do not sketch the graph.

37. $2x + 7y = 0$

38. $x^2 + 6y + y^2 = 25$

39. $x^2 - 4xy^2 = 3$

40. $3x - 5y = 2$

41. $x^4 - 5x^2y + y^4 = 1$

42. $x^4 - y^4 = 16$

43. $x^3 - y^3 = 8$

44. $x^2 + 2xy + 3y^2 = 12$

45. $x^4 - 4x^2y^2 + y^4 = 81$

46. $x^3 - 4y^2 = 1$

Test each equation in Problems 47–58 for symmetry with respect to the x axis, the y axis, and the origin. Sketch the graph of the equation.

47. $y^2 = x + 2$ **48.** $y^2 = x - 2$

49. $y = x^2 + 1$ **50.** $y + 2 = x^2$

51. $4y^2 - x^2 = 1$ **52.** $4x^2 - y^2 = 1$

53. $y^3 = x$ **54.** $y = x^4$

55. $y = 0.6x^2 - 4.5$ **56.** $x = 0.8y^2 - 3.5$

57. $y = x^{2/3}$ **58.** $y^{2/3} = x$

59. (A) Graph the triangle with vertices $A = (1, 1)$, $B = (7, 2)$, and $C = (4, 6)$.
(B) Now graph the triangle with vertices $A' = (1, -1)$, $B' = (7, -2)$, and $C' = (4, -6)$ in the same coordinate system.
(C) How are these two triangles related? How would you describe the effect of changing the sign of the y coordinate of all the points on a graph?

2-2 Exercises

1. State the Pythagorean theorem.

2. Explain how to calculate the distance between two points in the plane if you know their coordinates.

3. Explain how to calculate the midpoint of a line segment if you know the coordinates of the endpoints.

4. Explain how to find the standard form of the equation of the circle with center (1, 5) and radius $\sqrt{2}$.

In Problems 5–12, find the distance between each pair of points and the midpoint of the line segment joining the points. Leave distance in radical form, if applicable.

5. (1, 0), (4, 4) **6.** (0, 1), (3, 5)

7. (0, −2), (5, 10) **8.** (3, 0), (−2, −3)

9. (−6, −4), (3, 4) **10.** (−5, 4), (6, −1)

11. (−6, −3), (−2, −1) **12.** (−5, −2), (−1, 2)

In Problems 13–20, write the equation of a circle with the indicated center and radius.

13. $C = (0, 0), r = 7$ **14.** $C = (0, 0), r = 5$

15. $C = (2, 3), r = 6$ **16.** $C = (5, 6), r = 2$

17. $C = (-4, 1), r = \sqrt{7}$ **18.** $C = (-5, 6), r = \sqrt{11}$

19. $C = (-3, -4), r = \sqrt{2}$ **20.** $C = (4, -1), r = \sqrt{5}$

In Problems 21–26, write an equation for the given set of points. Graph your equation.

21. The set of all points that are two units from the origin.

22. The set of all points that are four units from the origin.

23. The set of all points that are one unit from (1, 0).

24. The set of all points that are one unit from (0, −1).

25. The set of all points that are three units from (−2, 1).

26. The set of all points that are two units from (3, −2).

27. Let M be the midpoint of A and B, where

$$A = (a_1, a_2),\ B = (1, 3), \text{ and } M = (-2, 6).$$

(A) Use the fact that −2 is the average of a_1 and 1 to find a_1.
(B) Use the fact that 6 is the average of a_2 and 3 to find a_2.
(C) Find $d(A, M)$ and $d(M, B)$.

28. Let M be the midpoint of A and B, where

$$A = (-3, 5),\ B = (b_1, b_2), \text{ and } M = (4, -2).$$

(A) Use the fact that 4 is the average of −3 and b_1 to find b_1.
(B) Use the fact that −2 is the average of 5 and b_2 to find b_2.
(C) Find $d(A, M)$ and $d(M, B)$.

29. Find x such that $(x, 7)$ is 10 units from $(-4, 1)$.

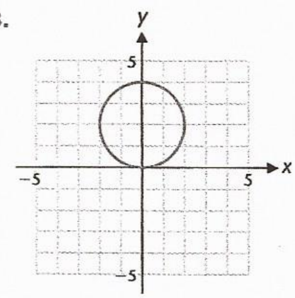
30. Find x such that $(x, 2)$ is 4 units from $(3, -3)$.

31. Find y such that $(2, y)$ is 3 units from $(-1, 4)$.

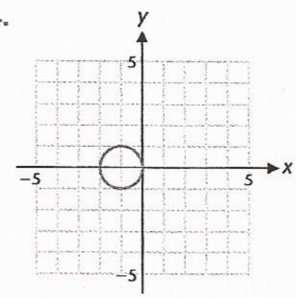
32. Find y such that $(3, y)$ is 13 units from $(-9, 2)$.

In Problems 33–36, write a verbal description of the graph and then write an equation that would produce the graph.

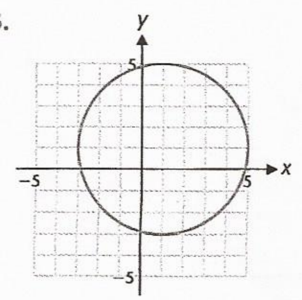
33.



34.



35.



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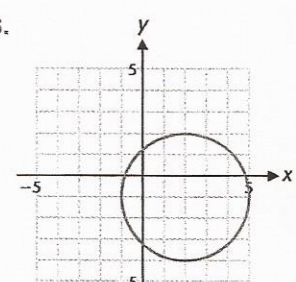


2-3 Exercises

1. Explain how to find the x and y intercepts of a line if its equation is written in standard form.

2. Given the graph of a line, explain how to determine whether the slope is negative.

3. Explain why $y = mx + b$ is called the slope–intercept form.

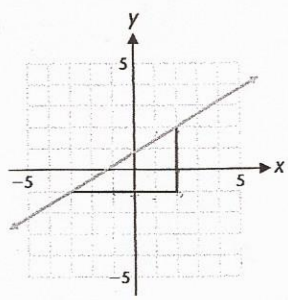
4. Explain why $y - y_1 = m(x - x_1)$ is called the point–slope form.

5. Given the equations of two lines in standard form, explain how to determine whether the lines are parallel.

6. Given the equations of two lines in standard form, explain how to determine whether the lines are perpendicular.

In Problems 7–12, use the graph of each line to find the rise, run, and slope. Write the equation of each line in the standard form $Ax + By = C$, $A \geq 0$. (All the horizontal and vertical line segments have integer lengths.)

7.



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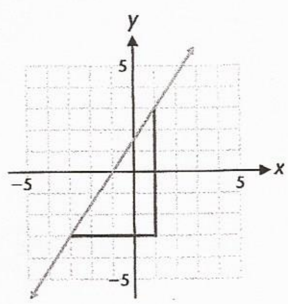

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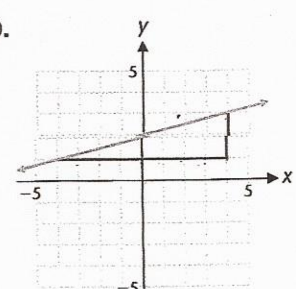

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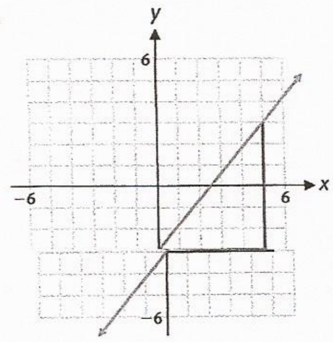

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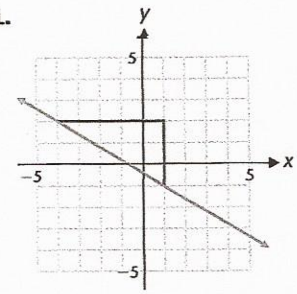

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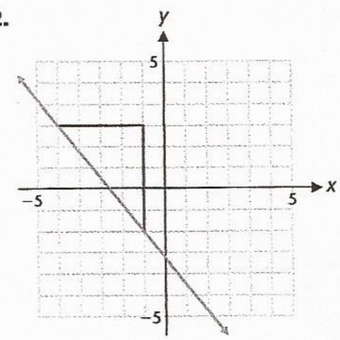
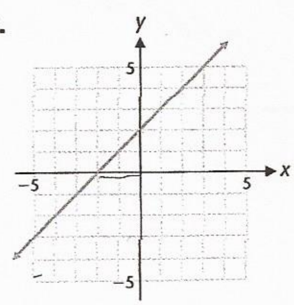


In Problems 13–18, use the graph of each line to find the x inter y intercept, and slope, if they exist. Write the equation of each li using the slope–intercept form whenever possible.

13.



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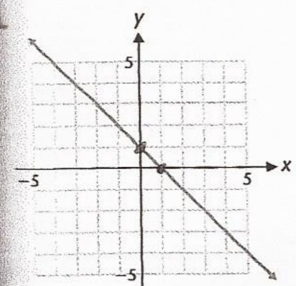

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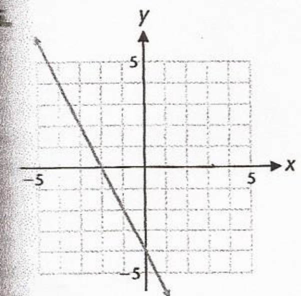
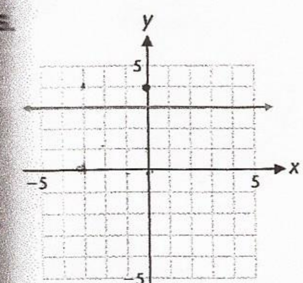
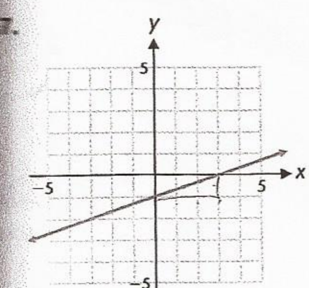


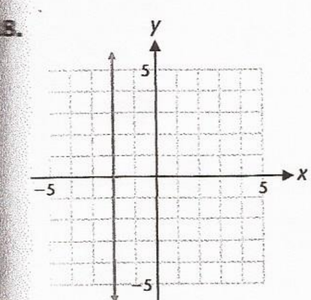
16.



17.



18.



Graph each equation in Problems 19–32, and indicate the slope, if it exists.

19. $y = -\frac{3}{5}x + 4$ **20.** $y = -\frac{3}{2}x + 6$

21. $y = -\frac{3}{4}x$ **22.** $y = \frac{2}{3}x - 3$

23. $4x + 2y = 0$ 24. $6x - 2y = 0$

25. $4x - 5y = -24$ **26.** $6x - 7y = -49$

27. $\frac{y}{8} - \frac{x}{4} = 1$ **28.** $\frac{y}{6} - \frac{x}{5} = 1$

29. $x = -3$ **30.** $y = -2$

31. $y = 3.5$ **32.** $x = 2.5$

In Problems 33–38, find an equation of the line with the indicated slope and y intercept, and write it in the form $Ax + By = C$, $A \geq 0$, where A, B, and C are integers.

33. Slope $= -3$; y intercept $= 7$

34. Slope $= 4$; y intercept $= -10$

35. Slope $= \frac{7}{2}$; y intercept $= -\frac{1}{3}$

36. Slope $= -\frac{5}{4}$; y intercept $= \frac{11}{5}$

37. Slope $= 0$; y intercept $= \frac{2}{3}$

38. Slope $= 0$; y intercept $= 0$

In Problems 39–44, find the equation of the line passing through the given point with the given slope. Write the final answer in the slope–intercept form $y = mx + b$.

39. $(0, 3)$; $m = -2$ **40.** $(4, 0)$; $m = 3$

41. $(-5, 4)$; $m = \frac{3}{2}$ **42.** $(2, -3)$; $m = -\frac{4}{5}$

43. $(-2, -3)$; $m = -\frac{1}{2}$ **44.** $(2, 1)$; $m = \frac{4}{3}$

In Problem 45–58, write the equation of the line that contains the indicated point(s), and/or has the given slope or intercepts; use either the slope–intercept form $y = mx + b$, or the form $x = c$.

45. $(0, 4)$; $m = -3$ **46.** $(2, 0)$; $m = 2$

47. $(-5, 4)$; $m = -\frac{2}{5}$ **48.** $(-4, -2)$; $m = \frac{1}{2}$

49. $(1, 6)$; $(5, -2)$ **50.** $(-3, 4)$; $(6, 1)$

51. $(-4, 8)$; $(2, 0)$ **52.** $(2, -1)$; $(10, 5)$

53. $(-3, 4)$; $(5, 4)$ **54.** $(0, -2)$; $(4, -2)$

55. $(4, 6)$; $(4, -3)$ **56.** $(-3, 1)$; $(-3, -4)$

57. x intercept -4; y intercept 3 **58.** x intercept -4; y intercept -5

In Problems 59–66, write an equation of the line that contains the indicated point and meets the indicated condition(s). Write the final answer in the standard form $Ax + By = C$, $A \geq 0$.

59. $(-3, 4)$; parallel to $y = 3x - 5$

60. $(-4, 0)$; parallel to $y = -2x + 1$

61. $(2, -3)$; perpendicular to $y = -\frac{1}{3}x$

62. $(-2, -4)$; perpendicular to $y = \frac{2}{3}x - 5$

63. $(5, 0)$; parallel to $3x - 2y = 4$

64. $(3, 5)$; parallel to $3x + 4y = 8$

65. $(0, -4)$; perpendicular to $x + 3y = 9$

66. $(-2, 4)$; perpendicular to $4x + 5y = 0$