103. $d = \sqrt{(-4-2)^2 + (11-3)^2}$

$= \sqrt{36+64}$

$= \sqrt{100}$

$= 10$

Since the diameter is 10, the radius is 5.
The center is the midpoint of the line segment from (2,3) to (-4,11).

$\left(\frac{2+(-4)}{2}, \frac{3+11}{2}\right) = (-1,7)$ center

$(x+1)^2 + (y-7)^2 = 5^2$

105. Since it is tangent to the *x*-axis, its radius is 11.

$(x-7)^2 + (y-11)^2 = 11^2$

107. The center is (-3,3). The radius is 3.

$(x+3)^2 + (y-3)^2 = 3^2$

SECTION 2.2, Page 158

1. Given $f(x) = 3x - 1$,

a. $f(2) = 3(2) - 1$
$= 6 - 1$
$= 5$

b. $f(-1) = 3(-1) - 1$
$= -3 - 1$
$= -4$

c. $f(0) = 3(0) - 1$
$= 0 - 1$
$= -1$

d. $f(\frac{2}{3}) = 3(\frac{2}{3}) - 1$
$= 2 - 1$
$= 1$

e. $f(k) = 3(k) - 1$
$= 3k - 1$

f. $f(k+2) = 3(k+2) - 1$
$= 3k + 6 - 1$
$= 3k + 5$

3. Given $A(w) = \sqrt{w^2 + 5}$,

a. $A(0) = \sqrt{(0)^2 + 5}$
$= \sqrt{5}$

b. $A(2) = \sqrt{(2)^2 + 5}$
$= \sqrt{9}$
$= 3$

c. $A(-2) = \sqrt{(-2)^2 + 5}$
$= \sqrt{9}$
$= 3$

d. $A(4) = \sqrt{4^2 + 5}$
$= \sqrt{21}$

e. $A(r+1) = \sqrt{(r+1)^2 + 5}$
$= \sqrt{r^2 + 2r + 1 + 5}$
$= \sqrt{r^2 + 2r + 6}$

f. $A(-c) = \sqrt{(-c)^2 + 5}$
$= \sqrt{c^2 + 5}$

5. Given $f(x) = \frac{1}{|x|}$,

a. $f(2) = \frac{1}{|2|}$
$= \frac{1}{2}$

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

c. $f\left(-\frac{3}{5}\right) = \frac{1}{\left|-\frac{3}{5}\right|}$
$= \frac{1}{3/5}$
$= 1 \div \frac{3}{5}$
$= 1 \cdot \frac{5}{3}$
$= \frac{5}{3}$

d. $f(2) + f(-2) = \frac{1}{2} + \frac{1}{2}$
$= 1$

e. $f(c^2+4) = \frac{1}{|c^2+4|}$
$= \frac{1}{c^2+4}$

f. $f(2+h) = \frac{1}{|2+h|}$

7. Given $s(x) = \frac{x}{|x|}$,

a. $s(4) = \frac{4}{|4|} = \frac{4}{4} = 1$

b. $s(5) = \frac{5}{|5|} = \frac{5}{5} = 1$

c. $s(-2) = \frac{-2}{|-2|} = \frac{-2}{2} = -1$

d. $s(-3) = \frac{-3}{|-3|} = \frac{-3}{3} = -1$

e. Since $t > 0, |t| = t$.

$s(t) = \frac{t}{|t|} = \frac{t}{t} = 1$

f. Since $t < 0, |t| = -t$.

$s(t) = \frac{t}{|t|} = \frac{t}{-t} = -1$

9. **a.** Since $x = -4 < 2$, use $P(x) = 3x + 1$.

$P(-4) = 3(-4) + 1 = -12 + 1 = -11$

b. Since $x = \sqrt{5} \geq 2$, use $P(x) = -x^2 + 11$.

$P(\sqrt{5}) = -(\sqrt{5})^2 + 11 = -5 + 11 = 6$

c. Since $x = c < 2$, use $P(x) = 3x + 1$.

$P(c) = 3c + 1$

d. Since $k \geq 1$, then $x = k + 1 \geq 2$,

so use $P(x) = -x^2 + 11$.

$$P(k+1) = -(k+1)^2 + 11 = -(k^2 + 2k + 1) + 11$$
$$= -k^2 - 2k - 1 + 11$$
$$= -k^2 - 2k + 10$$

11. $2x + 3y = 7$

$3y = -2x + 7$

$y = -\frac{2}{3}x + \frac{7}{3}$, y is a function of x.

13. $-x + y^2 = 2$

$y^2 = x + 2$

$y = \pm\sqrt{x+2}$, y is a not function of x.

15. $y = 4 \pm \sqrt{x}$, y is not a function of x since for each $x > 0$ there are two values of x.

17. $y = \sqrt[3]{x}$, y is a function of x.

19. $y^2 = x^2$

$y = \pm\sqrt{x^2}$, y is a not function of x.

21. Function; each x is paired with exactly one y.

23. Function; each x is paired with exactly one y.

25. Function; each x is paired with exactly one y.

27. $f(x) = 3x - 4$ Domain is the set of all real numbers.

29. $f(x) = x^2 + 2$ Domain is the set of all real numbers.

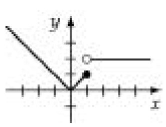
31. $f(x) = \frac{4}{x+2}$ Domain is $\{x \mid x \neq -2\}$.

33. $f(x) = \sqrt{7+x}$ Domain is $\{x \mid x \geq -7\}$.

35. $f(x) = \sqrt{4 - x^2}$ Domain is $\{x \mid -2 \leq x \leq 2\}$.

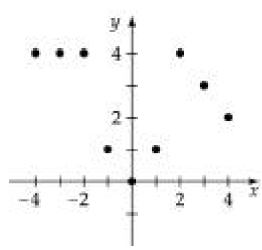
37. $f(x) = \frac{1}{\sqrt{x+4}}$ Domain is $\{x \mid x > -4\}$.

39.



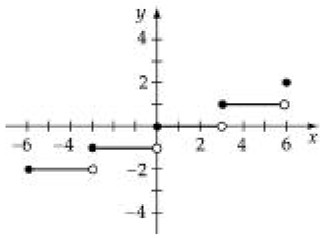
Domain: the set of all real numbers

41.



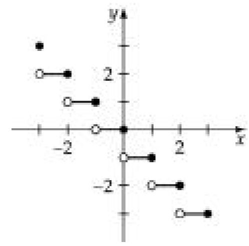
Domain: {−4, −3, −2, −1, 0, 1, 2, 3, 4}

43.



Domain: $\{x \mid -6 \le x \le 6\}$

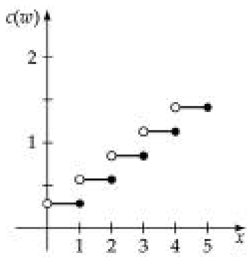
45.



Domain: $\{x \mid -3 \le x \le 3\}$

47. **a.** $C(3.97) = 0.29 - 0.29\text{int}(1-3.97)$
$= 0.29 - 0.29\text{int}(-2.97)$
$= 0.29 - 0.29(-3)$
$= 0.29 + 0.87$
$= \$1.16$

b.



49. **a.** Yes; every vertical line intersects the graph in one point.
b. Yes; every vertical line intersects the graph in one point.
c. No; some vertical lines intersect the graph at more than one point.
d. Yes; every vertical line intersects the graph in at most one point.

51. Decreasing on $(-\infty, 0]$; increasing on $[0, \infty)$

53. Increasing on $(-\infty, \infty)$

55. Decreasing on $(-\infty, -3]$; increasing on $[-3, 0]$; decreasing on $[0, 3]$; increasing on $[3, \infty)$

57. Constant on $(-\infty, 0]$; increasing on $[0, \infty)$

59. Decreasing on $(-\infty, 0]$; constant on $[0, 1]$; increasing on $[1, \infty)$

61. g and F are one-to-one since every horizontal line intersects the graph at one point.
f, V, and p are not one-to-one since some horizontal lines intersect the graph at more than one point.

63. **a.** $P = 2l + 2w = 50$
$2w = 50 - 2l$
$w = 25 - l$

b. $A = lw$
$A = l(25-l)$
$A = 25l - l^2$

65. $v(t) = 80{,}000 - 6500t, \quad 0 \le t \le 10$

67. **a.** $C(x) = 5(400) + 22.80x$
$= 2000 + 22.80x$

b. $R(x) = 37.00x$

c. $P(x) = 37.00x - C(x)$
$= 37.00 - [2000 + 22.80x]$
$= 37.00x - 2000 - 22.80x$
$= 14.20x - 2000$

Note x is a natural number.

69. $\dfrac{15}{3} = \dfrac{15-h}{r}$
$5 = \dfrac{15-h}{r}$
$5r = 15 - h$
$h = 15 - 5r$
$h(r) = 15 - 5r$

71. $d = \sqrt{(3t)^2 + (50)^2}$

$d = \sqrt{9t^2 + 2500}$ meters, $0 \le t \le 60$

73. $d = \sqrt{(45 - 8t)^2 + (6t)^2}$ miles

where t is the number of hours after 12:00 noon

75.

x	5	10	12.5	15	20
$Y(x)$	275	375	385	390	394

answers accurate to nearest apple

77. $f(c) = c^2 - c - 5 = 1$

$c^2 - c - 6 = 0$

$(c - 3)(c + 2) = 0$

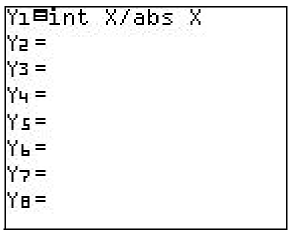
$c - 3 = 0$ or $c + 2 = 0$

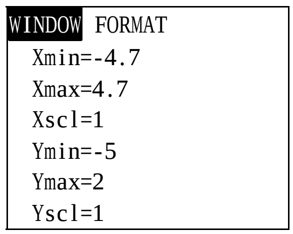
$c = 3$ $\quad$ $c = -2$

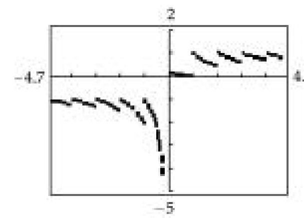
79. 1 is not in the range of $f(x)$, since

$1 = \dfrac{x-1}{x+1}$ only if $x + 1 = x - 1$ or $1 = -1$.

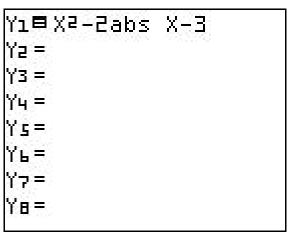
81. Set the graphing utility to "dot" mode.

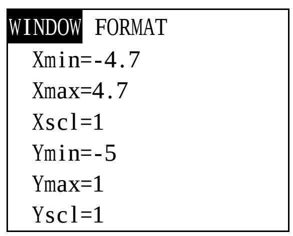


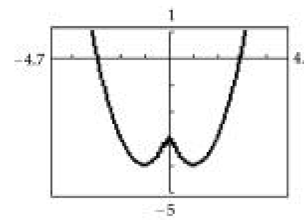




83.







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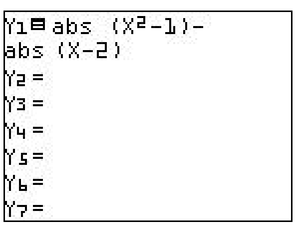

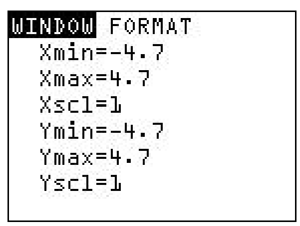

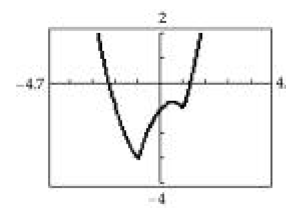

87. $f(x)\Big|_2^3 = (9 - 3) - (4 - 2) = 6 - 2 = 4$

89. $f(x)\Big|_0^2 = (16 - 12 - 2) - 0 = 2$

91. **a.** $f(1,7) = 3(1) + 5(7) - 2 = 3 + 35 - 2 = 36$

b. $f(0,3) = 3(0) + 5(3) - 2 = 13$

c. $f(-2,4) = 3(-2) + 5(4) - 2 = 12$

d. $f(4,4) = 3(4) + 5(4) - 2 = 30$

e. $f(k,2k) = 3(k) + 5(2k) - 2 = 13k - 2$

f. $f(k+2, k-3) = 3(k+2) + 5(k-3) - 2$

$= 3k + 6 + 5k - 15 - 2$

$= 8k - 11$

93. $s = \dfrac{5 + 8 + 11}{2} = 12$

$A(5,8,11) = \sqrt{12(12-5)(12-8)(12-11)}$

$= \sqrt{12(7)(4)(1)} = \sqrt{336} = 4\sqrt{21}$

95. $a^2 + 3a - 3 = a$

$a^2 + 2a - 3 = 0$

$(a - 1)(a + 3) = 0$

$a = 1$ or $a = -3$

97.