Summer Review Packet for students entering Precalculus Honors in the fall

We are really looking forward to meeting you next fall! In order to get the most out of you Precalculus Honors course, we are asking that you have the following algebra review assignment completed by the FIRST day of school.

This assignment is a review of algebra skills that you already have. If you are having difficulty remembering this information, we recommend that you work with your friends and/or go online to check for YouTube videos, possibly the Khan Academy ones.

Here are the specific details of your summer assignment which should have work shown on separate sheets of paper:

Pages 51-54: odd numbered problems

Pages 64-66: odd numbered problems

Pages 77-79: ALL problems

Page 81: ALL problems

We hope that you have a wonderful summer!
Sincerely,
Ms. L. Stone & Mr. S. Martin
May, 2019

P.4 /// EXERCISES

In Exercises 1–4, determine whether the given values of x are solutions of the equation.

Equation	Values	
1. $5x - 3 = 3x + 5$	(a) $x = 0$	(b) $x = -5$
	(c) $x = 4$	(d) $x = 10$
2. $3 + \dfrac{1}{x+2} = 4$	(a) $x = -1$	(b) $x = -2$
	(c) $x = 0$	(d) $x = 5$
3. $(x + 5)(x - 3) = 20$	(a) $x = 3$	(b) $x = -2$
	(c) $x = 0$	(d) $x = -7$
4. $\sqrt[3]{x - 8} = 3$	(a) $x = 2$	(b) $x = -5$
	(c) $x = 35$	(d) $x = 8$

In Exercises 5–8, determine whether the equation is an identity or a conditional equation.

5. $2(x - 1) = 2x - 2$
6. $3(x + 2) = 5x + 4$
7. $3 + \dfrac{1}{x + 1} = \dfrac{4x}{x + 1}$
8. $x^2 + 2(3x - 2) = x^2 + 6x - 4$
9. *Think About It* What is meant by equivalent equations? Give an example of two equivalent equations.
10. Justify each step of the solution.

$$3(x - 4) + 10 = 7$$
$$3x - 12 + 10 = 7$$
$$3x - 2 = 7$$
$$3x - 2 + 2 = 7 + 2$$
$$3x = 9$$
$$\frac{3x}{3} = \frac{9}{3}$$
$$x = 3$$

11. Solve each equation mentally.
    (a) $3x = 15$ (b) $\frac{1}{2}t = 7$
    (c) $s + 12 = 18$ (d) $2u - 3 = 25$
12. Solve each equation in two ways. Then explain which way was easier for you.
    (a) $3(x - 1) = 4$ (b) $\frac{3}{4}(z - 4) = 6$

In Exercises 13–24, solve the equation and use a graphing utility to verify your solution.

13. ~~$8x - 5 = 3x + 10$~~
14. ~~$7x + 3 = 3x - 13$~~
15. $2(x + 5) - 7 = 3(x - 2)$
16. $2(13t - 15) + 3(t - 19) = 0$
17. $6[x - (2x + 3)] = 8 - 5x$
18. $3(x + 3) = 5(1 - x) - 1$
19. $\dfrac{5x}{4} + \dfrac{1}{2} = x - \dfrac{1}{2}$
20. $\dfrac{x}{5} - \dfrac{x}{2} = 3$
21. $\frac{3}{2}(z + 5) - \frac{1}{4}(z + 24) = 0$
22. $\dfrac{3x}{2} + \dfrac{1}{4}(x - 2) = 10$
23. $0.25x + 0.75(10 - x) = 3$
24. $0.60x + 0.40(100 - x) = 50$

In Exercises 25–40, solve the equation (if possible) and use a graphing utility to verify your solution.

25. $\dfrac{100 - 4u}{3} = \dfrac{5u + 6}{4} + 6$
26. $\dfrac{17 + y}{y} + \dfrac{32 + y}{y} = 100$
27. $\dfrac{5x - 4}{5x + 4} = \dfrac{2}{3}$
28. $\dfrac{15}{x} - 4 = \dfrac{6}{x} + 3$
29. $\dfrac{1}{x - 3} + \dfrac{1}{x + 3} = \dfrac{10}{x^2 - 9}$
30. $\dfrac{1}{x - 2} + \dfrac{3}{x + 3} = \dfrac{4}{x^2 + x - 6}$
31. $\dfrac{x}{x + 4} + \dfrac{4}{x + 4} + 2 = 0$
32. $\dfrac{2}{(x - 4)(x - 2)} = \dfrac{1}{x - 4} + \dfrac{2}{x - 2}$
33. $\dfrac{7}{2x + 1} - \dfrac{8x}{2x - 1} = -4$

34. $\dfrac{4}{u-1} + \dfrac{6}{3u+1} = \dfrac{15}{3u+1}$

35. $\dfrac{1}{x} + \dfrac{2}{x-5} = 0$

36. $\dfrac{6}{x} - \dfrac{2}{x+3} = \dfrac{3(x+5)}{x(x+3)}$

37. $\dfrac{3}{x(x-3)} + \dfrac{4}{x} = \dfrac{1}{x-3}$

38. $3 = 2 + \dfrac{2}{z+2}$

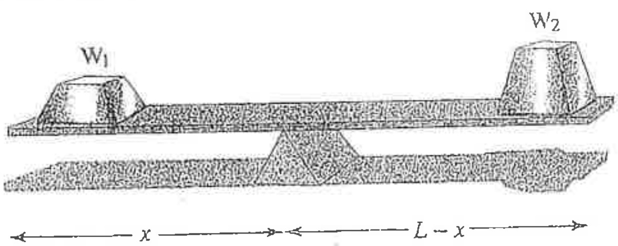
39. $(x+2)^2 + 5 = (x+3)^2$

40. $(x+1)^2 + 2(x-2) = (x+1)(x-2)$

Statistics Problems In Exercises 41 and 42, suppose you have a uniform beam of length L with a fulcrum x feet from one end (see figure). If objects with weights W_1 and W_2 are placed at opposite ends of the beam, the beam will balance if

$$W_1x = W_2(L - x).$$

Find x such that the beam will balance.

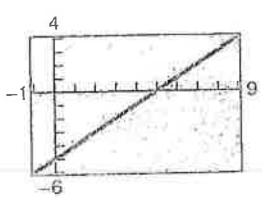


41. Two children weighing 50 pounds and 75 pounds are going to play on a seesaw that is 10 feet long.

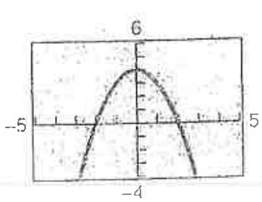
42. A person weighing 200 pounds is attempting to move a 550-pound rock with a bar that is 5 feet long.

In Exercises 43–48, find the x- and y-intercepts of the graph of the equation.

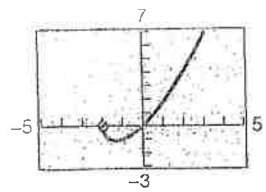
43. $y = x - 5$



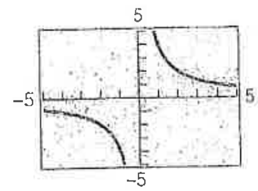
44. $y = 4 - x^2$



45. $y = x\sqrt{x+2}$



46. $xy = 4$



47. $y = |x - 2| - 3$

48. $x^2y - x^2 + 4y = 0$

In Exercises 49–54, use a graphing utility to graph the function and verify its zero(s).

Function	*Zero(s)*
49. $f(x) = 12 - 4x$	$x = 3$
50. $f(x) = 3(x - 5) + 9$	$x = 2$
51. $f(x) = x^2 - 2.5x - 6$	$x = -1.5,\ x = 4$
52. $f(x) = x^3 - 9x^2 + 18x$	$x = 0,\ x = 3,\ x = 6$
53. $f(x) = \dfrac{x+2}{3} - \dfrac{x-1}{5} - 1$	$x = 1$
54. $f(x) = x - 3 - \dfrac{10}{x}$	$x = -2,\ x = 5$

Graphical Analysis In Exercises 55–58, use a graphing utility to graph the equation and approximate any x-intercepts. Set $y = 0$ and solve the resulting equation. Compare the results with the x-intercepts of the graph.

55. $y = 2(x - 1) - 4$

56. $y = \frac{4}{3}x + 2$

57. $y = 20 - (3x - 10)$

58. $y = 10 + 2(x - 2)$

In Exercises 59–62, solve the equation algebraically. Then write the equation in the form $f(x) = 0$ and use a graphing utility to verify the algebraic solution.

59. $\dfrac{3x}{2} + \dfrac{1}{4}(x - 2) = 10$

60. $0.60x + 0.40(100 - x) = 50$

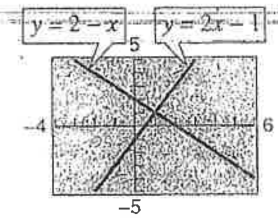
61. $3(x + 3) = 5(1 - x) - 1$

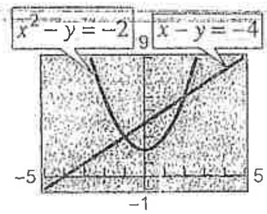
62. $(x + 1)^2 + 2(x - 2) = (x + 1)(x - 2)$

In Exercises 63–66, find any points of intersection algebraically.

63. $y = 2 - x$
$y = 2x - 1$

64. $x - y = -4$
$x^2 - y = -2$





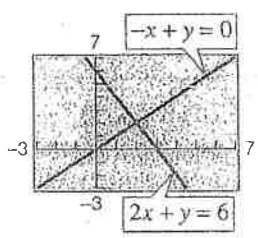
65. $y = \frac{1}{3}x + 2$
$y = \frac{5}{2}x - 11$

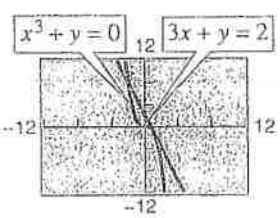
66. $y = 4 - x^2$
$y = 2x + 1$

In Exercises 67–74, use a graphing utility to approximate any points of intersection (accurate to three decimal places) of the graphs of the equations.

67. $2x + y = 6$
$-x + y = 0$

68. $3x + y = 2$
$x^3 + y = 0$





69. $y = 9 - 2x$
$y = x - 3$

70. $y = x^3 - 3$
$y = 5 - 2x$

71. $y = 8$
$y = 3x^2 + 2x$

72. $y = 32$
$y = x^5 - x^2$

73. $y = 2x^2$
$y = x^4 - 2x^2$

74. $y = -x$
$y = 2x - x^2$

In Exercises 75–78, solve the quadratic equation.

75. $x^2 - 2x - 1 = 0$

76. $11x^2 + 33x = 0$

77. $(x + 3)^2 = 81$

78. $x^2 + 3x - \frac{3}{4} = 0$

In Exercises 79–108, find all real solutions of the equation. Use a graphing utility to verify your solutions.

79. $4x^4 - 18x^2 = 0$

80. $20x^3 - 125x = 0$

81. $x^4 - 4x^2 + 3 = 0$

82. $4x^4 - 65x^2 + 16 = 0$

83. $\frac{1}{t^2} + \frac{8}{t} + 15 = 0$

84. $6\left(\frac{s}{s+1}\right)^2 + 5\left(\frac{s}{s+1}\right) - 6 = 0$

85. $2x + 9\sqrt{x} - 5 = 0$

86. $3x^{1/3} + 2x^{2/3} = 5$

87. $\sqrt{x - 10} - 4 = 0$

88. $\sqrt{5 - x} - 3 = 0$

89. $\sqrt[3]{2x + 5} + 3 = 0$

90. $\sqrt[3]{3x + 1} - 5 = 0$

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

92. $\sqrt{x + 5} = \sqrt{x - 5}$

93. $\sqrt{x} - \sqrt{x - 5} = 1$

94. $\sqrt{x} + \sqrt{x - 20} = 10$

95. $(x - 5)^{2/3} = 16$

96. $(x^2 - x - 22)^{4/3} = 16$

97. $\frac{20 - x}{x} = x$

98. $\frac{4}{x} - \frac{5}{3} = \frac{x}{6}$

99. $\frac{1}{x} - \frac{1}{x + 1} = 3$

100. $\frac{x}{x^2 - 4} + \frac{1}{x + 2} = 3$

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

102. $4x + 1 = \frac{3}{x}$

103. $\frac{4}{x + 1} - \frac{3}{x + 2} = 1$

104. $\frac{x + 1}{3} - \frac{x + 1}{x + 2} = 0$

105. $|2x - 1| = 5$

106. $|3x + 2| = 7$

107. $|x| = x^2 + x - 3$

108. $|x - 10| = x^2 - 10x$

Graphical Analysis **In Exercises 109–120, use a graphing utility to graph the equation. Use the graph to approximate any x-intercepts of the graph. Set $y = 0$ and solve the resulting equation. Compare the result with the x-intercepts of the graph.**

109. $y = x^3 - 2x^2 - 3x$

110. $y = 2x^4 - 15x^3 + 18x^2$

111. $y = x^4 - 10x^2 + 9$

112. $y = x^4 - 29x^2 + 100$

113. $y = \sqrt{11x - 30} - x$

114. $y = 2x - \sqrt{15 - 4x}$

115. $y = \sqrt{7x + 36} - \sqrt{5x + 16} - 2$

116. $y = 3\sqrt{x} - \dfrac{4}{\sqrt{x}} - 4$

117. $y = \dfrac{1}{x} - \dfrac{4}{x - 1} - 1$

118. $y = x + \dfrac{9}{x + 1} - 5$

119. $y = |x + 1| - 2$ **120.** $y = |x - 2| - 3$

In Exercises 121–126, solve for the indicated variable.

121. *Area of a Triangle*
Solve for h: $A = \frac{1}{2}bh$

122. *Investment at Compound Interest*
Solve for P: $A = P\left(1 + \dfrac{r}{n}\right)^{nt}$

123. *Area of a Trapezoid*
Solve for b: $A = \frac{1}{2}(a + b)h$

124. *Geometric Progression*
Solve for r: $S = \dfrac{rL - a}{r - 1}$

125. *Surface Area of a Cone*
Solve for h: $S = \pi r\sqrt{r^2 + h^2}$

126. *Inductance*
Solve for Q: $i = \pm\sqrt{\dfrac{1}{LC}}\sqrt{Q^2 - q}$

127. *Numerical, Graphical, and Analytical Analysis* A rancher has 100 meters of fencing to enclose two adjacent rectangular corrals (see figure).

(a) Write the area of the enclosed region as a function of x.

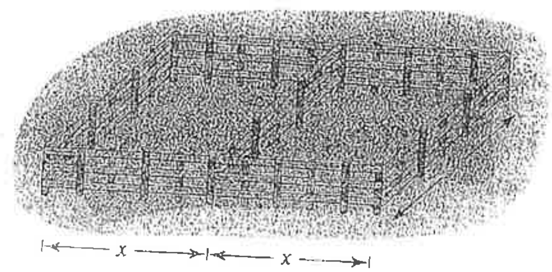
(b) Use a graphing utility to generate additional rows of the table. Use the table to estimate the dimensions that will produce a maximum area.

x	y	Area $(2xy)$
2	$\frac{92}{3}$	$\frac{368}{3} \approx 123$
4	28	224

(c) Use a graphing utility to graph the area function. Use the graph to estimate the dimensions that will produce a maximum area.

(d) Use the graph to approximate the dimensions such that the enclosed area will be 350 square meters.

(e) Find the required dimensions of part (d) analytically.



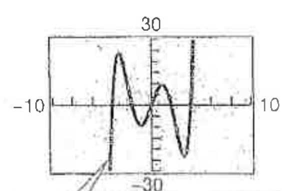
$4x + 3y = 100$

128. *Exploration* The graph of the function $f(x) = \frac{1}{5}(x^5 - 20x^3 + 64x) + k$ for $k = 0$ is given in the figure.

(a) Determine the number of zeros of the function when $k = 0$.

(b) Use a graphing utility to graph the function for different values of k. Find a value of k such that the function has one zero. Find k so there are three distinct zeros.

(c) Is there a value of k such that the function has no zero? Explain.



$f(x) = \frac{1}{5}(x^5 - 20x^3 + 64x)$

Group Activity

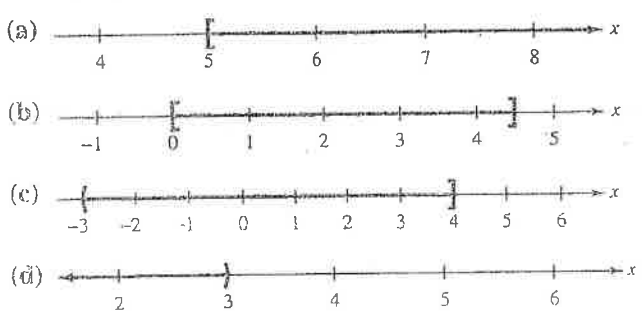
Communicating Mathematically

Some people find that it is easier to remember a verbal statement, a numerical example, or a picture than it is to remember a mathematical formula. For instance, you can remember the factoring formula $(u + v)(u - v) = u^2 - v^2$ as, "the product of the sum and difference of two terms is the difference of each term squared."

Four different properties of inequalities are listed on page 56. For each property, (a) translate the mathematical statement into a *verbal statement*, (b) compile a list of several numerical examples that demonstrate the property, and (c) construct a number line or series of number lines that graphically illustrates the property.

P.5 /// EXERCISES

In Exercises 1–4, match the inequality with its graph. [The graphs are labeled (a), (b), (c), and (d).]



1. $x < 3$
2. $x \geq 5$
3. $-3 < x \leq 4$
4. $0 \leq x \leq \frac{9}{2}$

In Exercises 5–8, determine whether the given values of x are solutions of the inequality.

Inequality	*Values*	
5. $5x - 12 > 0$	(a) $x = 3$	(b) $x = -3$
	(c) $x = \frac{5}{2}$	(d) $x = \frac{3}{2}$
6. $-1 < \frac{3 - x}{2} \leq 1$	(a) $x = 0$	(b) $x = \sqrt{5}$
	(c) $x = 1$	(d) $x = 5$
7. $\lvert x - 10 \rvert \geq 3$	(a) $x = 13$	(b) $x = -1$
	(c) $x = 14$	(d) $x = 9$
8. $\lvert 2x - 3 \rvert < 15$	(a) $x = -6$	(b) $x = 0$
	(c) $x = 12$	(d) $x = 7$

In Exercises 9–18, solve the inequality and sketch the solution on the real number line. Use a graphing utility to verify your solution graphically.

9. $-10x < 40$
10. $2x > 3$
11. $4(x + 1) < 2x + 3$
12. $2x + 7 < 3$
13. $1 < 2x + 3 < 9$
14. $-8 \leq 1 - 3(x - 2) < 13$
15. $-4 < \frac{2x - 3}{3} < 4$
16. $0 \leq \frac{x + 3}{2} < 5$
17. $-1 < -\frac{x}{3} < 1$
18. $\frac{3}{4} > x + 1 > \frac{1}{4}$

Graphical Analysis **In Exercises 19–24, use a graphing utility to graph the inequality.**

19. $6x > 12$
20. $3x - 1 \leq 5$
21. $5 - 2x \geq 1$
22. $3(x + 1) < x + 7$
23. $0 \leq 2(x + 4) < 20$
24. $-2 < 3x + 1 < 10$

Graphical Analysis **In Exercises 25–28, use a graphing utility to graph the equation. Use the graph to approximate the values of x that satisfy the specified inequalities.**

Equation	*Inequalities*	
25. $y = 2x - 3$	(a) $y \geq 1$	(b) $y \leq 0$
26. $y = \frac{2}{3}x + 1$	(a) $y \leq 5$	(b) $y \geq 0$
27. $y = -\frac{1}{2}x + 2$	(a) $0 \leq y \leq 3$	(b) $y \geq 0$
28. $y = -3x + 8$	(a) $-1 \leq y \leq 3$	(b) $y \leq 0$

In Exercises 29 and 30, find the interval(s) on the real number line for which the radicand is nonnegative (greater than or equal to zero).

29. $\sqrt{x - 5}$
30. $\sqrt[4]{6x + 15}$

In Exercises 31–40, solve the inequality and sketch the solution on the real number line.

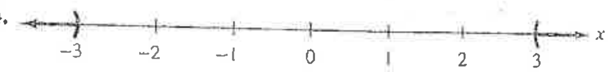
31. $\left|\frac{x}{2}\right| > 3$
32. $|5x| > 10$
33. $|x - 20| \leq 4$
34. $|x - 7| < 6$
35. $|x - 20| \geq 4$
36. $|x + 14| + 3 > 17$
37. $\left|\frac{x - 3}{2}\right| \geq 5$
38. $|1 - 2x| < 5$
39. $|x - 5| < 0$
40. $3|4 - 5x| \leq 9$

Graphical Analysis **In Exercises 41 and 42, use a graphing utility to graph the equation. Use the graph to approximate the values of x that satisfy the specified inequalities.**

Equation	*Inequalities*	
41. $y = \|x - 3\|$	(a) $y \leq 2$	(b) $y \geq 4$
42. $y = \left\|\frac{1}{2}x + 1\right\|$	(a) $y \leq 4$	(b) $y \geq 1$

In Exercises 43–48, use absolute value notation to define each interval (or pair of intervals) on the real number line.

43.


44.


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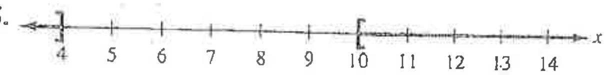

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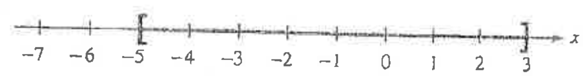


47. All real numbers within 10 units of 12
48. All real numbers whose distances from -3 are more than 5

49. *Data Analysis* The college admissions office wants to decide if there is a relationship between IQ scores x and grade-point averages y after the first year. A sample of 12 students yielded the following data.

x	118	131	125	123	133	136
y	2.2	2.4	3.2	2.4	3.5	3.0

x	128	124	116	120	134	131
y	3.0	2.8	2.2	1.8	3.4	3.6

(a) Use a graphing utility to plot the points. What shape does the plot have?

(b) Use the regression capabilities of a graphing utility to find a model appropriate to the shape of the plotted data. Graph the model in the same viewing rectangle as part (a).

(c) Which values of x predict a grade-point average of at least 3.0?

(d) Use the graph to write a statement about the accuracy of the model. If you think the graph indicates that IQ scores are not particularly good predictors of grade-point average, list other factors that may influence college performance.

50. *Teachers' Salaries* The average salary for elementary and secondary teachers in the United States from 1984 to 1993 is approximated by the model

Salary $= 15.812 + 1.472t$

where the salary is given in thousands of dollars and the time t represents the calendar year, with $t = 4$ corresponding to 1984. (Source: National Education Association)

(a) Use a graphing utility to graph the model.

(b) Assuming the model is correct, when will the average salary *exceed* $40,000?

In Exercises 51–58, solve the inequality and graph the solution on the real number line. Use a graphing utility to verify your solution graphically.

51. $(x + 2)^2 < 25$ **52.** $(x + 6)^2 \le 8$

53. $x^2 + 4x + 4 \ge 9$ **54.** $x^2 - 6x + 9 < 16$

55. $x^2 + x < 6$ **56.** $4x^3 - 12x^2 > 0$

57. $x^3 - 4x \ge 0$ **58.** $x^4(x - 3) \le 0$

Graphical Analysis **In Exercises 59–62, use a graphing utility to graph the equation. Use the graph to approximate the values of x that satisfy the specified inequalities.**

Equation	*Inequalities*	
59. $y = -x^2 + 2x + 3$	(a) $y \le 0$	(b) $y \ge 3$
60. $y = \frac{1}{2}x^2 - 2x + 1$	(a) $y \le 1$	(b) $y \ge 7$
61. $y = \frac{1}{8}x^3 - \frac{1}{2}x$	(a) $y \ge 0$	(b) $y \le 6$
62. $y = x^3 - x^2 - 16x + 16$	(a) $y \le 0$	(b) $y \ge 36$

In Exercises 63–66, solve the inequality and graph the solution on the real number line. Use a graphing utility to verify your solution graphically.

63. $\dfrac{1}{x} - x > 0$ **64.** $\dfrac{1}{x} - 4 < 0$

65. $\dfrac{x + 6}{x + 1} - 2 < 0$ **66.** $\dfrac{x + 12}{x + 2} - 3 \ge 0$

Graphical Analysis **In Exercises 67–70, use a graphing utility to graph the equation. Use the graph to approximate the values of x that satisfy the specified inequalities.**

Equation	*Inequalities*	
67. $y = \dfrac{3x}{x - 2}$	(a) $y \le 0$	(b) $y \ge 6$
68. $y = \dfrac{2(x - 2)}{x + 1}$	(a) $y \le 0$	(b) $y \ge 8$
69. $y = \dfrac{2x^2}{x^2 + 4}$	(a) $y \ge 1$	(b) $y \le 2$
70. $y = \dfrac{5x}{x^2 + 4}$	(a) $y \ge 1$	(b) $y \le 0$

In Exercises 71 and 72, find the domain of x in the expression.

71. $\sqrt[4]{4 - x^2}$ **72.** $\sqrt{x^2 - 4}$

73. *Percent of College Graduates* The percent P of the American population that graduated from college between 1950 and 1990 is approximated by

$P = 5.9556 + 1.492t + 0.0056t^2$

where the time t represents the calendar year, with $t = 0$ corresponding to 1950. (Source: U.S. Bureau of Census)

(a) Use a graphing utility to graph the model over the indicated years.

(b) According to this model, when will the percent of college graduates exceed 25% of the population? Solve algebraically and verify graphically.

P /// REVIEW EXERCISES

Geometry **In Exercises 1 and 2, plot the points and verify that the points form the polygon.**

1. *Right Triangle:* (2, 3), (13, 11), (5, 22)
2. *Parallelogram:* (1, 2), (8, 3), (9, 6), (2, 5)

In Exercises 3 and 4, determine the quadrant(s) in which (x, y) is (are) located so that the conditions are satisfied.

3. $x > 0$ and $y = -2$
4. $xy = 4$

5. (a) Plot the points $(-3, 8)$ and $(1, 5)$, (b) find the distance between the points, and (c) find the midpoint of the line segment joining the points.
6. Complete the table for the equation $y = x^2 - 3x$. Use the resulting solution points to sketch the graph of the equation. Use a graphing utility to verify the graph

$y = x^2 - 3x.$

x	-1	0	1	2	3
y					

In Exercises 7–14, sketch the graph of the equation *by hand*. Use a graphing utility to verify your graph.

7. $y - 2x - 3 = 0$
8. $x - 5 = 0$
9. $y = 8 - |x|$
10. $y = \sqrt{x + 2}$
11. $y + 2x^2 = 0$
12. $y = x^2 - 4x$
13. $y = \sqrt{25 - x^2}$
14. $x^2 + y^2 = 10$

In Exercises 15–22, use a graphing utility to graph the equation. Approximate any intercepts.

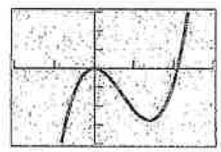
15. $y = \frac{1}{4}(x + 1)^3$
16. $y = 4 - (x - 4)^2$
17. $y = \frac{1}{4}x^4 - 2x^2$
18. $y = \frac{1}{4}x^3 - 3x$
19. $y = x\sqrt{9 - x^2}$
20. $y = x\sqrt{x + 3}$
21. $y = |x - 4| - 4$
22. $y = |x + 2| + |3 - x|$

23. Find the center and radius of the circle given by

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

Sketch the graph of the circle.

24. Find the standard form of the equation of a circle if the endpoints of its diameter are $(0, 0)$ and $(4, -6)$.
25. Find a setting on a graphing utility such that the graph of $y = 10x^3 - 21x^2$ agrees with the graph below.



26. *Data Analysis* The total annual expenditures y for NASA (in billions) for each year from 1990 through 1993 are given in the table. (Source: U.S. Department of Treasury)

x	1990	1991	1992	1993
y	12.4	13.9	14.0	14.3

A mathematical model for the expenditures for this period is

$y = 0.58t + 12.78$

where t is the time in years, with $t = 0$ corresponding to 1990. (a) Use a graphing utility to plot the data and sketch the model for the data, and (b) use the model to estimate the value of y for the years 1998 and 2000.

In Exercises 27–30, plot the points and find the slope of the line passing through the points.

27. $(-4.5, 6), (2.1, 3)$
28. $(-3, 2), (8, 2)$
29. $\left(\frac{3}{2}, 1\right), \left(5, \frac{5}{2}\right)$
30. $(7, -1), (7, 12)$

In Exercises 31–34, use the point on the line and the slope of the line to find three additional points through which the line passes. (The solution is not unique.)

	Point	*Slope*
31.	$(2, -1)$	$m = \frac{1}{4}$
32.	$(-3, 5)$	$m = -\frac{3}{2}$
33.	$(-6, -5)$	$m = -2$
34.	$(10, -6)$	m is undefined.

In Exercises 35–40, find an equation of the line that passes through the points.

35. $(0, 0), (0, 10)$ **36.** $(-1, 4), (2, 0)$

37. $(2, 1), (14, 6)$ **38.** $(-2, 2), (3, -10)$

39. $(-1, 0), (6, 2)$ **40.** $(1, 6), (4, 2)$

In Exercises 41–44, find an equation of the line that passes through the given point and has the specified slope. Use a graphing utility to graph the line.

	Point	*Slope*
41.	$(0, -5)$	$m = \frac{3}{2}$
42.	$(-2, 6)$	$m = 0$
43.	$(3, 0)$	$m = -\frac{2}{3}$
44.	$(5, 4)$	m is undefined.

In Exercises 45 and 46, write an equation of the line through the point (a) parallel to the given line and (b) perpendicular to the given line. Verify your result with a graphing utility (use a square setting).

	Point	*Line*
45.	$(3, -2)$	$5x - 4y = 8$
46.	$(-8, 3)$	$2x + 3y = 5$

Rate of Change In Exercises 47 and 48, you are given the dollar value of a product in 1996 *and* the rate at which the value of the item is expected to change during the next 5 years. Use this information to write a linear equation that gives the dollar value V of the product in terms of the year t. (Let $t = 6$ represent 1996.)

	1996 Value	*Rate*
47.	\$12,500	\$850 increase per year
48.	\$72.95	\$5.15 increase per year

Exploration In Exercises 49 and 50, find a relationship between x and y such that (x, y) is equidistant from the two points.

49. $(-2, -5), (6, 3)$ **50.** $\left(1, \frac{7}{2}\right), (5, 0)$

In Exercises 51 and 52, determine whether the equation is an identity or a conditional equation.

51. $6 - (x - 2)^2 = 2 + 4x - x^2$

52. $3(x - 2) + 2x = 2(x + 3)$

In Exercises 53–74, solve the equation (if possible) and use a graphing utility to verify your solution.

53. $4(x + 3) - 3 = 2(4 - 3x) - 4$

54. $\frac{1}{2}(x - 3) - 2(x + 1) = 5$

55. $3\left(1 - \frac{1}{5t}\right) = 0$ **56.** $\frac{1}{x - 2} = 3$

57. $6x = 3x^2$ **58.** $15 + x - 2x^2 = 0$

59. $(x + 4)^2 = 18$ **60.** $16x^2 = 25$

61. $x^2 - 12x + 30 = 0$ **62.** $x^2 + 6x - 3 = 0$

63. $5x^4 - 12x^3 = 0$ **64.** $4x^3 - 6x^2 = 0$

65. $\frac{4}{(x - 4)^2} = 1$ **66.** $\frac{1}{(t + 1)^2} = 1$

67. $\sqrt{x + 4} = 3$ **68.** $\sqrt{3x - 2} = 4 - x$

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

70. $5\sqrt{x} - \sqrt{x - 1} = 6$

71. $(x - 1)^{2/3} - 25 = 0$

72. $(x + 2)^{3/4} = 27$

73. $|x - 5| = 10$

74. $|x^2 - 6| = x$

In Exercises 75–80, use a graphing utility to graph the equation. Use the graph to approximate any x-intercepts of the graph. Set $y = 0$ and solve the resulting equation. Compare the result with the x-intercepts of the graph.

75. $y = 4x^3 - 12x^2 + 8x$

76. $y = 12x^3 - 84x^2 + 120x$

77. $y = \dfrac{1}{x} + \dfrac{1}{x + 1} - 2$

78. $y = \dfrac{4}{x - 3} - \dfrac{4}{x} - 1$

79. $y = \sqrt{x^2 + 1} + x - 9$

80. $y = |2x - 3| - 5$

In Exercises 81–84, solve the equation for the indicated variable.

81. Solve for r: $V = \frac{1}{3}\pi r^2 h$

82. Solve for X: $Z = \sqrt{R^2 - X^2}$

83. Solve for p: $L = \dfrac{k}{3\pi r^2 p}$

84. Solve for v: $E = 2kw\left(\dfrac{v}{2}\right)^2$

In Exercises 85–92, solve the inequality. Use a graphing utility to verify your solution.

85. $\frac{1}{2}(3 - x) > \frac{1}{3}(2 - 3x)$

86. $x^2 - 2x \geq 3$

87. $\dfrac{x - 5}{3 - x} < 0$

88. $\dfrac{2}{x + 1} \leq \dfrac{3}{x - 1}$

89. $|x - 2| < 1$

90. $|x| \leq 4$

91. $\left|x - \frac{3}{2}\right| \geq \frac{3}{2}$

92. $|x - 3| > 4$

In Exercises 93–96, use a graphing utility to solve the inequality.

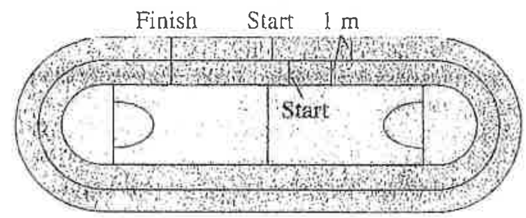
93. $\dfrac{x}{5} - 6 \leq -\dfrac{x}{2} + 6$

94. $2x^2 + x \geq 15$

95. $(x - 4)|x| > 0$

96. $|x(x - 6)| < 5$

97. *Starting Position* A fitness center has two running tracks around a rectangular playing floor. The tracks are 1 meter wide and form semicircles at the narrow ends of the rectangular floor (see figure). Determine the distance between the starting positions if two runners must run the same distance to the finish line in one lap around the track.



98. *Simply Supported Beam* A simply supported beam of length 20 feet supports a uniformly distributed load of 1000 pounds per foot. The bending moment M in foot-pounds x feet from one end of the beam is given by

$$M = 500x(20 - x).$$

(a) Use a graphing utility to graph the equation.

(b) Determine any points on the beam where the bending moment is zero.

(c) Use the graph to determine the point on the beam where the bending moment is greatest. What is the bending moment at that point?

(d) Determine the positions on the beam where the bending moment is less than 40,000 foot-pounds.

99. *Weather* The normal daily maximum and minimum temperatures for each month in the city of Chicago are given in the table. Make a double line graph for the data. (Source: NOAA)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.
Max.	29.0	33.5	45.8	58.6	70.1	79.6
Min.	12.9	17.2	28.5	38.6	47.7	57.5

Month	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Max.	83.7	81.8	74.8	63.3	48.4	34.0
Min.	62.6	61.6	53.9	42.2	31.6	19.1

P /// CHAPTER TEST

Take this test as you would take a test in class. After you are done, check your work against the answers given in the back of the book.

The *Interactive* CD-ROM provides answers to the Chapter Tests and Cumulative Tests. It also offers Chapter Pre-Tests (that test key skills and concepts covered in previous chapters) and Chapter Post-Tests, both of which have randomly generated exercises with diagnostic capabilities.

1. Plot the points $(-2, 5)$ and $(6, 0)$. Find the coordinates of the midpoint of the line segment joining the points and the distance between the points.

2. The numbers (in millions) of votes cast for the Democratic candidate for president in 1980, 1984, 1988, and 1992 were 35.5, 37.6, 41.8, and 44.9, respectively. Create a bar graph for the data.

In Exercises 3–8, use a graphing utility to graph the equation. Check for symmetry and identify any x- or y-intercepts.

3. $y = 4 - \frac{3}{4}|x|$ **4.** $y = 4 - (x - 2)^2$ **5.** $y = x - x^3$

6. $y = \sqrt{3 - x}$ **7.** $2x - 3y = 12$ **8.** $(x - 3)^2 + y^2 = 9$

9. A line with slope $m = \frac{3}{2}$ passes through the point $(3, -1)$. List three additional points on the line.

10. Find an equation of the line for each of the following.

(a) Passes through the points $(-4, 0)$ and $(2, 3)$.

(b) Passes through the point $(0, 4)$ and is perpendicular to the line $5x + 2y = 3$.

In Exercises 11–16, solve (if possible) the equation. Use a graphing utility to verify your solution.

11. $2x - 3(x - 4) = 5$ **12.** $\dfrac{2}{t - 3} + \dfrac{2}{t - 2} = \dfrac{10}{t^2 - 5t + 6}$

13. $3y^2 + 6y + 2 = 0$ **14.** $\sqrt{x + 10} = x - 2$

15. $2\sqrt{x} - \sqrt{2x + 1} = 1$ **16.** $|3x - 1| = 7$

In Exercises 17 and 18, solve the inequality and sketch the solution on the real number line.

17. $-3 \le 2(x + 4) < 14$ **18.** $\dfrac{2}{x} > \dfrac{5}{x + 6}$

19. The area of the ellipse in the figure is $A = \pi ab$. If a and b satisfy the constraint $a + b = 100$, find a and b if the area of the ellipse equals the area of the circle.

Figure for 19