Summer Assignment **Honors Precalculus** **Summer, 2017**

1) Your summer assignment text can be found here: http://www.nhvweb.net/nhhs/math/. This is a copy of your textbook for next year – become familiar with the format, style, etc. This is a review of algebra and it will be assumed that you understand these concepts and topics.

2) You should be capable of doing all of these problems, unless otherwise stated, WITHOUT A CALCULATOR. Any problems that require the use of a calculator will be "starred" on the assignment sheet. (example: 4* means number 4 requires the use of a graphing calculator).

3) This assignment will be collected, checked by a notebook check, or both during the first days of school. A test on Chapters A-P will follow soon after.

4) You should do these problems showing all work in a neat, organized manner. Graphs should be done accurately (scale and points labeled, etc.).

5) Helping each other to understand the concepts and material is acceptable and encouraged. Doing each other's problems and copying each other's work is NOT. Being penalized for cheating on the first assignment of the year is not a good way to start the course.

6) Calculators: You will be assigned a TI-83+ or TI-84+ when you return to school, unless you already have your own.

HONORS PRECALCULUS

Assignments Chapter P

Section	Page(s)	Problems
A.1		2, 11, 17, 19, 22, 29, 32, 35, 43, 46, 47, 50, 51, 56, 59, 62, 67, 70, 76
A.2		4, 6, 7, 12, 18, 20, 23, 26, 31, 36, 40, 47, 52, 53, 56, 61, 67, 71, 74, 83
P.1		5, 7, 11, 15, 19, 23, 27, 31, 39, 41, 43, 47-50, 63
P.2		9, 13, 21, 27, 37, 43, 45, 51, 55, 67-69
P.3		3, 7, 23, 27, 33, 41, 45, 49, 53
P.4		5, 9, 13, 17, 21, 25, 35, 43, 47, 55, 59
P.5		5, 9, 17, 23, 33*, 34*, 47, 49, 51*, 53*, 59*, 61*, 68-71
P.6		3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43
P.7		1-15 odd, 7-29 odd (All *), 33*, 37*, 39*, 46-48 (All*)
Review		8, 11b, 14, 18, 21, 24, 31, 32, 38, 43, 46, 50, 62, 63, 68*, 71, 74, 75, 80, 81*

If you have any questions, please see one of us. We will be occasionally checking e-mail over the summer if you have questions during that time. Have fun!!

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Mr. Mark Gallo mgallo@nhvweb.net

APPENDIX A.1 Exercises

In Exercises 1–6, find the indicated real roots.

1. Square roots of 81
2. Fourth roots of 81
3. Cube roots of 64
4. Fifth roots of 243
5. Square roots of 16/9
6. Cube roots of $-27/8$

In Exercises 7–12, evaluate the expression without using a calculator.

7. $\sqrt{144}$
8. $\sqrt{-16}$
9. $\sqrt[3]{-216}$
10. $\sqrt[3]{216}$
11. $\sqrt[3]{-\frac{64}{27}}$
12. $\sqrt{\frac{64}{25}}$

In Exercises 13–22, use a calculator to evaluate the expression.

13. $\sqrt[4]{256}$
14. $\sqrt[5]{3125}$
15. $\sqrt[3]{15.625}$
16. $\sqrt{12.25}$
17. $81^{3/2}$
18. $16^{5/4}$
19. $32^{-2/5}$
20. $27^{-4/3}$
21. $\left(-\frac{1}{8}\right)^{-1/3}$
22. $\left(-\frac{125}{64}\right)^{-1/3}$

In Exercises 27–36, simplify by removing factors from the radicand.

27. $\sqrt{288}$
28. $\sqrt[3]{500}$
29. $\sqrt[3]{-250}$
30. $\sqrt[4]{192}$
31. $\sqrt{2x^3y^4}$
32. $\sqrt[3]{-27x^3y^6}$
33. $\sqrt[4]{3x^8y^6}$
34. $\sqrt[3]{8x^6y^4}$
35. $\sqrt[5]{96x^{10}}$
36. $\sqrt{108x^4y^9}$

In Exercises 37–42, rationalize the denominator.

37. $\frac{4}{\sqrt[3]{2}}$
38. $\frac{1}{\sqrt{5}}$
39. $\frac{1}{\sqrt[5]{x^2}}$
40. $\frac{2}{\sqrt[4]{y}}$
41. $\sqrt[3]{\frac{x^2}{y}}$
42. $\sqrt[5]{\frac{a^3}{b^2}}$

In Exercises 43–46, convert to exponential form.

43. $\sqrt[3]{(a+2b)^2}$
44. $\sqrt[5]{x^2y^3}$
45. $2x\sqrt[3]{x^2y}$
46. $xy\sqrt[4]{xy^3}$

In Exercises 47–50, convert to radical form.

47. $a^{3/4}b^{1/4}$
48. $x^{2/3}y^{1/3}$
49. $x^{-5/3}$
50. $(xy)^{-3/4}$

In Exercises 51–56, write using a single radical.

51. $\sqrt{\sqrt{2x}}$
52. $\sqrt{\sqrt[3]{3x^2}}$
53. $\sqrt[4]{\sqrt{xy}}$
54. $\sqrt[3]{\sqrt{ab}}$
55. $\frac{\sqrt[5]{a^2}}{\sqrt[3]{a}}$
56. $\sqrt{a}\sqrt[3]{a^2}$

In Exercises 57–64, simplify the exponential expression.

57. $\frac{a^{3/5}a^{1/3}}{a^{3/2}}$
58. $(x^2y^4)^{1/2}$
59. $(a^{5/3}b^{3/4})(3a^{1/3}b^{5/4})$
60. $\left(\frac{x^{1/2}}{y^{2/3}}\right)^6$
61. $\left(\frac{-8x^6}{y^{-3}}\right)^{2/3}$
62. $\frac{(p^2q^4)^{1/2}}{(27q^3p^6)^{1/3}}$
63. $\frac{(x^9y^6)^{-1/3}}{(x^6y^2)^{-1/2}}$
64. $\left(\frac{2x^{1/2}}{y^{2/3}}\right)\left(\frac{3x^{-2/3}}{y^{1/2}}\right)$

In Exercises 65–74, simplify the radical expression.

65. $\sqrt{9x^{-6}y^4}$
66. $\sqrt{16y^8z^{-2}}$
67. $\sqrt[4]{\frac{3x^8y^2}{8x^2}}$
68. $\sqrt[5]{\frac{4x^6y}{9x^3}}$
69. $\sqrt[3]{\frac{4x^2}{y^2}} \cdot \sqrt[3]{\frac{2x^2}{y}}$
70. $\sqrt[5]{9ab^6} \cdot \sqrt[5]{27a^2b^{-1}}$
71. $3\sqrt{48} - 2\sqrt{108}$
72. $2\sqrt{175} - 4\sqrt{28}$
73. $\sqrt{x^3} - \sqrt{4xy^2}$
74. $\sqrt{18x^2y} + \sqrt{2y^3}$

In Exercises 75–82, replace ○ with $<$, $=$, or $>$ to make a true statement.

75. $\sqrt{2+6} \bigcirc \sqrt{2} + \sqrt{6}$
76. $\sqrt{4} + \sqrt{9} \bigcirc \sqrt{4+9}$
77. $(3^{-2})^{-1/2} \bigcirc 3$
78. $(2^{-3})^{1/3} \bigcirc 2$
79. $\sqrt[4]{(-2)^4} \bigcirc -2$
80. $\sqrt[3]{(-2)^3} \bigcirc -2$
81. $2^{2/3} \bigcirc 3^{3/4}$
82. $4^{-2/3} \bigcirc 3^{-3/4}$

83. The time t (in seconds) that it takes for a pendulum to complete one cycle is approximately $t = 1.1\sqrt{L}$, where L is the length (in feet) of the pendulum. How long is the period of a pendulum of length 10 ft?

84. The time t (in seconds) that it takes for a rock to fall a distance d (in meters) is approximately $t = 0.45\sqrt{d}$. How long does it take for the rock to fall a distance of 200 m?

85. **Writing to Learn** Explain why $\sqrt[n]{a}$ and a real nth root of a need not have the same value.

APPENDIX A.2 Exercises

In Exercises 1–4, write the polynomial in standard form and state its degree.

1. $2x - 1 + 3x^2$
2. $x^2 - 2x - 2x^3 + 1$
3. $1 - x^7$
4. $x^2 - x^4 + x - 3$

In Exercises 5–8, state whether the expression is a polynomial.

5. $x^3 - 2x^2 + x^{-1}$
6. $\dfrac{2x - 4}{x}$
7. $(x^2 + x + 1)^2$
8. $1 - 3x + x^4$

In Exercises 9–18, simplify the expression. Write your answer in standard form.

9. $(x^2 - 3x + 7) + (3x^2 + 5x - 3)$
10. $(-3x^2 - 5) - (x^2 + 7x + 12)$
11. $(4x^3 - x^2 + 3x) - (x^3 + 12x - 3)$
12. $-(y^2 + 2y - 3) + (5y^2 + 3y + 4)$
13. $2x(x^2 - x + 3)$
14. $y^2(2y^2 + 3y - 4)$
15. $-3u(4u - 1)$
16. $-4v(2 - 3v^3)$
17. $(2 - x - 3x^2)(5x)$
18. $(1 - x^2 + x^4)(2x)$

In Exercises 19–40, expand the product. Use vertical alignment in Exercises 33 and 34.

19. $(x - 2)(x + 5)$
20. $(2x + 3)(4x + 1)$
21. $(3x - 5)(x + 2)$
22. $(2x - 3)(2x + 3)$
23. $(3x - y)(3x + y)$
24. $(3 - 5x)^2$
25. $(3x + 4y)^2$
26. $(x - 1)^3$
27. $(2u - v)^3$
28. $(u + 3v)^3$
29. $(2x^3 - 3y)(2x^3 + 3y)$
30. $(5x^3 - 1)^2$
31. $(x^2 - 2x + 3)(x + 4)$
32. $(x^2 + 3x - 2)(x - 3)$
33. $(x^2 + x - 3)(x^2 + x + 1)$
34. $(2x^2 - 3x + 1)(x^2 - x + 2)$
35. $(x - \sqrt{2})(x + \sqrt{2})$
36. $(x^{1/2} - y^{1/2})(x^{1/2} + y^{1/2})$
37. $(\sqrt{u} + \sqrt{v})(\sqrt{u} - \sqrt{v})$
38. $(x^2 - \sqrt{3})(x^2 + \sqrt{3})$
39. $(x - 2)(x^2 + 2x + 4)$
40. $(x + 1)(x^2 - x + 1)$

In Exercises 41–44, factor out the common factor.

41. $5x - 15$
42. $5x^3 - 20x$
43. $yz^3 - 3yz^2 + 2yz$
44. $2x(x + 3) - 5(x + 3)$

In Exercises 45–48, factor the difference of two squares.

45. $z^2 - 49$
46. $9y^2 - 16$
47. $64 - 25y^2$
48. $16 - (x + 2)^2$

In Exercises 49–52, factor the perfect square trinomial.

49. $y^2 + 8y + 16$
50. $36y^2 + 12y + 1$
51. $4z^2 - 4z + 1$
52. $9z^2 - 24z + 16$

In Exercises 53–58, factor the sum or difference of two cubes.

53. $y^3 - 8$
54. $z^3 + 64$
55. $27y^3 - 8$
56. $64z^3 + 27$
57. $1 - x^3$
58. $27 - y^3$

In Exercises 59–68, factor the trinomial.

59. $x^2 + 9x + 14$
60. $y^2 - 11y + 30$
61. $z^2 - 5z - 24$
62. $6t^2 + 5t + 1$
63. $14u^2 - 33u - 5$
64. $10v^2 + 23v + 12$
65. $12x^2 + 11x - 15$
66. $2x^2 - 3xy + y^2$
67. $6x^2 + 11xy - 10y^2$
68. $15x^2 + 29xy - 14y^2$

In Exercises 69–74, factor by grouping.

69. $x^3 - 4x^2 + 5x - 20$
70. $2x^3 - 3x^2 + 2x - 3$
71. $x^6 - 3x^4 + x^2 - 3$
72. $x^6 + 2x^4 + x^2 + 2$
73. $2ac + 6ad - bc - 3bd$
74. $3uw + 12uz - 2vw - 8vz$

In Exercises 75–90, factor completely.

75. $x^3 + x$
76. $4y^3 - 20y^2 + 25y$
77. $18y^3 + 48y^2 + 32y$
78. $2x^3 - 16x^2 + 14x$
79. $16y - y^3$
80. $3x^4 + 24x$
81. $5y + 3y^2 - 2y^3$
82. $z - 8z^4$
83. $2(5x + 1)^2 - 18$
84. $5(2x - 3)^2 - 20$
85. $12x^2 + 22x - 20$
86. $3x^2 + 13xy - 10y^2$
87. $2ac - 2bd + 4ad - bc$
88. $6ac - 2bd + 4bc - 3ad$
89. $x^3 - 3x^2 - 4x + 12$
90. $x^4 - 4x^3 - x^2 + 4x$

SECTION P.1 Exercises

Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

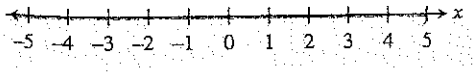
In Exercises 1–4, find the decimal form for the rational number. State whether it repeats or terminates.

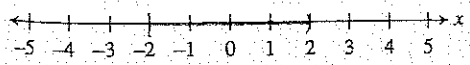
1. $-37/8$
2. $15/99$
3. $-13/6$
4. $5/37$

In Exercises 5–10, describe and graph the interval of real numbers.

5. $x \leq 2$
6. $-2 \leq x < 5$
7. $(-\infty, 7)$
8. $[-3, 3]$
9. x is negative.
10. x is greater than or equal to 2 and less than or equal to 6.

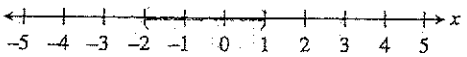
In Exercises 11–16, use an inequality to describe the interval of real numbers.

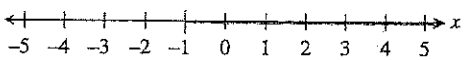
11. $[-1, 1)$
12. $(-\infty, 4]$
13. 

14. 

15. x is between -1 and 2.
16. x is greater than or equal to 5.

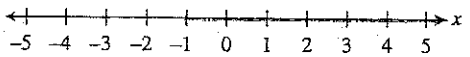
In Exercises 17–22, use interval notation to describe the interval of real numbers.

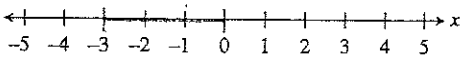
17. $x > -3$
18. $-7 < x < -2$
19. 

20. 

21. x is greater than -3 and less than or equal to 4.
22. x is positive.

In Exercises 23–28, use words to describe the interval of real numbers.

23. $4 < x \leq 9$
24. $x \geq -1$
25. $[-3, \infty)$
26. $(-5, 7)$
27. 

28. 

In Exercises 37–40, use the distributive property to write the factored form or the expanded form of the given expression.

37. $a(x^2 + b)$
38. $(y - z^3)c$
39. $ax^2 + dx^2$
40. $a^3z + a^3w$

In Exercises 41 and 42, find the additive inverse of the number.

41. $6 - \pi$
42. -7

In Exercises 43 and 44, identify the base of the exp[illegible]

43. -5^2
44. $(-2)^7$

In Exercises 47–52, simplify the expression. Assume that the variables in the denominators are nonzero.

47. $\dfrac{x^4y^3}{x^2y^5}$
48. $\dfrac{(3x^2)^2y^4}{3y^2}$
49. $\left(\dfrac{4}{x^2}\right)^2$
50. $\left(\dfrac{2}{xy}\right)^{-3}$

In Exercises 63 and 64, use scientific notation to simplify.

63. $\dfrac{(1.3 \times 10^{-7})(2.4 \times 10^{8})}{1.3 \times 10^{9}}$ without using a calculator
64. $\dfrac{(3.7 \times 10^{-7})(4.3 \times 10^{6})}{2.5 \times 10^{7}}$

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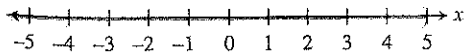
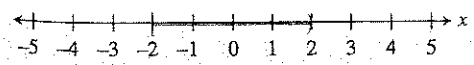
13. 

14. 

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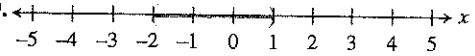
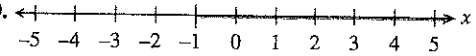
19. 

20. 

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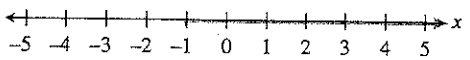
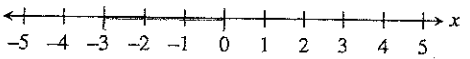
27. 

28. 

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SECTION P.2 Exercises

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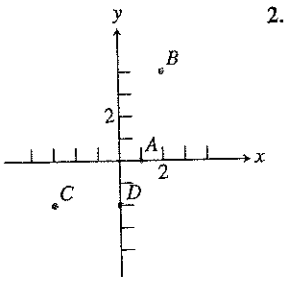
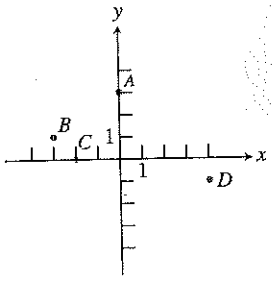
In Exercises 1 and 2, estimate the coordinates of the points.

1.



2.



In Exercises 3 and 4, name the quadrants containing the points.

3. (a) $(2, 4)$ (b) $(0, 3)$ (c) $(-2, 3)$ (d) $(-1, -4)$

4. (a) $\left(\frac{1}{2}, \frac{3}{2}\right)$ (b) $(-2, 0)$ (c) $(-1, -2)$ (d) $\left(-\frac{3}{2}, -\frac{7}{3}\right)$

In Exercises 5–8, evaluate the expression.

5. $3 + |-3|$

6. $2 - |-2|$

7. $|(-2)3|$

8. $\dfrac{-2}{|-2|}$

In Exercises 9 and 10, rewrite the expression without using absolute value symbols.

9. $|\pi - 4|$

10. $|\sqrt{5} - 5/2|$

In Exercises 11–18, find the distance between the points.

11. $-9.3, 10.6$

12. $-5, -17$

13. $(-3, -1), (5, -1)$

14. $(-4, -3), (1, 1)$

15. $(0, 0), (3, 4)$

16. $(-1, 2), (2, -3)$

17. $(-2, 0), (5, 0)$

18. $(0, -8), (0, -1)$

In Exercises 19–22, find the perimeter and area of the figure determined by the points.

19. $(-5, 3), (0, -1), (4, 4)$

20. $(-2, -2), (-2, 2), (2, 2), (2, -2)$

21. $(-3, -1), (-1, 3), (7, 3), (5, -1)$

22. $(-2, 1), (-2, 6), (4, 6), (4, 1)$

In Exercises 23–28, find the midpoint of the line segment with the given endpoints.

23. $-9.3, 10.6$

24. $-5, -17$

25. $(-1, 3), (5, 9)$

26. $\left(3, \sqrt{2}\right), (6, 2)$

27. $(-7/3, 3/4), (5/3, -9/4)$

28. $(5, -2), (-1, -4)$

37. Prove that the figure determined by the points is an isosceles triangle: $(1, 3), (4, 7), (8, 4)$

In Exercises 41–44, find the standard form equation for the circle.

41. Center $(1, 2)$, radius 5

42. Center $(-3, 2)$, radius 1

43. Center $(-1, -4)$, radius 3

44. Center $(0, 0)$, radius $\sqrt{3}$

In Exercises 45–48, find the center and radius of the circle.

45. $(x - 3)^2 + (y - 1)^2 = 36$

46. $(x + 4)^2 + (y - 2)^2 = 121$

47. $x^2 + y^2 = 5$

48. $(x - 2)^2 + (y + 6)^2 = 25$

In Exercises 49–52, write the statement using absolute value notation.

49. The distance between x and 4 is 3.

50. The distance between y and -2 is greater than or equal to 4.

51. The distance between x and c is less than d units.

52. y is more than d units from c.

53. Let $(4, 4)$ be the midpoint of the line segment determined by the points $(1, 2)$ and (a, b). Determine a and b.

54. **Writing to Learn Isosceles but Not Equilateral** Prove that the triangle determined by the points $(3, 0)$, $(-1, 2)$, and $(5, 4)$ is isosceles but not equilateral.

55. **Writing to Learn Equidistant Point** Prove that the midpoint of the hypotenuse of the right triangle with vertices $(0, 0)$, $(5, 0)$, and $(0, 7)$ is equidistant from the three vertices.

56. **Writing to Learn** Describe the set of real numbers that satisfy $|x - 2| < 3$.

57. **Writing to Learn** Describe the set of real numbers that satisfy $|x + 3| \geq 5$.

In Exercises 67–69, let $P(a, b)$ be a point in the first quadrant.

67. Find the coordinates of the point Q in the fourth quadrant so that the x-axis is the perpendicular bisector of PQ.

68. Find the coordinates of the point Q in the second quadrant so that the y-axis is the perpendicular bisector of PQ.

69. Find the coordinates of the point Q in the third quadrant so that the origin is the midpoint of the segment PQ.

70. **Writing to Learn** Prove that the distance formula for the number line is a special case of the distance formula for the Cartesian plane.

SECTION P.3 Exercises

Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1–4, which values of x are solutions of the equation?

1. $2x^2 + 5x = 3$

(a) $x = -3$ (b) $x = -\frac{1}{2}$ (c) $x = \frac{1}{2}$

2. $\frac{x}{2} + \frac{1}{6} = \frac{x}{3}$

(a) $x = -1$ (b) $x = 0$ (c) $x = 1$

3. $\sqrt{1 - x^2} + 2 = 3$

(a) $x = -2$ (b) $x = 0$ (c) $x = 2$

4. $(x - 2)^{1/3} = 2$

(a) $x = -6$ (b) $x = 8$ (c) $x = 10$

In Exercises 5–10, determine whether the equation is linear in x.

5. $5 - 3x = 0$ **6.** $5 = 10/2$

7. $x + 3 = x - 5$ **8.** $x - 3 = x^2$

9. $2\sqrt{x} + 5 = 10$ **10.** $x + \frac{1}{x} = 1$

In Exercises 11–24, solve the equation without using a calculator.

11. $3x = 24$ **12.** $4x = -16$

13. $3t - 4 = 8$ **14.** $2t - 9 = 3$

15. $2x - 3 = 4x - 5$ **16.** $4 - 2x = 3x - 6$

17. $4 - 3y = 2(y + 4)$ **18.** $4(y - 2) = 5y$

19. $\frac{1}{2}x = \frac{7}{8}$ **20.** $\frac{2}{3}x = \frac{4}{5}$

21. $\frac{1}{2}x + \frac{1}{3} = 1$ **22.** $\frac{1}{3}x + \frac{1}{4} = 1$

23. $2(3 - 4z) - 5(2z + 3) = z - 17$

24. $3(5z - 3) - 4(2z + 1) = 5z - 2$

In Exercises 25–28, solve the equation. Support your answer with a calculator.

25. $\frac{2x - 3}{4} + 5 = 3x$ **26.** $2x - 4 = \frac{4x - 5}{3}$

27. $\frac{t + 5}{8} - \frac{t - 2}{2} = \frac{1}{3}$ **28.** $\frac{t - 1}{3} + \frac{t + 5}{4} = \frac{1}{2}$

In Exercises 31–34, which values of x are solutions of the inequality?

31. $2x - 3 < 7$

(a) $x = 0$ (b) $x = 5$ (c) $x = 6$

32. $3x - 4 \geq 5$

(a) $x = 0$ (b) $x = 3$ (c) $x = 4$

33. $-1 < 4x - 1 \leq 11$

(a) $x = 0$ (b) $x = 2$ (c) $x = 3$

34. $-3 \leq 1 - 2x \leq 3$

(a) $x = -1$ (b) $x = 0$ (c) $x = 2$

In Exercises 35–42, solve the inequality, and draw a number line graph of the solution set.

35. $x - 4 < 2$ **36.** $x + 3 > 5$

37. $2x - 1 \leq 4x + 3$ **38.** $3x - 1 \geq 6x + 8$

39. $2 \leq x + 6 < 9$ **40.** $-1 \leq 3x - 2 < 7$

41. $2(5 - 3x) + 3(2x - 1) \leq 2x + 1$

42. $4(1 - x) + 5(1 + x) > 3x - 1$

In Exercises 43–54, solve the inequality.

43. $\frac{5x + 7}{4} \leq -3$ **44.** $\frac{3x - 2}{5} > -1$

45. $4 \geq \frac{2y - 5}{3} \geq -2$ **46.** $1 > \frac{3y - 1}{4} > -1$

47. $0 \leq 2z + 5 < 8$ **48.** $-6 < 5t - 1 < 0$

49. $\frac{x - 5}{4} + \frac{3 - 2x}{3} < -2$ **50.** $\frac{3 - x}{2} + \frac{5x - 2}{3} < -1$

51. $\frac{2y - 3}{2} + \frac{3y - 1}{5} < y - 1$

52. $\frac{3 - 4y}{6} - \frac{2y - 3}{8} \geq 2 - y$

53. $\frac{1}{2}(x - 4) - 2x \leq 5(3 - x)$

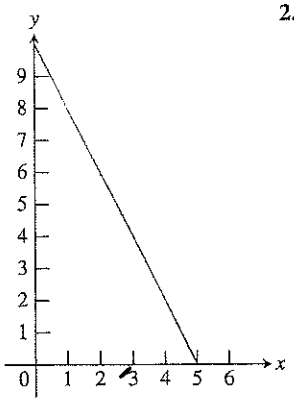
54. $\frac{1}{2}(x + 3) + 2(x - 4) < \frac{1}{3}(x - 3)$

SECTION P.4 Exercises

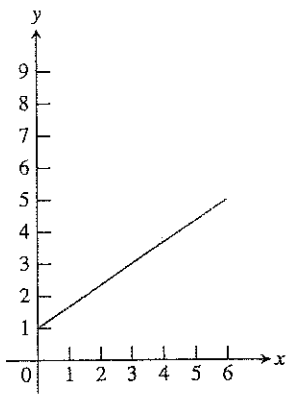
Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1 and 2, estimate the slope of the line.

1.



2.



In Exercises 3–6, find the slope of the line through the pair of points.

3. $(-3, 5)$ and $(4, 9)$

4. $(-2, 1)$ and $(5, -3)$

5. $(-2, -5)$ and $(-1, 3)$

6. $(5, -3)$ and $(-4, 12)$

In Exercises 7–10, find the value of x or y so that the line through the pair of points has the given slope.

Points	Slope
7. $(x, 3)$ and $(5, 9)$	$m = 2$
8. $(-2, 3)$ and $(4, y)$	$m = -3$
9. $(-3, -5)$ and $(4, y)$	$m = 3$
10. $(-8, -2)$ and $(x, 2)$	$m = 1/2$

In Exercises 11–14, find a point-slope form equation for the line through the point with given slope.

Point	Slope	Point	Slope
11. $(1, 4)$	$m = 2$	**12.** $(-4, 3)$	$m = -2/3$
13. $(5, -4)$	$m = -2$	**14.** $(-3, 4)$	$m = 3$

In Exercises 15–20, find a general form equation for the line through the pair of points.

15. $(-7, -2)$ and $(1, 6)$

16. $(-3, -8)$ and $(4, -1)$

17. $(1, -3)$ and $(5, -3)$

18. $(-1, -5)$ and $(-4, -2)$

19. $(-1, 2)$ and $(2, 5)$

20. $(4, -1)$ and $(4, 5)$

In Exercises 21–26, find a slope-intercept form equation for the line.

21. The line through $(0, 5)$ with slope $m = -3$

22. The line through $(1, 2)$ with slope $m = 1/2$

23. The line through the points $(-4, 5)$ and $(4, 3)$

24. The line through the points $(4, 2)$ and $(-3, 1)$

25. The line $2x + 5y = 12$

26. The line $7x - 12y = 96$

In Exercises 27–30, graph the linear equation on a grapher. Choose a viewing window that shows the line intersecting both the x- and y-axes.

27. $8x + y = 49$

28. $2x + y = 35$

29. $123x + 7y = 429$

30. $2100x + 12y = 3540$

In Exercises 33–36, find the value of x and the value of y for which $(x, 14)$ and $(18, y)$ are points on the graph.

33. $y = 0.5x + 12$

34. $y = -2x + 18$

35. $3x + 4y = 26$

36. $3x - 2y = 14$

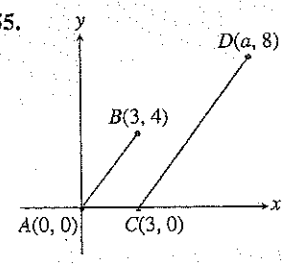
In Exercises 41–44, (a) find an equation for the line passing through the point and parallel to the given line, and (b) find an equation for the line passing through the point and perpendicular to the given line. Support your work graphically.

Point	Line
41. $(1, 2)$	$y = 3x - 2$
42. $(-2, 3)$	$y = -2x + 4$
43. $(3, 1)$	$2x + 3y = 12$
44. $(6, 1)$	$3x - 5y = 15$

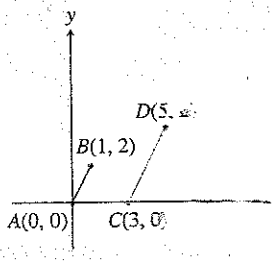
47. Navigation A commercial jet airplane climbs at takeoff with slope $m = 3/8$. How far in the horizontal direction will the airplane fly to reach an altitude of 12,000 ft above the take-off point?

In Exercises 55 and 56, determine a so that the line segments AB and CD are parallel.

55.



56.



59. Writing to Learn Perpendicular Lines

(a) Is it possible for two lines with positive slopes to be perpendicular? Explain.

(b) Is it possible for two lines with negative slopes to be perpendicular? Explain.

SECTION P.5 Exercises

In Exercises 1–6, solve the equation graphically by finding x-intercepts. Confirm by using factoring to solve the equation.

1. $x^2 - x - 20 = 0$ **2.** $2x^2 + 5x - 3 = 0$

3. $4x^2 - 8x + 3 = 0$ **4.** $x^2 - 8x = -15$

5. $x(3x - 7) = 6$ **6.** $x(3x + 11) = 20$

In Exercises 7–12, solve the equation by extracting square roots.

7. $4x^2 = 25$ **8.** $2(x - 5)^2 = 17$

9. $3(x + 4)^2 = 8$ **10.** $4(u + 1)^2 = 18$

11. $2y^2 - 8 = 6 - 2y^2$ **12.** $(2x + 3)^2 = 169$

In Exercises 13–18, solve the equation by completing the square.

13. $x^2 + 6x = 7$ **14.** $x^2 + 5x - 9 = 0$

15. $x^2 - 7x + \frac{5}{4} = 0$ **16.** $4 - 6x = x^2$

17. $2x^2 - 7x + 9 = (x - 3)(x + 1) + 3x$

18. $3x^2 - 6x - 7 = x^2 + 3x - x(x + 1) + 3$

In Exercises 19–24, solve the equation using the quadratic formula.

19. $x^2 + 8x - 2 = 0$ **20.** $2x^2 - 3x + 1 = 0$

21. $3x + 4 = x^2$ **22.** $x^2 - 5 = \sqrt{3}x$

23. $x(x + 5) = 12$

24. $x^2 - 2x + 6 = 2x^2 - 6x - 26$

In Exercises 29–34, solve the equation graphically by finding x-intercepts.

29. $x^2 + x - 1 = 0$ **30.** $4x^2 + 20x + 23 = 0$

31. $x^3 + x^2 + 2x - 3 = 0$ **32.** $x^3 - 4x + 2 = 0$

33. $x^2 + 4 = 4x$ **34.** $x^2 + 2x = -2$

In Exercises 47–56, use a method of your choice to solve the equation.

47. $x^2 + x - 2 = 0$ **48.** $x^2 - 3x = 12 - 3(x - 2)$

49. $|2x - 1| = 5$ **50.** $x + 2 - 2\sqrt{x + 3} = 0$

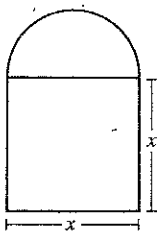
51. $x^3 + 4x^2 - 3x - 2 = 0$ **52.** $x^3 - 4x + 2 = 0$

53. $|x^2 + 4x - 1| = 7$ **54.** $|x + 5| = |x - 3|$

55. $|0.5x + 3| = x^2 - 4$ **56.** $\sqrt{x + 7} = -x^2 + 5$

59. Size of a Soccer Field Several of the World Cup '94 soccer matches were played in Stanford University's stadium in Menlo Park, California. The field is 30 yd longer than it is wide, and the area of the field is 8800 yd^2. What are the dimensions of this soccer field?

61. Finding the Dimensions of a Norman Window A Norman window has the shape of a square with a semicircle mounted on it. Find the width of the window if the total area of the square and the semicircle is to be 200 ft^2.



Explorations

68. Deriving the Quadratic Formula Follow these steps to use completing the square to solve $ax^2 + bx + c = 0$, $a \neq 0$.

(a) Subtract c from both sides of the original equation and divide both sides of the resulting equation by a to obtain

$$x^2 + \frac{b}{a}x = -\frac{c}{a}.$$

(b) Add the square of one-half of the coefficient of x in (a) to both sides and simplify to obtain

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}.$$

(c) Extract square roots in (b) and solve for x to obtain the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Extending the Ideas

69. Finding Number of Solutions Consider the equation $|x^2 - 4| = c$.

(a) Find a value of c for which this equation has four solutions. (There are many such values.)

(b) Find a value of c for which this equation has three solutions. (There is only one such value.)

(c) Find a value of c for which this equation has two solutions. (There are many such values.)

(d) Find a value of c for which this equation has no solutions. (There are many such values.)

(e) Writing to Learn Are there any other possible numbers of solutions of this equation? Explain.

70. Sums and Products of Solutions of $ax^2 + bx + c = 0$, $a \neq 0$ Suppose that $b^2 - 4ac > 0$.

(a) Show that the sum of the two solutions of this equation is $-b/a$.

(b) Show that the product of the two solutions of this equation is c/a.

71. Exercise 70 Continued The equation $2x^2 + bx + c = 0$ has two solutions x_1 and x_2. If $x_1 + x_2 = 5$ and $x_1 \cdot x_2 = 3$, find the two solutions.

SECTION P.6 Exercises

Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

In Exercises 1–8, write the sum or difference in the standard form $a + bi$ without using a calculator.

1. $(2 - 3i) + (6 + 5i)$

2. $(2 - 3i) + (3 - 4i)$

3. $(7 - 3i) + (6 - i)$

4. $(2 + i) - (9i - 3)$

5. $(2 - i) + (3 - \sqrt{-3})$

6. $(\sqrt{5} - 3i) + (-2 + \sqrt{-9})$

7. $(i^2 + 3) - (7 + i^3)$

8. $(\sqrt{7} + i^2) - (6 - \sqrt{-81})$

In Exercises 9–16, write the product in standard form without using a calculator.

9. $(2 + 3i)(2 - i)$

10. $(2 - i)(1 + 3i)$

11. $(1 - 4i)(3 - 2i)$

12. $(5i - 3)(2i + 1)$

13. $(7i - 3)(2 + 6i)$

14. $(\sqrt{-4} + i)(6 - 5i)$

15. $(-3 - 4i)(1 + 2i)$

16. $(\sqrt{-2} + 2i)(6 + 5i)$

In Exercises 17–20, write the expression in the form bi, where b is a real number.

17. $\sqrt{-16}$

18. $\sqrt{-25}$

19. $\sqrt{-3}$

20. $\sqrt{-5}$

In Exercises 21–24, find the real numbers x and y that make the equation true.

21. $2 + 3i = x + yi$

22. $3 + yi = x - 7i$

23. $(5 - 2i) - 7 = x - (3 + yi)$

24. $(x + 6i) = (3 - i) + (4 - 2yi)$

In Exercises 25–28, write the complex number in standard form.

25. $(3 + 2i)^2$

26. $(1 - i)^3$

27. $\left(\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i\right)^4$

28. $\left(\frac{\sqrt{3}}{2} + \frac{1}{2}i\right)^3$

In Exercises 29–32, find the product of the complex number and its conjugate.

29. $2 - 3i$

30. $5 - 6i$

31. $-3 + 4i$

32. $-1 - \sqrt{2}i$

In Exercises 33–40, write the expression in standard form without using a calculator.

33. $\frac{1}{2 + i}$

34. $\frac{i}{2 - i}$

35. $\frac{2 + i}{2 - i}$

36. $\frac{2 + i}{3i}$

37. $\frac{(2 + i)^2(-i)}{1 + i}$

38. $\frac{(2 - i)(1 + 2i)}{5 + 2i}$

39. $\frac{(1 - i)(2 - i)}{1 - 2i}$

40. $\frac{(1 - \sqrt{2}i)(1 + i)}{(1 + \sqrt{2}i)}$

In Exercises 41–44, solve the equation.

41. $x^2 + 2x + 5 = 0$

42. $3x^2 + x + 2 = 0$

43. $4x^2 - 6x + 5 = x + 1$

44. $x^2 + x + 11 = 5x - 8$

SECTION P.7 Exercises

In Exercises 1–8, solve the inequality algebraically. Write the solution in interval notation and draw its number line graph.

1. $|x + 4| \geq 5$
2. $|2x - 1| > 3.6$
3. $|x - 3| < 2$
4. $|x + 3| \leq 5$
5. $|4 - 3x| - 2 < 4$
6. $|3 - 2x| + 2 > 5$
7. $\left|\frac{x + 2}{3}\right| \geq 3$
8. $\left|\frac{x - 5}{4}\right| \leq 6$

In Exercises 9–16, solve the inequality. Use algebra to solve the corresponding equation.

9. $2x^2 + 17x + 21 \leq 0$
10. $6x^2 - 13x + 6 \geq 0$
11. $2x^2 + 7x > 15$
12. $4x^2 + 2 < 9x$
13. $2 - 5x - 3x^2 < 0$
14. $21 + 4x - x^2 > 0$
15. $x^3 - x \geq 0$
16. $x^3 - x^2 - 30x \leq 0$

In Exercises 17–26, solve the inequality graphically.

17. $x^2 - 4x < 1$
18. $12x^2 - 25x + 12 \geq 0$
19. $6x^2 - 5x - 4 > 0$
20. $4x^2 - 1 \leq 0$
21. $9x^2 + 12x - 1 \geq 0$
22. $4x^2 - 12x + 7 < 0$
23. $4x^2 + 1 > 4x$
24. $x^2 + 9 \leq 6x$
25. $x^2 - 8x + 16 < 0$
26. $9x^2 + 12x + 4 \geq 0$

In Exercises 27–30, solve the cubic inequality graphically.

27. $3x^3 - 12x + 2 \geq 0$
28. $8x - 2x^3 - 1 < 0$
29. $2x^3 + 2x > 5$
30. $4 \leq 2x^3 + 8x$

31. **Group Activity** Give an example of a quadratic inequality with the indicated solution.
   (a) All real numbers
   (b) No solution
   (c) Exactly one solution
   (d) $[-2, 5]$
   (e) $(-\infty, -1) \cup (4, \infty)$
   (f) $(-\infty, 0] \cup [4, \infty)$

32. **Revisiting Example 8** Solve the inequality $-16t^2 + 288t \geq 1152$ algebraically and compare your answer with the result obtained in Example 10.

33. **Projectile Motion** A projectile is launched straight up from ground level with an initial velocity of 256 ft/sec.
   (a) When will the projectile's height above ground be 768 ft?
   (b) When will the projectile's height above ground be at least 768 ft?
   (c) When will the projectile's height above ground be less than or equal to 768 ft?

34. **Projectile Motion** A projectile is launched straight up from ground level with an initial velocity of 272 ft/sec.
   (a) When will the projectile's height above ground be 960 ft?
   (b) When will the projectile's height above ground be more than 960 ft?
   (c) When will the projectile's height above ground be less than or equal to 960 ft?

35. **Writing to Learn** Explain the role of equation solving in the process of solving an inequality. Give an example.

36. **Travel Planning** Barb wants to drive to a city 105 mi from her home in no more than 2 h. What is the lowest average speed she must maintain on the drive?

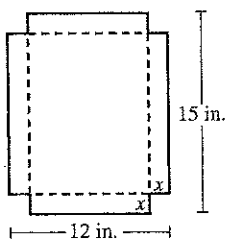
37. **Connecting Algebra and Geometry** Consider the collection of all rectangles that have length 2 in. less than twice their width.
   (a) Find the possible widths (in inches) of these rectangles if their perimeters are less than 200 in.
   (b) Find the possible widths (in inches) of these rectangles if their areas are less than or equal to 1200 in.^{2}.

38. **Boyle's Law** For a certain gas, $P = 400/V$, where P is pressure and V is volume. If $20 \leq V \leq 40$, what is the corresponding range for P?

39. **Cash-Flow Planning** A company has current assets (cash, property, inventory, and accounts receivable) of \$200,000 and current liabilities (taxes, loans, and accounts payable) of \$50,000. How much can it borrow if it wants its ratio of assets to liabilities to be no less than 2? Assume the amount borrowed is added to both current assets and current liabilities.

Explorations

46. **Constructing a Box with No Top** An open box is formed by cutting squares from the corners of a regular piece of cardboard (see figure) and folding up the flaps.
   (a) What size corner squares should be cut to yield a box with a volume of 125 in.^{3}?
   (b) What size corner squares should be cut to yield a box with a volume more than 125 in.^{3}?
   (c) What size corner squares should be cut to yield a box with a volume of at most 125 in.^{3}?



Extending the Ideas

In Exercises 47 and 48, use a combination of algebraic and graphical techniques to solve the inequalities.

47. $|2x^2 + 7x - 15| < 10$
48. $|2x^2 + 3x - 20| \geq 10$

CHAPTER P Review Exercises

Exercise numbers with a gray background indicate problems that the authors have designed to be solved *without a calculator*.

The collection of exercises marked in red could be used as a chapter test.

In Exercises 1 and 2, find the endpoints and state whether the interval is bounded or unbounded.

1. $[0, 5]$
2. $(2, \infty)$
3. **Distributive Property** Use the distributive property to write the expanded form of $2(x^2 - x)$.
4. **Distributive Property** Use the distributive property to write the factored form of $2x^3 + 4x^2$.

In Exercises 5 and 6, simplify the expression. Assume that denominators are not zero.

5. $\dfrac{(uv^2)^3}{v^2u^3}$
6. $(3x^2y^3)^{-2}$

In Exercises 7 and 8, write the number in scientific notation.

7. The mean distance from Pluto to the Sun is about 3,680,000,000 miles.
8. The diameter of a red blood corpuscle is about 0.000007 meter.

In Exercises 9 and 10, write the number in decimal form.

9. Our solar system is about 5×10^9 years old.
10. The mass of an electron is about 9.1094×10^{-28} g (gram).
11. The data in Table P.9 give the Fiscal 2009 final budget for some Department of Education programs. Using scientific notation and no calculator, write the amount in dollars for the programs.

Table P.9 Fiscal 2009 Budget

Program	Amount
Title 1 district grants	\$14.5 billion
Title 1 school improvement grants	\$545.6 million
IDEA (Individuals with Disabilities Education Act) state grants	\$11.5 billion
Teacher Incentive Fund	\$97 million
Head Start	\$7.1 billion

Source: U.S. Departments of Education, Health and Human Services as reported in Education Week, May 13, 2009.

(a) Title 1 district grants

(b) Title 1 school improvement grants

(c) IDEA state grants

(d) Teacher Incentive Fund

(e) Head Start

12. **Decimal Form** Find the decimal form for $-5/11$. State whether it repeats or terminates.

In Exercises 13 and 14, find (a) the distance between the points and (b) the midpoint of the line segment determined by the points.

13. -5 and 14
14. $(-4, 3)$ and $(5, -1)$

In Exercises 15 and 16, show that the figure determined by the points is the indicated type.

15. Right triangle: $(-2, 1)$, $(3, 11)$, $(7, 9)$
16. Equilateral triangle: $(0, 1)$, $(4, 1)$, $(2, 1 - 2\sqrt{3})$

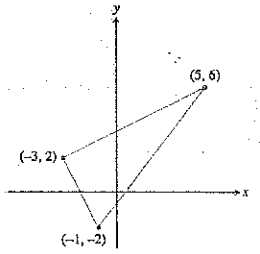
In Exercises 17 and 18, find the standard form equation for the circle.

17. Center $(0, 0)$, radius 2
18. Center $(5, -3)$, radius 4

In Exercises 19 and 20, find the center and radius of the circle.

19. $(x + 5)^2 + (y + 4)^2 = 9$
20. $x^2 + y^2 = 1$
21. (a) Find the length of the sides of the triangle in the figure.

    (b) **Writing to Learn** Show that the triangle is a right triangle.



22. **Distance and Absolute Value** Use absolute value notation to write the statement that the distance between z and -3 is less than or equal to 1.
23. **Finding a Line Segment with Given Midpoint** Let (3, 5) be the midpoint of the line segment with endpoints $(-1, 1)$ and (a, b). Determine a and b.
24. **Finding Slope** Find the slope of the line through the points $(-1, -2)$ and $(4, -5)$.
25. **Finding Point-Slope Form Equation** Find an equation in point-slope form for the line through the point $(2, -1)$ with slope $m = -2/3$.
26. Find an equation of the line through the points $(-5, 4)$ and $(2, -5)$ in the general form $Ax + By + C = 0$.

In Exercises 27–32, find an equation in slope-intercept form for the line.

27. The line through $(3, -2)$ with slope $m = 4/5$
28. The line through the points $(-1, -4)$ and $(3, 2)$
29. The line through $(-2, 4)$ with slope $m = 0$
30. The line $3x - 4y = 7$
31. The line through $(2, -3)$ and parallel to the line $2x + 5y = 3$
32. The line through $(2, -3)$ and perpendicular to the line $2x + 5y = 3$

33. **SAT Math Scores** Scores on each part of the SAT are on a scale of 200–800. Table P.10 shows the average SAT math score for selected years.

Table P.10 Average SAT Math Scores

Year	Scaled Scores
1995	506
2000	514
2005	520
2006	518
2007	515
2008	515
2009	515
2010	516
2011	514

Source: The College Board, The World Almanac and Book of Facts 2012.

(a) Draw a scatter plot of the data.

(b) Use the 1995 and 2005 data to write a linear equation for the average SAT math score y in terms of the year x. Superimpose the graph of the equation on the scatter plot.

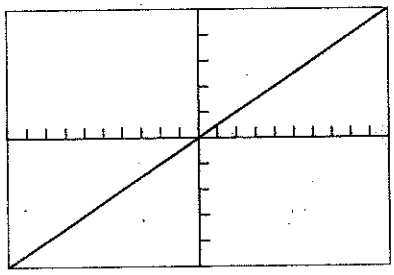
(c) Use the equation in (b) to predict the average SAT math score for 2015.

(d) **Writing to Learn** Do you think the prediction in (c) is valid? Explain.

34. Consider the point $(-6, 3)$ and Line L: $4x - 3y = 5$. Write an equation **(a)** for the line passing through this point and parallel to L, and **(b)** for the line passing through this point and perpendicular to L. Support your work graphically.

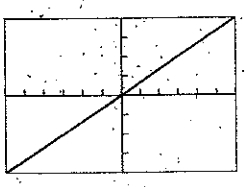
In Exercises 35 and 36, assume that each graph contains the origin and the upper right-hand corner of the viewing window.

35. Find the slope of the line in the figure.

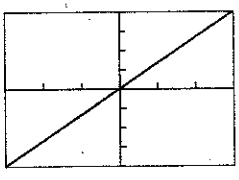


[–10, 10] by [–25, 25]

36. **Writing to Learn** Which line has the greater slope? Explain.



[–6, 6] by [–4, 4]
(a)



[–15, 15] by [–12, 12]
(b)

In Exercises 37–52, solve the equation algebraically without using a calculator.

37. $3x - 4 = 6x + 5$

38. $\frac{x-2}{3} + \frac{x+5}{2} = \frac{1}{3}$

39. $2(5 - 2y) - 3(1 - y) = y + 1$

40. $3(3x - 1)^2 = 21$

41. $x^2 - 4x - 3 = 0$

42. $16x^2 - 24x + 7 = 0$

43. $6x^2 + 7x = 3$

44. $2x^2 + 8x = 0$

45. $x(2x + 5) = 4(x + 7)$

46. $|4x + 1| = 3$

47. $4x^2 - 20x + 25 = 0$

48. $-9x^2 + 12x - 4 = 0$

49. $x^2 = 3x$

50. $4x^2 - 4x + 2 = 0$

51. $x^2 - 6x + 13 = 0$

52. $x^2 - 2x + 4 = 0$

53. **Completing the Square** Use completing the square to solve the equation $2x^2 - 3x - 1 = 0$.

54. **Quadratic Formula** Use the quadratic formula to solve the equation $3x^2 + 4x - 1 = 0$.

In Exercises 55–58, solve the equation graphically.

55. $3x^3 - 19x^2 - 14x = 0$

56. $x^3 + 2x^2 - 4x - 8 = 0$

57. $x^3 - 2x^2 - 2 = 0$

58. $|2x - 1| = 4 - x^2$

In Exercises 59 and 60, solve the inequality and draw a number line graph of the solution.

59. $-2 < x + 4 \leq 7$

60. $5x + 1 \geq 2x - 4$

In Exercises 61–72, solve the inequality.

61. $\frac{3x-5}{4} \leq -1$

62. $|2x - 5| < 7$

63. $|3x + 4| \geq 2$

64. $4x^2 + 3x > 10$

65. $2x^2 - 2x - 1 > 0$

66. $9x^2 - 12x - 1 \leq 0$

67. $x^3 - 9x \leq 3$

68. $4x^3 - 9x + 2 > 0$

69. $\left|\frac{x+7}{5}\right| > 2$

70. $2x^2 + 3x - 35 < 0$

71. $4x^2 + 12x + 9 \geq 0$

72. $x^2 - 6x + 9 < 0$

In Exercises 73–80, perform the indicated operation, and write the result in the standard form $a + bi$ without using a calculator.

73. $(3 - 2i) + (-2 + 5i)$

74. $(5 - 7i) - (3 - 2i)$

75. $(1 + 2i)(3 - 2i)$

76. $(1 + i)^3$

77. $(1 + 2i)^2(1 - 2i)^2$

78. i^{29}

79. $\sqrt{-16}$

80. $\frac{2+3i}{1-5i}$

81. **Projectile Motion** A projectile is launched straight up from ground level with an initial velocity of 320 ft/sec.

(a) When will the projectile's height above ground be 1538 ft?

(b) When will the projectile's height above ground be at most 1538 ft?

(c) When will the projectile's height above ground be greater than or equal to 1538 ft?