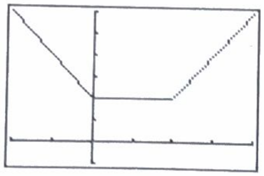
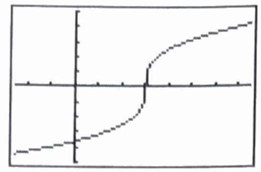
67. $y = |x| + |x - 10|$



68. $y = 8\sqrt[3]{x - 6}$



In Exercises 69–78, find the standard form of the equation of the specified circle.

69. Center: $(0, 0)$; radius: 3

70. Center: $(0, 0)$; radius: 5

71. Center: $(2, -1)$; radius: 4

72. Center: $\left(0, \frac{1}{3}\right)$; radius: $\frac{1}{3}$

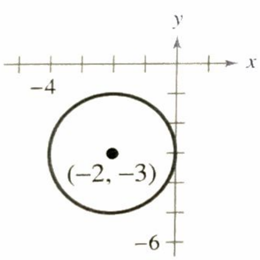
73. Center: $(-1, 2)$; solution point: $(0, 0)$

74. Center: $(3, -2)$; solution point: $(-1, 1)$

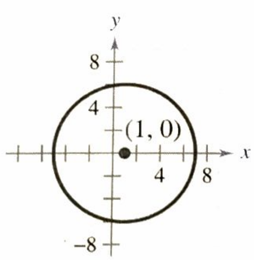
75. Endpoints of a diameter: $(0, 0)$, $(6, 8)$

76. Endpoints of a diameter: $(-4, -1)$, $(4, 1)$

77.



78.



In Exercises 79–84, find the center and radius, and sketch the graph of the equation.

79. $x^2 + y^2 = 4$

80. $x^2 + y^2 = 16$

81. $(x - 1)^2 + (y + 3)^2 = 4$

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

83. $\left(x - \frac{1}{2}\right)^2 + \left(y - \frac{1}{2}\right)^2 = \frac{9}{4}$

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

In Exercises 85 and 86, use a graphing utility to graph y_1 and y_2. Use a square setting. Identify the graph.

85. $y_1 = \sqrt{9 - x^2}$
$y_2 = -\sqrt{9 - x^2}$

86. $y_1 = 2 + \sqrt{16 - (x - 1)^2}$
$y_2 = 2 - \sqrt{16 - (x - 1)^2}$

In Exercises 87–90, explain how to use a graphing utility to verify that $y_1 = y_2$. Identify the rule of algebra that is illustrated.

87. $y_1 = \frac{1}{4}(x^2 - 8)$
$y_2 = \frac{1}{4}x^2 - 2$

88. $y_1 = \frac{1}{2}x + (x + 1)$
$y_2 = \frac{3}{2}x + 1$

89. $y_1 = \frac{1}{5}[10(x^2 - 1)]$
$y_2 = 2(x^2 - 1)$

90. $y_1 = (x - 3) \cdot \dfrac{1}{x - 3}$
$y_2 = 1$

91. ***Depreciation*** A manufacturing plant purchases a new molding machine for \$225,000. The depreciated value y after t years is given by

$$y = 225{,}000 - 20{,}000t, \qquad 0 \le t \le 8.$$

Sketch the graph of the equation.

92. ***Dimensions of a Rectangle*** A rectangle of length x and width w has a perimeter of 12 meters.

(a) Draw a rectangle that gives a visual representation of the problem. Use the specified variables to label the sides of the rectangle.

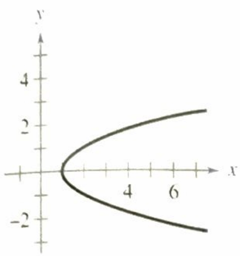
(b) Show that the width of the rectangle is $w = 6 - x$ and its area is $A = x(6 - x)$.

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

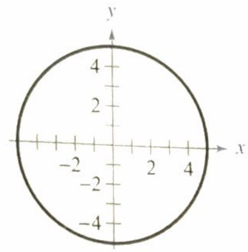
(d) From the graph of part (c), estimate the dimensions of the rectangle that yield a maximum area.

93. ***Think About It*** Suppose you correctly enter an expression for the variable y on a graphing utility. However, no graph appears on the display when you graph the equation. Give a possible explanation and the steps you could take to remedy the problem. Illustrate your explanation with an example.

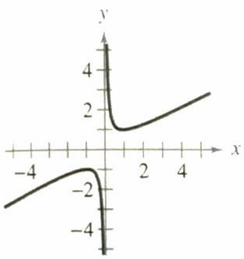
9. $x - y^2 = 1$



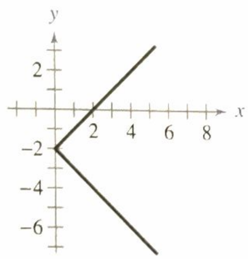
10. $x^2 + y^2 = 25$



11. $x^2 = 2xy - 1$



12. $x = |y + 2|$



13. ***Think About It*** Does the graph in Exercise 9 represent x as a function of y? Explain.

14. ***Think About It*** Does the graph in Exercise 10 represent x as a function of y? Explain.

In Exercises 15–18, select the viewing rectangle that shows the most complete graph of the function.

15. $f(x) = -0.2x^2 + 3x + 32$

Xmin = -2	Xmin = -10	Xmin = 0
Xmax = 20	Xmax = 30	Xmax = 10
Xscl = 1	Xscl = 5	Xscl = 0.5
Ymin = -10	Ymin = -5	Ymin = 0
Ymax = 30	Ymax = 50	Ymax = 200
Yscl = 4	Yscl = 5	Yscl = 25

16. $f(x) = 6[x - (0.1x)^5]$

Xmin = -500	Xmin = -25	Xmin = -20
Xmax = 5000	Xmax = 25	Xmax = 20
Xscl = 50	Xscl = 5	Xscl = 5
Ymin = -500	Ymin = -25	Ymin = -100
Ymax = 500	Ymax = 25	Ymax = 100
Yscl = 50	Yscl = 5	Yscl = 20

17. $f(x) = 4x^3 - x^4$

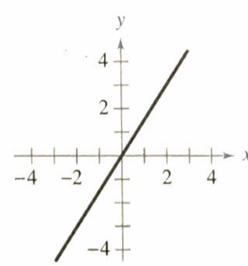
Xmin = -2	Xmin = -50	Xmin = 0
Xmax = 6	Xmax = 50	Xmax = 2
Xscl = 1	Xscl = 5	Xscl = 0.2
Ymin = -10	Ymin = -50	Ymin = -2
Ymax = 30	Ymax = 50	Ymax = 2
Yscl = 4	Yscl = 5	Yscl = 0.5

18. $f(x) = 10x\sqrt{400 - x^2}$

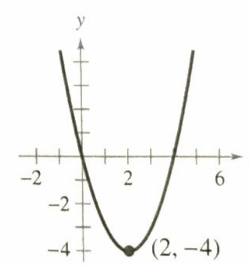
Xmin = -5	Xmin = -20	Xmin = -25
Xmax = 50	Xmax = 20	Xmax = 25
Xscl = 5	Xscl = 2	Xscl = 5
Ymin = -5000	Ymin = -500	Ymin = -2000
Ymax = 5000	Ymax = 500	Ymax = 2000
Yscl = 500	Yscl = 50	Yscl = 200

In Exercises 19–22, (a) determine the intervals over which the function is increasing, decreasing, or constant, and (b) determine if the function is even, odd, or neither.

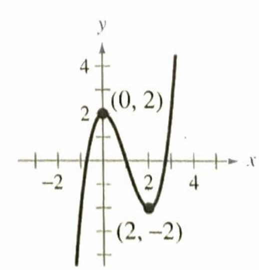
19. $f(x) = \frac{3}{2}x$



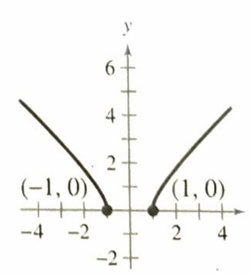
20. $f(x) = x^2 - 4x$



21. $f(x) = x^3 - 3x^2 + 2$



22. $f(x) = \sqrt{x^2 - 1}$



Alternate Group Activity

Use the school's library or some other reference source to find examples of three different functions that represent quantities between 1985 and 1995. Find one that decreased during the decade, one that increased, and one that was constant. For instance, the value of the dollar decreased, the population of the United States increased, and the land area of the United States remained constant. Can you find three other examples? Decide whether your examples represent *linear growth* or *decline*. If so, use the methods described in Section 1.2 to find a linear function $f(x) = mx + b$ that approximates the data.

WARM UP

1. Find $f(2)$ for $f(x) = -x^3$.

2. Find $f(6)$ for $f(x) = x^2 - 6x$.

3. Find $f(-x)$ for $f(x) = \frac{3}{x}$.

4. Find $f(-x)$ for $f(x) = x^2 - 3$.

Solve for *x*.

5. $x^3 - 16x = 0$

6. $2x^2 - 3x + 1 = 0$

Find the domain of the function.

7. $g(x) = \frac{4}{x - 4}$

8. $f(x) = \frac{2x}{x^2 - 9x + 20}$

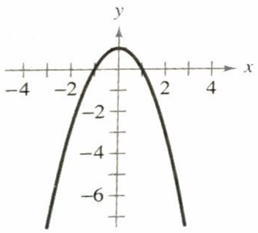
9. $h(t) = \sqrt[4]{5 - 3t}$

10. $f(t) = t^3 + 3t - 5$

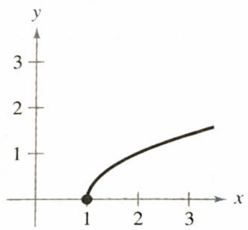
1.4 Exercises

In Exercises 1–6, find the domain and range of the function.

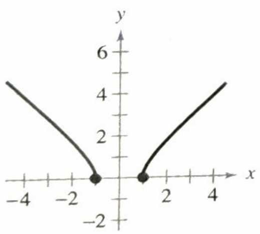
1. $f(x) = 1 - x^2$



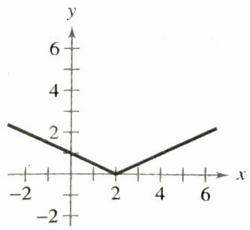
2. $f(x) = \sqrt{x - 1}$



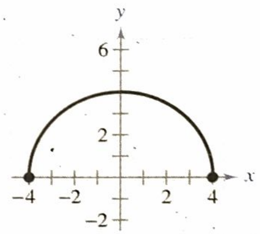
3. $f(x) = \sqrt{x^2 - 1}$



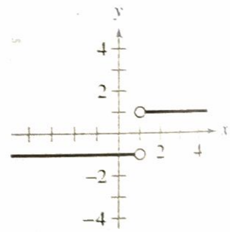
4. $f(x) = \frac{1}{2}|x - 2|$



5. $h(x) = \sqrt{16 - x^2}$

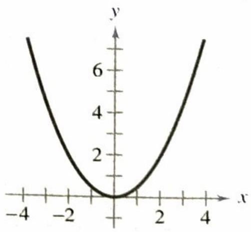


6. $g(x) = \frac{|x - 1|}{x - 1}$



In Exercises 7–12, use the Vertical Line Test to determine whether *y* is a function of *x*.

7. $y = \frac{1}{2}x^2$



8. $y = \frac{1}{4}x^3$