ALGEBRA REVIEW

Order of Operations

Much of the algebra in this chapter involves evaluation of algebraic expressions. When you evaluate an algebraic expression, you need to know the priorities assigned to different operations. These priorities are called the *order of operations*.

1. Perform operations inside *symbols of grouping or absolute value symbols*, starting with the innermost symbol.

2. Evaluate all *exponential* expressions.

3. Perform all *multiplications* and *divisions* from left to right.

4. Perform all *additions* and *subtractions* from left to right.

EXAMPLE 1   Using Order of Operations

Evaluate each expression.

(a) $7 - [(5 \cdot 3) + 2^3]$

(b) $[36 \div (3^2 \cdot 2)] + 6$

(c) $36 - [3^2 \cdot (2 \div 6)]$

(d) $10 - 2(8 + |5 - 7|)$

SOLUTION

(a)
$$\begin{aligned}
7 - [(5 \cdot 3) + 2^3] &= 7 - [15 + 2^3] &&\text{Multiply inside parentheses.} \\
&= 7 - [15 + 8] &&\text{Evaluate exponential expression.} \\
&= 7 - 23 &&\text{Add inside brackets.} \\
&= -16 &&\text{Subtract.}
\end{aligned}$$

(b)
$$\begin{aligned}
[36 \div (3^2 \cdot 2)] + 6 &= [36 \div (9 \cdot 2)] + 6 &&\text{Evaluate exponential expression inside parentheses.} \\
&= [36 \div 18] + 6 &&\text{Multiply inside parentheses.} \\
&= 2 + 6 &&\text{Divide inside brackets.} \\
&= 8 &&\text{Add.}
\end{aligned}$$

(c)
$$\begin{aligned}
36 - [3^2 \cdot (2 \div 6)] &= 36 - \left[3^2 \cdot \tfrac{1}{3}\right] &&\text{Divide inside parentheses.} \\
&= 36 - \left[9 \cdot \tfrac{1}{3}\right] &&\text{Evaluate exponential expression.} \\
&= 36 - 3 &&\text{Multiply inside brackets.} \\
&= 33 &&\text{Subtract.}
\end{aligned}$$

(d)
$$\begin{aligned}
10 - 2(8 + |5 - 7|) &= 10 - 2(8 + |-2|) &&\text{Subtract inside absolute value symbols.} \\
&= 10 - 2(8 + 2) &&\text{Evaluate absolute value.} \\
&= 10 - 2(10) &&\text{Add inside parentheses.} \\
&= 10 - 20 &&\text{Multiply.} \\
&= -10 &&\text{Subtract.}
\end{aligned}$$

TECHNOLOGY

Most scientific and graphing calculators use the same order of operations listed above. Try entering the expressions in Example 1 into your calculator. Do you get the same results?

Solving Equations

A second algebraic skill in this chapter is solving an equation in one variable.

1. To solve a *linear equation*, you can add or subtract the same quantity from each side of the equation. You can also multiply or divide each side of the equation by the same *nonzero* quantity.

2. To solve a *quadratic equation*, you can take the square root of each side, use factoring, or use the Quadratic Formula.

3. To solve a *radical equation*, isolate the radical on one side of the equation and square each side of the equation.

4. To solve an *absolute value equation*, use the definition of absolute value to rewrite the equation as two equations.

TECHNOLOGY

The equations in Example 2 are solved algebraically. Most graphing utilities have a "solve" key that allows you to solve the equation graphically. If you have a graphing utility, try using it to solve graphically the equations in Example 2.

EXAMPLE 2   Solving Equations

Solve each equation.

(a) $3x - 3 = 5x - 7$

(b) $2x^2 = 10$

(c) $2x^2 + 5x - 6 = 6$

(d) $\sqrt{2x - 7} = 5$

SOLUTION

(a) $3x - 3 = 5x - 7$ Write original (linear) equation.

$ -3 = 2x - 7$ Subtract $3x$ from each side.

$ 4 = 2x$ Add 7 to each side.

$ 2 = x$ Divide each side by 2.

(b) $2x^2 = 10$ Write original (quadratic) equation.

$ x^2 = 5$ Divide each side by 2.

$ x = \pm\sqrt{5}$ Take the square root of each side.

(c) $2x^2 + 5x - 6 = 6$ Write original (quadratic) equation.

$2x^2 + 5x - 12 = 0$ Write in general form.

$(2x - 3)(x + 4) = 0$ Factor.

$2x - 3 = 0 \implies x = \tfrac{3}{2}$ Set first factor equal to zero.

$x + 4 = 0 \implies x = -4$ Set second factor equal to zero.

(d) $\sqrt{2x - 7} = 5$ Write original (radical) equation.

$\phantom{\sqrt{}} 2x - 7 = 25$ Square each side.

$\phantom{\sqrt{}} 2x = 32$ Add 7 to each side.

$\phantom{\sqrt{}} x = 16$ Divide each side by 2.

ALGEBRA REVIEW

You should be aware that solving radical equations can sometimes lead to *extraneous solutions* (those that do not satisfy the original equation). For example, squaring both sides of the following equation yields two possible solutions, one of which is extraneous.

$$\sqrt{x} = x - 2$$

$$x = x^2 - 4x + 4$$

$$0 = x^2 - 5x + 4$$

$$ = (x - 4)(x - 1)$$

$x - 4 = 0 \implies x = 4 \text{ (solution)}$

$x - 1 = 0 \implies x = 1 \text{ (extraneous)}$

1 CHAPTER SUMMARY AND STUDY STRATEGIES

After studying this chapter, you should have acquired the following skills. The exercise numbers are keyed to the view Exercises that begin on page 76. Answers to odd-numbered Review Exercises are given in the back of the text.*

■ Plot points in a coordinate plane and read data presented graphically.   *Review Exercises 1–4*
   (Section 1.1)

■ Find the distance between two points in a coordinate plane.   *(Section 1.1)*   *Review Exercises 5–8*
   $$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

■ Find the midpoints of line segments connecting two points.   *(Section 1.1)*   *Review Exercises 9–12*
   $$\text{Midpoint} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

■ Interpret real-life data that is presented graphically.   *(Section 1.1)*   *Review Exercises 13, 14*

■ Translate points in a coordinate plane.   *(Section 1.1)*   *Review Exercises 15, 16*

■ Construct a bar graph from real-life data.   *(Section 1.1)*   *Review Exercise 17*

■ Sketch graphs of equations by hand.   *(Section 1.2)*   *Review Exercises 18–27*

■ Find the x- and y-intercepts of graphs of equations algebraically *and*   *Review Exercises 28, 29*
   graphically using a graphing utility.   *(Section 1.2)*

■ Write the standard forms of equations of circles, given the center and a point on   *Review Exercises 30, 31*
   the circle.   *(Section 1.2)*
   $$(x - h)^2 + (y - k)^2 = r^2$$

■ Convert equations of circles from general form to standard form by completing   *Review Exercises 32, 33*
   the square, and sketch the circles.   *(Section 1.2)*

■ Find the points of intersection of two graphs algebraically *and* graphically using   *Review Exercises 34–37*
   a graphing utility.   *(Section 1.2)*

■ Find the break-even point for a business.   *(Section 1.2)*   *Review Exercises 38, 39*

   The break-even point occurs when the revenue R is equal to the cost C.

■ Find the equilibrium points of supply equations and demand equations.   *Review Exercise 40*
   (Section 1.2)

   The equilibrium point is the point of intersection of the graphs
   of the supply and demand equations.

■ Use the slope-intercept form of a linear equation to sketch graphs of lines.   *Review Exercises 41–46*
   (Section 1.3)
   $$y = mx + b$$

■ Find slopes of lines passing through two points.   *(Section 1.3)*   *Review Exercises 47–50*
   $$m = \frac{y_2 - y_1}{x_2 - x_1}$$

■ Use the point-slope form to write equations of lines and graph equations using a   *Review Exercises 51, 52*
   graphing utility.   *(Section 1.3)*
   $$y - y_1 = m(x - x_1)$$

- Find equations of parallel and perpendicular lines.   *(Section 1.3)*   *Review Exercises 53, 54*

  Parallel lines: $m_1 = m_2$ Perpendicular lines: $m_1 = -\dfrac{1}{m_2}$

- Use linear equations to solve real-life problems such as predicting future sales   *Review Exercises 55, 56*
  or creating a linear depreciation schedule.   *(Section 1.3)*

- Use the vertical line test to decide whether equations define functions.   *Review Exercises 57–60*
  (Section 1.4)

- Use function notation to evaluate functions.   *(Section 1.4)*   *Review Exercises 61, 62*

- Use a graphing utility to graph functions and find the domains and ranges   *Review Exercises 63–68*
  of functions.   *(Section 1.4)*

- Combine functions to create other functions.   *(Section 1.4)*   *Review Exercises 69, 70*

- Use the horizontal line test to determine whether functions have inverse functions.   *Review Exercises 71–74*
  If they do, find the inverse functions.   *(Section 1.4)*

- Determine whether limits exist. If they do, find the limits.   *(Section 1.5)*   *Review Exercises 75–92*

- Use a table to estimate one-sided limits.   *(Section 1.5)*   *Review Exercises 93, 94*

- Determine whether statements about limits are true or false.   *(Section 1.5)*   *Review Exercises 95–100*

- Determine whether functions are continuous at a point, on an open interval, and   *Review Exercises 101–108*
  on a closed interval.   *(Section 1.6)*

- Determine the constant such that *f* is continuous.   *(Section 1.6)*   *Review Exercises 109, 110*

- Use analytic and graphical models of real-life data to solve real-life problems.   *Review Exercises 111–114*
  (Section 1.6)

On pages xxv–xxviii of the preface, we included a feature called A Plan for You as a Student. *If you have not already read this feature, we encourage you to do so now. Here are some other strategies that can help you succeed in this course.*

- ***Use a Graphing Utility***   A graphing calculator or graphing software for a computer can help you in this course in two important ways. As an *exploratory device*, a graphing utility allows you to learn concepts by allowing you to compare graphs of equations. For instance, sketching the graphs of $y = x^2$, $y = x^2 + 1$, and $y = x^2 - 1$ helps confirm that adding (or subtracting) a constant to (or from) a function shifts the graph of the function vertically. As a *problem-solving tool*, a graphing utility frees you of some of the drudgery of sketching complicated graphs by hand. The time that you save can be spent using mathematics to solve real-life problems.

- ***Use the Warm-Up Exercises***   Each exercise set in this text begins with a set of warm-up exercises. We urge you to begin each homework session by quickly working all of the warm-up exercises (all are answered in the back of the text). The "old" skills covered in the warm-up exercises are needed to master the "new" skills in the section exercise set. The warm-up exercises remind you that mathematics is cumulative—to be successful in this course, you must retain "old" skills.

- ***Use the Additional Study Aids***   The additional study aids were prepared specifically to help you master the concepts discussed in the text. They are the *Student Solutions Guide*, the *Calculus: An Applied Approach Learning Tools Student CD-ROM*, *The Algebra of Calculus*, and the *Graphing Technology Guide*.


Study Tools   *Additional resources that accompany this chapter*

- **Algebra Review**   (pages 72 and 73)
- **Chapter Summary and Study Strategies**   (pages 74 and 75)
- **Review Exercises**   (pages 76–79)
- **Sample Post-Graduation Exam Questions**   (page 80)
- **Web Exercises**   (page 10, Exercises 39 and 40; page 23, Exercise 74; page 34, Exercise 79; page 35, Exercise 91; page 48, Exercise 87)

- **Student Solutions Guide**
- **HM mathSpace® Student CD-ROM**
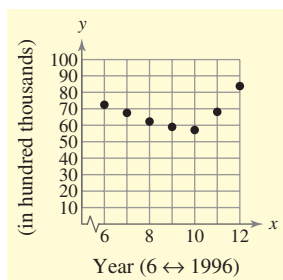- **Graphing Technology Guide**   (*math.college.hmco.com/students*)

1   **CHAPTER REVIEW EXERCISES**

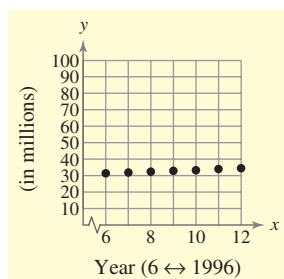In Exercises 1–4, match the data with the real-life situation that it represents. [The graphs are labeled (a)–(d).]

1. Population of Texas

2. Population of California

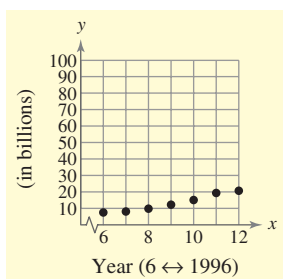**3.** Number of unemployed workers in the United States

4. Best Buy sales
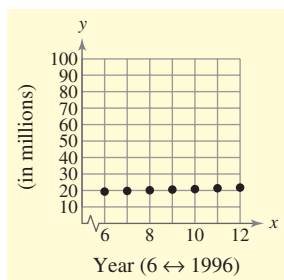
(a)

(b)

(c)

(d)

In Exercises 5–8, find the distance between the two points.

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

6. $(1, 2)$, $(4, 3)$

7. $(-1, 3)$, $(-4, 6)$

8. $(6, 8)$, $(-3, 7)$

In Exercises 9–12, find the midpoint of the line segment connecting the two points.

9. $(5, 6)$, $(9, 2)$

10. $(0, 0)$, $(-4, 8)$

11. $(-10, 4)$, $(-6, 8)$

12. $(7, -9)$, $(-3, 5)$

In Exercises 13 and 14, use the graph below, which gives the revenues, costs, and profits for Pixar from 1999 through 2003. (Pixar develops and produces animated feature films.) *(Source: Pixar)*
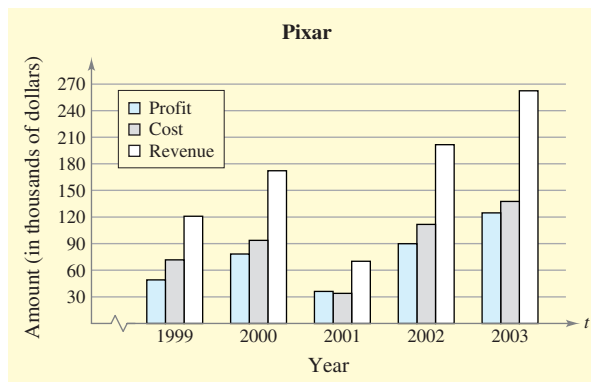
13. Write an equation that relates the revenue R, cost C, and profit P. Explain the relationship between the heights of the bars and the equation.

14. Estimate the revenue, cost, and profit for Pixar for each year.

15. Translate the triangle whose vertices are $(1, 3)$, $(2, 4)$, and $(5, 6)$ three units to the right and four units up. Find the coordinates of the translated vertices.

16. Translate the rectangle whose vertices are $(-2, 1)$, $(-1, 2)$, $(1, 0)$, and $(0, -1)$ four units to the right and one unit down.

17. *Biology*   The following data represent six intertidal invertebrate species collected from four stations along the Maine coast.

Mytilus	107	*Gammarus*	78
Littorina	65	*Arbacia*	6
Nassarius	112	*Mya*	18

Use a graphing utility to construct a bar graph that represents the data.   *(Source: Adapted from Haefner,* Exploring Marine Biology: Laboratory and Field Exercises*)*

In Exercises 18–27, sketch the graph of the equation.

18. $y = 4x - 12$

19. $y = 4 - 3x$

20. $y = x^2 + 5$

21. $y = 1 - x^2$

22. $y = |4 - x|$

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

24. $y = x^3 + 4$

25. $y = x^3 + 2x^2 - x + 2$

26. $y = \sqrt{4x + 1}$

27. $y = \sqrt{2x}$

In Exercises 28 and 29, find the *x*- and *y*-intercepts of the graph of the equation algebraically. Use a graphing utility to verify your results.

28. $4x + y + 3 = 0$

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

In Exercises 30 and 31, write the standard form of the equation of the circle.

30. Center: $(0, 0)$

Solution point: $\left(2, \sqrt{5}\right)$

31. Center: $(2, -1)$

Solution point: $(-1, 7)$

In Exercises 32 and 33, complete the square to write the equation of the circle in standard form. Determine the radius and center of the circle. Then sketch the circle.

32. $x^2 + y^2 - 6x + 8y = 0$

33. $x^2 + y^2 + 10x + 4y - 7 = 0$

In Exercises 34–37, find the point(s) of intersection of the graphs algebraically. Then use a graphing utility to verify your results.

34. $x + y = 2, \ 2x - y = 1$

35. $x^2 + y^2 = 5, \ x - y = 1$

36. $y = x^3, \ y = x$ **37.** $y = \sqrt{x}, \ y = x$

38. *Break-Even Analysis* The student government association wants to raise money by having a T-shirt sale. Each shirt costs $8. The silk screening costs $200 for the design, plus $2 per shirt. Each shirt will sell for $14.

   (a) Find equations for the total cost C and the total revenue R for selling x shirts.

   (b) Find the break-even point.

39. *Break-Even Analysis* You are starting a part-time business. You make an initial investment of $6000. The unit cost of the product is $6.50, and the selling price is $13.90.

   (a) Find equations for the total cost C and the total revenue R for selling x units of the product.

   (b) Find the break-even point.

40. *Supply and Demand* The demand and supply equations for a cordless screwdriver are given by

$$p = 91.4 - 0.009x \qquad \text{Demand equation}$$
$$p = 6.4 + 0.008x \qquad \text{Supply equation}$$

where p is the price in dollars and x represents the number of units. Find the equilibrium point for this market.

In Exercises 41–46, find the slope and *y*-intercept (if possible) of the linear equation. Then sketch the graph of the equation.

41. $3x + y = -2$ **42.** $-\frac{1}{3}x + \frac{5}{6}y = 1$

43. $y = -\frac{5}{3}$ **44.** $x = -3$

45. $-2x - 5y - 5 = 0$ **46.** $3.2x - 0.8y + 5.6 = 0$

In Exercises 47–50, find the slope of the line passing through the two points.

47. $(0, 0), (7, 6)$ **48.** $(-1, 5), (-5, 7)$

49. $(10, 17), (-11, -3)$ **50.** $(-11, -3), (-1, -3)$

In Exercises 51 and 52, find an equation of the line that passes through the point and has the given slope. Then use a graphing utility to graph the line.

51. Point: $(3, -1)$; slope: $m = -2$

52. Point: $(-3, -3)$; slope: $m = \frac{1}{2}$

In Exercises 53 and 54, find the general form of the equation of the line passing through the point and satisfying the given condition.

53. Point: $(-3, 6)$

   (a) Slope is $\frac{7}{8}$.

   (b) Parallel to the line $4x + 2y = 7$.

   (c) Passes through the origin.

   (d) Perpendicular to the line $3x - 2y = 2$.

54. Point: $(1, -3)$

   (a) Parallel to the *x*-axis.

   (b) Perpendicular to the *x*-axis.

   (c) Parallel to the line $-4x + 5y = -3$.

   (d) Perpendicular to the line $5x - 2y = 3$.

55. *Demand* When a wholesaler sold a product at $32 per unit, sales were 750 units per week. After a price increase of $5 per unit, however, the sales dropped to 700 units per week.

   (a) Write the quantity demanded x as a linear function of the price p.

   (b) *Linear Interpolation* Predict the number of units sold at a price of $34.50 per unit.

   (c) *Linear Extrapolation* Predict the number of units sold at a price of $42.00 per unit.

56. *Linear Depreciation* A small business purchases a typesetting system for $117,000. After 9 years, the system will be obsolete and have no value.

   (a) Write a linear equation giving the value v of the system in terms of the time t.

   (b) Use a graphing utility to graph the function.

   (c) Use a graphing utility to estimate the value of the system after 4 years.

   (d) Use a graphing utility to estimate the time when the system's value will be $84,000.

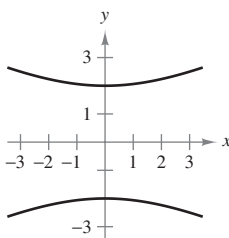In Exercises 57–60, use the vertical line test to determine whether y is a function of x.
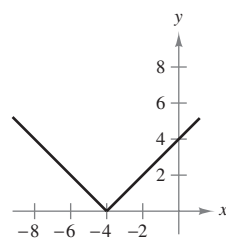
57. $y = -x^2 + 2$
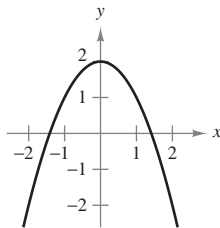
58. $x^2 + y^2 = 4$
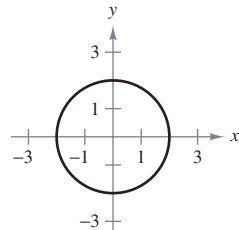
59. $y^2 - \frac{1}{4}x^2 = 4$

60. $y = |x + 4|$

In Exercises 61 and 62, evaluate the function at the specified values of the independent variable. Simplify the result.

61. $f(x) = 3x + 4$

    (a) $f(1)$ (b) $f(x + 1)$ (c) $f(2 + \Delta x)$

62. $f(x) = x^2 + 4x + 3$

    (a) $f(0)$ (b) $f(x - 1)$ (c) $f(x + \Delta x) - f(x)$

In Exercises 63–68, use a graphing utility to graph the function. Then find the domain and range of the function.

63. $f(x) = x^2 + 3x + 2$

64. $f(x) = 2$

65. $f(x) = \sqrt{x + 1}$

66. $f(x) = \dfrac{x - 3}{x^2 + x - 12}$

67. $f(x) = -|x| + 3$

68. $f(x) = -\frac{12}{13}x - \frac{7}{8}$

In Exercises 69 and 70, use f and g to find the combinations of the functions.

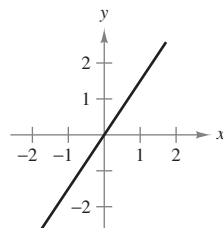(a) $f(x) + g(x)$ (b) $f(x) - g(x)$ (c) $f(x)g(x)$

(d) $\dfrac{f(x)}{g(x)}$ (e) $f(g(x))$ (f) $g(f(x))$

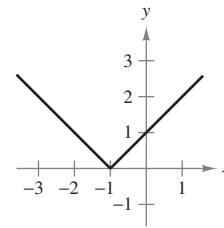**69.** $f(x) = 1 + x^2$, $g(x) = 2x - 1$

70. $f(x) = 2x - 3$, $g(x) = \sqrt{x + 1}$

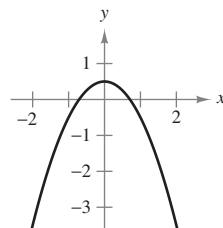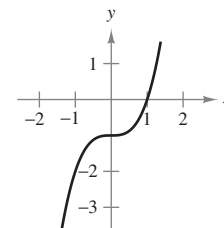In Exercises 71–74, find the inverse function of f (if it exists).

71. $f(x) = \frac{3}{2}x$

72. $f(x) = |x + 1|$

73. $f(x) = -x^2 + \frac{1}{2}$

74. $f(x) = x^3 - 1$

In Exercises 75–92, find the limit (if it exists).

75. $\lim\limits_{x \to 2} (5x - 3)$

76. $\lim\limits_{x \to 2} (2x + 9)$

77. $\lim\limits_{x \to 2} (5x - 3)(2x + 3)$

78. $\lim\limits_{x \to 2} \dfrac{5x - 3}{2x + 9}$

79. $\lim\limits_{t \to 3} \dfrac{t^2 + 1}{t}$

80. $\lim\limits_{t \to 0} \dfrac{t^2 + 1}{t}$

81. $\lim\limits_{t \to 1} \dfrac{t + 1}{t - 2}$

82. $\lim\limits_{t \to 2} \dfrac{t + 1}{t - 2}$

83. $\lim\limits_{x \to -2} \dfrac{x + 2}{x^2 - 4}$

84. $\lim\limits_{x \to 3^-} \dfrac{x^2 - 9}{x - 3}$

85. $\lim\limits_{x \to 0^+} \left(x - \dfrac{1}{x} \right)$

86. $\lim\limits_{x \to 1/2} \dfrac{2x - 1}{6x - 3}$

87. $\lim\limits_{x \to 0} \dfrac{[1/(x - 2)] - 1}{x}$

88. $\lim\limits_{x \to 0} \dfrac{[1/(x - 4)] - (1/4)}{x}$

89. $\lim\limits_{t \to 0} \dfrac{(1/\sqrt{t + 4}) - (1/2)}{t}$

90. $\lim\limits_{s \to 0} \dfrac{(1/\sqrt{1 + s}) - 1}{s}$

91. $\lim\limits_{\Delta x \to 0} \dfrac{(x + \Delta x)^3 - (x + \Delta x) - (x^3 - x)}{\Delta x}$

92. $\lim\limits_{\Delta x \to 0} \dfrac{1 - (x + \Delta x)^2 - (1 - x^2)}{\Delta x}$

In Exercises 93 and 94, use a table to estimate the limit.

93. $\lim\limits_{x \to 1^+} \dfrac{\sqrt{2x + 1} - \sqrt{3}}{x - 1}$

94. $\lim\limits_{x \to 1^+} \dfrac{1 - \sqrt[3]{x}}{x - 1}$

True or False?   In Exercises 95–100, determine whether the statement is true or false. If it is false, explain why or give an example that shows it is false.

95. $\lim\limits_{x\to 0} \dfrac{|x|}{x} = 1$

96. $\lim\limits_{x\to 0} x^3 = 0$

97. $\lim\limits_{x\to 0} \sqrt{x} = 0$

98. $\lim\limits_{x\to 0} \sqrt[3]{x} = 0$

99. $\lim\limits_{x\to 2} f(x) = 3, \quad f(x) = \begin{cases} 3, & x \le 2 \\ 0, & x > 2 \end{cases}$

100. $\lim\limits_{x\to 3} f(x) = 1, \quad f(x) = \begin{cases} x - 2, & x \le 3 \\ -x^2 + 8x - 14, & x > 3 \end{cases}$

In Exercises 101–108, describe the interval(s) on which the function is continuous.

101. $f(x) = \dfrac{1}{(x + 4)^2}$

102. $f(x) = \dfrac{x + 2}{x}$

103. $f(x) = \dfrac{3}{x + 1}$

104. $f(x) = \dfrac{x + 1}{2x + 2}$

105. $f(x) = [\![x + 3]\!]$

106. $f(x) = [\![x]\!] - 2$

107. $f(x) = \begin{cases} x, & x \le 0 \\ x + 1, & x > 0 \end{cases}$

108. $f(x) = \begin{cases} x, & x \le 0 \\ x^2, & x > 0 \end{cases}$

In Exercises 109 and 110, find the constant a such that f is continuous on the entire real line.

109. $f(x) = \begin{cases} -x + 1, & x \le 3 \\ ax - 8, & x > 3 \end{cases}$

110. $f(x) = \begin{cases} x + 1, & x < 1 \\ 2x + a, & x \ge 1 \end{cases}$

111. ***National Debt***   The table lists the national debt D (in billions of dollars) for selected years. A mathematical model for the national debt is

$$D = 2.7502t^3 - 61.061t^2 + 598.79t + 3103.6,$$

$$0 \le t \le 13$$

where $t = 0$ represents 1990.   *(Source: U.S. Department of the Treasury)*

t	0	1	2	3	4
D	3206.3	3598.2	4001.8	4351.0	4643.3

t	5	6	7	8	9
D	4920.6	5181.5	5369.2	5478.2	5605.5

t	10	11	12	13
D	5628.7	5769.9	6198.4	6752.0

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

(b) Create a table that compares the values given by the model with the actual data.

(c) Use the model to estimate the national debt in 2008.

112. ***Consumer Awareness***   A cellular phone company charges \$2 for the first minute and \$0.10 for each additional minute or fraction thereof. Use the greatest integer function to create a model for the cost C of a phone call lasting t minutes. Use a graphing utility to graph the function, and discuss its continuity.

113. ***Recycling***   A recycling center pays \$0.25 for each pound of aluminum cans. Twenty-four aluminum cans weigh one pound. A mathematical model for the amount A paid by the recycling center is

$$A = \frac{1}{4}\left[\!\left[\frac{x}{24}\right]\!\right]$$

where x is the number of cans.

(a) Use a graphing utility to graph the function and then discuss its continuity.

(b) How much does a recycling center pay out for 1500 cans?

114. ***Biology***   A researcher experimenting with strains of corn produced the results in the figure below. From the figure, visually estimate the x- and y-intercepts, and use these points to write an equation for each line.
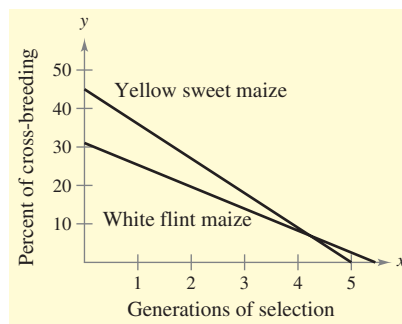
(Source: Adapted from Levine/Miller, Biology: Discovering Life, *Second Edition)*

1 SAMPLE POST-GRADUATION EXAM QUESTIONS

CPA
GMAT
GRE
Actuarial
CLAST

The following questions represent the types of questions that appear on certified public accountant (CPA) exams, Graduate Management Admission Tests (GMAT), Graduate Records Exams (GRE), actuarial exams, and College-Level Academic Skills Tests (CLAST). The answers to the questions are given in the back of the book.
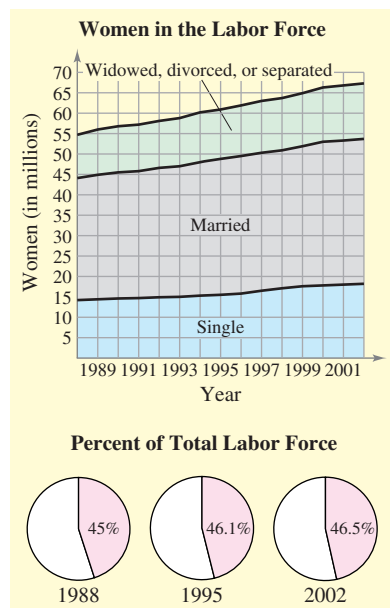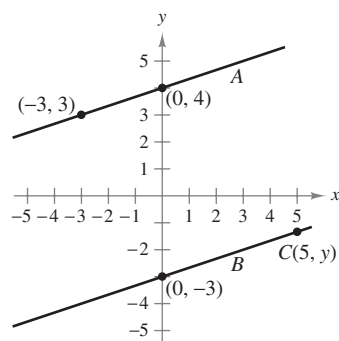
In Questions 1–5, use the data given in the graphs. *(Source: U.S. Bureau of Labor Statistics)*

Figure for 1–5

Women in the Labor Force

Percent of Total Labor Force

1988   1995   2002

1. The total labor force in 2002 was about y million with y equal to
(a) 100   (b) 118   (c) 129   (d) 145   (e) 154

2. In 1995, the percent of married women in the labor force was about
(a) 19   (b) 32   (c) 45   (d) 55   (e) 82

3. What was the first year when more than 60 million women were in the labor force?
(a) 1992   (b) 1994   (c) 1996   (d) 1998   (e) 2000

4. Between 1990 and 2000, the number of women in the labor force
(a) increased by about 17%   (b) increased by about 25%
(c) increased by about 50%   (d) increased by about 100%
(e) increased by about 125%

5. Which of the statements about the labor force can be inferred from the graphs?
  I. Between 1988 and 2002, there were no years when more than 20 million widowed, divorced, or separated women were in the labor force.
  II. In every year between 1988 and 2002, the number of married women in the labor force increased.
  III. In every year between 1988 and 2002, women made up at least $\frac{2}{5}$ of the total labor force.
(a) I only   (b) II only   (c) I and II only
(d) II and III only   (e) I, II, and III

6. What is the length of the line segment connecting $(1, 3)$ and $(-1, 5)$?
(a) $\sqrt{3}$ (b) 2   (c) $2\sqrt{2}$ (d) 4   (e) 8

7. The interest charged on a loan is p dollars per $1000 for the first month and q dollars per $1000 for each month after the first month. How much interest will be charged during the first 3 months on a loan of $10,000?
(a) $30p$ (b) $30q$ (c) $p + 2q$
(d) $20p + 10q$ (e) $10p + 20q$

8. If $x + y > 5$ and $x - y > 3$, which of the following describes the x solutions?
(a) $x > 3$ (b) $x > 4$ (c) $x > 5$ (d) $x < 5$ (e) $x < 3$

Figure for 9

9. In the figure at the left, in order for line A to be parallel to line B, the coordinates of C must be $(5, y)$ with y equal to which of the following?
(a) -4 (b) $-\frac{4}{3}$ (c) 0   (d) $\frac{1}{3}$ (e) 5