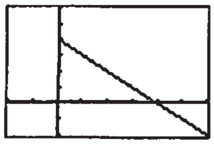
3. Domain of y_4: $[0, \infty)$; Range of y_4: $(-\infty, 4]$

y_4:



$[-2, 6]$ by $[-2, 6]$

4. $y_3 = y_2(y_1(x)) = \sqrt{y_1(x)} = \sqrt{4-x^2}$

$y_4 = y_1(y_2(x)) = 4-(y_2(x))^2 = 4-(\sqrt{x})^2 = 4-x,\ x \ge 0$

Quick Review 1.2

1. $3x-1 \le 5x+3$
$-2x \le 4$
$x \ge -2$

Solution: $[-2, \infty)$

2. $x(x-2) > 0$

Solutions to $x(x-2) = 0$: $x = 0, x = 2$

Test $x = -1$: $-1(-1-2) = 3 > 0$
$x(x-2) > 0$ is true when $x < 0$.

Test $x = 1$: $1(1-2) = -1 < 0$
$x(x-2) > 0$ is false when $0 < x < 2$.

Test $x = 3$: $3(3-2) = 3 > 0$
$x(x-2) > 0$ is true when $x > 2$.

Solution set: $(-\infty, 0) \cup (2, \infty)$

3. $|x-3| \le 4$
$-4 \le x-3 \le 4$
$-1 \le x \le 7$

Solution set: $[-1, 7]$

4. $|x-2| \ge 5$
$x-2 \le -5$ or $x-2 \ge 5$
$x \le -3$ or $x \ge 7$

Solution set: $(-\infty, -3] \cup [7, \infty)$

5. $x^2 < 16$

Solution to $x^2 = 16$: $x = -4, x = 4$

Test $x = -6$: $(-6)^2 = 36 > 16$
$x^2 < 16$ *is false when* $x < -4$

Test $x = 0$: $0^2 = 0 < 16$
$x^2 < 16$ is true when $-4 < x < 4$

Test $x = 6$: $6^2 = 36 > 16$
$x^2 < 16$ is false when $x > 4$.

Solution set: $(-4, 4)$

6. $9 - x^2 \ge 0$

Solutions to $9 - x^2 = 0$: $x = -3, x = 3$

Test $x = -4$: $9-(-4)^2 = 9-16 = -7 < 0$
$9-x^2 \ge 0$ is false when $x < -3$.

Test $x = 0$: $9-0^2 = 9 > 0$
$9-x^2 \ge 0$ is true when $-3 < x < 3$.

Test $x = 4$: $9-4^2 = 9-16 = -7 < 0$
$9-x^2 \ge 0$ is false when $x > 3$.

Solution set: $[-3, 3]$

7. Translate the graph of f 2 units left and 3 units downward.

8. Translate the graph of f 5 units right and 2 units upward.

9. (a) $f(x) = 4$
$x^2 - 5 = 4$
$x^2 - 9 = 0$
$(x+3)(x-3) = 0$
$x = -3$ or $x = 3$

(b) $f(x) = -6$
$x^2 - 5 = -6$
$x^2 = -1$

No real solution

10. (a) $f(x) = -5$
$\frac{1}{x} = -5$
$x = -\frac{1}{5}$

(b) $f(x) = 0$
$\frac{1}{x} = 0$

No solution

11. (a) $f(x) = 4$
$\sqrt{x+7} = 4$
$x+7 = 16$
$x = 9$

Check: $\sqrt{9+7} = \sqrt{16} = 4$; it checks.

(b) $f(x) = 1$
$\sqrt{x+7} = 1$
$x+7 = 1$
$x = -6$

Check: $\sqrt{-6+7} = 1$; it checks.

12. (a) $f(x) = -2$
$\sqrt[3]{x-1} = -2$
$x-1 = -8$
$x = -7$

(b) $f(x) = 3$
$\sqrt[3]{x-1} = 3$
$x-1 = 27$
$x = 28$

Section 1.2 Exercises

1. $A(d)=\pi\left(\frac{d}{2}\right)^2$

$A(d)=\pi\left(\frac{4\text{ in}}{2}\right)^2=\pi(2\text{ in})^2=4\pi\text{ in}^2$

2. $h(s)=\frac{\sqrt{3}}{2}s=3\frac{\sqrt{3}}{2}m=1.5\sqrt{3}m$

3. $S(e)=6e^2=6(5\text{ ft})^2=6(25\text{ ft}^2)=150\text{ ft}^2$

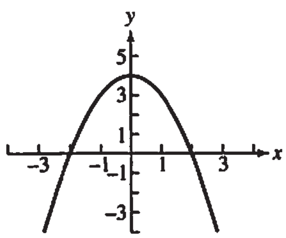
4. $v(r)=\frac{4}{3}\pi r^3=\frac{4}{3}\pi(3\text{cm})^3$

$=\frac{4}{3}\pi(27\text{ cm}^3)=36\pi\text{ cm}^3$

5. (a) $(-\infty, \infty)$ or all real numbers

(b) $(-\infty, 4]$

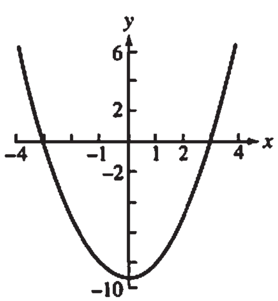
(c)



6. (a) $(-\infty, \infty)$ or all real numbers

(b) $[-9, \infty)$

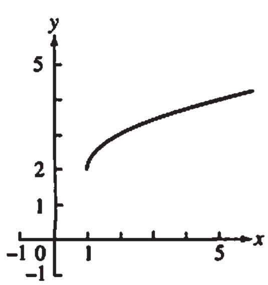
(c)



7. (a) Since we require $x-1\ge 0$, the domain is $[1, \infty)$.

(b) $[2, \infty)$

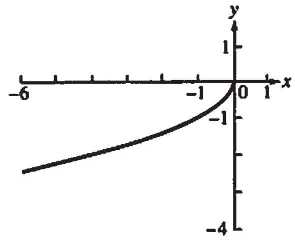
(c)



8. (a) Since we require $-x\ge 0$, the domain is $(-\infty, 0]$.

(b) $(-\infty, 0]$

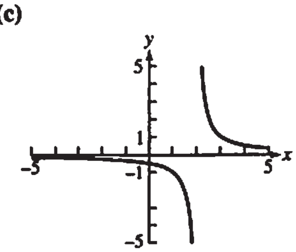
(c)



9. (a) Since we require $x-2\ne 0$, the domain is $(-\infty, 2)\cup(2, \infty)$.

(b) Since $\frac{1}{x-2}$ can assume any value except 0, the range is $(-\infty, 0)\cup(0, \infty)$.

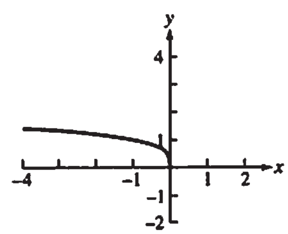
(c)



10. (a) Since we require $-x\ge 0$, the domain is $(-\infty, 0]$.

(b) $[0, \infty)$

(c)

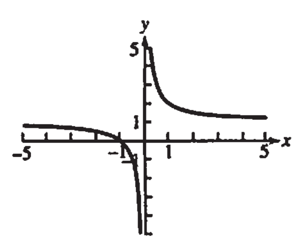


11. (a) Since we require $x\ne 0$, the domain is $(-\infty, 0)\cup(0, \infty)$.

(b) Note that $\frac{1}{x}$ can assume any value except 0, so $1+\frac{1}{x}$ can assume any value except 1.

The range is $(-\infty, 1)\cup(1, \infty)$.

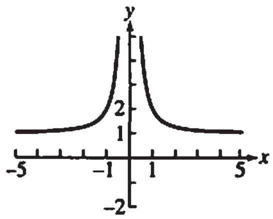
(c)



12. **(a)** Since we require $x^2 \neq 0$, the domain is $(-\infty, 0) \cup (0, \infty)$

(b) Since $\frac{1}{x^2} > 0$ for all x, the range is $(1, \infty)$.

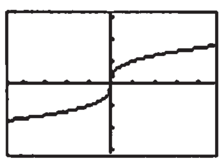
(c)



13. **(a)** $(-\infty, \infty)$ or all real numbers

(b) $(-\infty, \infty)$ or all real numbers

(c)

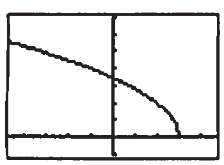


[-4.7, 4.7] by [-3.1, 3.1]

14. **(a)** Since we require $3 - x \geq 0$, the domain is $(-\infty, 3]$.

(b) $[0, \infty)$

(c)

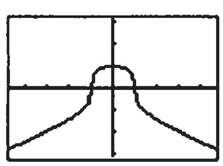


[-4.7, 4.7] by [-1, 7]

15. **(a)** $(-\infty, \infty)$ or all real numbers

(b) The maximum function value is attained at the point $(0, 1)$, so the range is $(-\infty, 1]$.

(c)

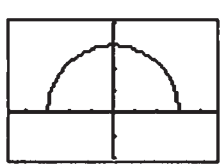


[-4.7, 4.7] by [-3.1, 3.1]

16. **(a)** Since we require $9 - x^2 \geq 0$ the domain is $[-3, 3]$

(b) $[0, 3]$

(c)

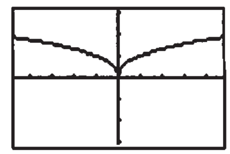


[-4.7, 4.7] by [-2, 4]

17. **(a)** $(-\infty, \infty)$ or all real numbers

(b) Since $x^{2/5}$ is equivalent to $\sqrt[5]{x^2}$, the range is $[0, \infty)$

(c)

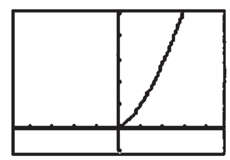


[-4.7, 4.7] by [-3.1, 3.1]

18. **(a)** This function is equivalent to $y = \sqrt{x^3}$, so its domain is $[0, \infty)$.

(b) $[0, \infty)$

(c)

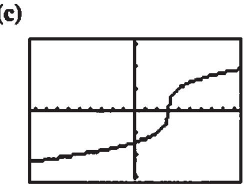


[-4.7, 4.7] by [-1, 5]

19. **(a)** $(-\infty, \infty)$ or all real numbers

(b) $(-\infty, \infty)$ or all real numbers

(c)

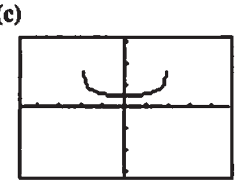


[-9.4, 9.4] by [-3.1, 3.1]

20. **(a)** Since $(4 - x^2) > 0$, the domain is $(-2, 2)$

(b) $[0.5, \infty)$

(c)



[-4.7, 4.7] by [-3.1, 3.1]

21. Even, since the function is an even power of x.

22. Neither, since the function is a sum of even and odd powers of x.

23. Neither, since the function is a sum of even and odd powers of $x\,(x^1 + 2x^0)$.

24. Even, since the function is a sum of even powers of $x(x^2 - 3x^0)$.

25. Even, since the function involves only even powers of x.

26. Odd, since the function is a sum of odd powers of x.

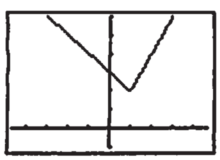
27. Odd, since the function is a quotient of an odd function (x^3) and an even function (x^2-1).

28. Neither, since, (for example), $y(-2) = 4^{1/3}$ and $y(2) = 0$.

29. Neither, since, (for example), $y(-1)$ is defined and $y(1)$ is undefined.

30. Even, since the function involves only even powers of x.

31. (a)

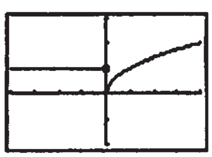


[−4.7, 4.7] by [−1, 6]

(b) $(-\infty, \infty)$ or all real numbers

(c) $[2, \infty)$

32. (a)

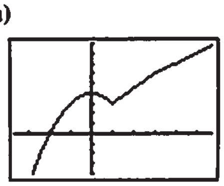


[−4, 4] by [−2, 3]

(b) $(-\infty, \infty)$ or all real numbers

(c) $[0, \infty)$

33. (a)

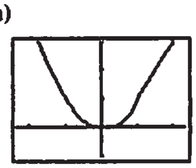


[−3.7, 5.7] by [−4, 9]

(b) $(-\infty, \infty)$ or all real numbers

(c) $(-\infty, \infty)$ or all real numbers

34. (a)



[−2.35, 2.35] by [−1, 3]

(b) $(-\infty, \infty)$ or all real numbers

(c) $[0, \infty)$

35. Because if the vertical line test holds, then for each x-coordinate, there is at most one y-coordinate giving a point on the curve. This y-coordinate would correspond to the value assigned to the x-coordinate. Since there is only one y-coordinate, the assignment would be unique.

36. If the curve is not $y = 0$, there must be a point (x, y) on the curve where $y \neq 0$. That would mean that (x, y) and $(x, -y)$ are two different points on the curve and it is not the graph of a function, since it fails the vertical line test.

37. No

38. Yes

39. Yes

40. No

41. Line through (0, 0) and (1, 1): $y = x$

Line through (1, 1) and (2, 0): $y = -x + 2$

$$f(x) = \begin{cases} x, & 0 \le x \le 1 \\ -x+2, & 1 < x \le 2 \end{cases}$$

42. $$f(x) = \begin{cases} 2, & 0 \le x < 1 \\ 0, & 1 \le x < 2 \\ 2, & 2 \le x < 3 \\ 0, & 3 \le x \le 4 \end{cases}$$

43. Line through (0, 2) and (2, 0): $y = -x + 2$

Line through (2, 1) and (5, 0): $m = \dfrac{0-1}{5-2} = \dfrac{-1}{3} = -\dfrac{1}{3}$,

so $y = -\dfrac{1}{3}(x-2) + 1 = -\dfrac{1}{3}x + \dfrac{5}{3}$

$$f(x) = \begin{cases} -x+2, & 0 < x \le 2 \\ -\frac{1}{3}x + \frac{5}{3}, & 2 < x \le 5 \end{cases}$$

44. Line through (−1, 0) and (0, −3):

$m = \dfrac{-3-0}{0-(-1)} = \dfrac{-3}{1} = -3$, so $y = -3x - 3$

Line through (0, 3) and (2, −1):

$m = \dfrac{-1-3}{2-0} = \dfrac{-4}{2} = -2$, so $y = -2x + 3$

$$f(x) = \begin{cases} -3x-3, & -1 < x \le 0 \\ -2x+3, & 0 < x \le 2 \end{cases}$$

45. Line through (−1, 1) and (0, 0): $y=-x$
Line through (0, 1) and (1, 1): $y=1$
Line through (1, 1) and (3, 0):

$$m=\frac{0-1}{3-1}=\frac{-1}{2}=-\frac{1}{2},$$

so $y=-\frac{1}{2}(x-1)+1=-\frac{1}{2}x+\frac{3}{2}$

$$f(x)=\begin{cases}-x, & -1\le x<0\\ 1, & 0<x\le 1\\ -\frac{1}{2}x+\frac{3}{2}, & 1<x<3\end{cases}$$

46. Line through (−2, −1) and (0, 0): $y=\frac{1}{2}x$

Line through (0, 2) and (1, 0): $y=-2x+2$
Line through (1, −1) and (3, −1): $y=-1$

$$f(x)=\begin{cases}\frac{1}{2}x, & -2\le x\le 0\\ -2x+2, & 0<x\le 1\\ -1, & 1<x\le 3\end{cases}$$

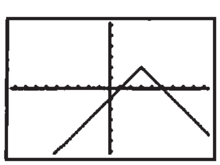
47. Line through $\left(\frac{T}{2},\ 0\right)$ and $(T, 1)$:

$$m=\frac{1-0}{T-(T/2)}=\frac{2}{T},\ \text{so}\ y=\frac{2}{T}\left(x-\frac{T}{2}\right)+0=\frac{2}{T}x-1$$

$$f(x)=\begin{cases}0, & 0\le x\le \frac{T}{2}\\ \frac{2}{T}x-1, & \frac{T}{2}<x\le T\end{cases}$$

48. $$f(x)=\begin{cases}A, & 0\le x<\frac{T}{2}\\ -A, & \frac{T}{2}\le x<T\\ A, & T\le x<\frac{3T}{2}\\ -A, & \frac{3T}{2}\le x\le 2T\end{cases}$$

49. (a)



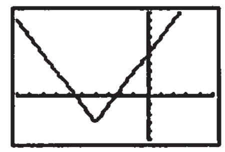
[−9.4, 9.4] by [−6.2, 6.2]

Note that $f(x)=-|x-3|+2$, so its graph is the graph of the absolute value function reflected across the x-axis and then shifted 3 units right and 2 units upward.

(b) $(-\infty, \infty)$

(c) $(-\infty, 2]$

50. (a) The graph of $f(x)$ is the graph of the absolute value function stretched vertically by a factor of 2 and then shifted 4 units to the left and 3 units downward.



[−10, 5] by [−5, 10]

(b) $(-\infty, \infty)$ or all real numbers

(c) $[-3, \infty)$

51. (a) $f(g(x))=(x^2-3)+5=x^2+2$

(b) $g(f(x))=(x+5)^2-3$
$=(x^2+10x+25)-3$
$=x^2+10x+22$

(c) $f(g(0))=0^2+2=2$

(d) $g(f(0))=0^2+10\cdot 0+22=22$

(e) $g(g(-2))=[(-2^2)-3]^2-3=1^2-3=-2$

(f) $f(f(x))=(x+5)+5=x+10$

52. (a) $f(g(x))=(x-1)+1=x$

(b) $g(f(x))=(x+1)-1=x$

(c) $f(g(x))=0$

(d) $g(f(0))=0$

(e) $g(g(-2))=(-2-1)-1=-3-1=-4$

(f) $f(f(x))=(x+1)+1=x+2$

53. (a) Since $(f\circ g)(x)=\sqrt{g(x)-5}=\sqrt{x^2-5},\ g(x)=x^2$.

(b) Since $(f\circ g)(x)=1+\frac{1}{g(x)}=x$, we know that

$$\frac{1}{g(x)}=x-1,\ \text{so}\ g(x)=\frac{1}{x-1}.$$

(c) Since $(f\circ g)(x)=f\left(\frac{1}{x}\right)=x, f(x)=\frac{1}{x}$.

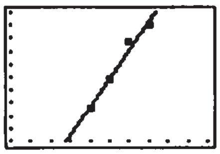
(d) Since $(f\circ g)(x)=f(\sqrt{x})=|x|, f(x)=x^2$.

The completed table is shown. Note that the absolute value sign in part (d) is optional.

$g(x)$	$f(x)$	$(f\circ g)(x)$
x^2	$\sqrt{x-5}$	$\sqrt{x^2-5}$
$\frac{1}{x-1}$	$1+\frac{1}{x}$	$x, x\ne -1$
$\frac{1}{x}$	$\frac{1}{x}$	$x, x\ne 0$
$\sqrt{x}$	x^2	$\lvert x\rvert, x\ge 0$

54. **(a)** $y = 2.893x^2 - 24.107x + 590.214$

(b)



[0, 15] by [500, 800]

(c) $y = 2.893(18)^2 - 24.107(18) + 590.214$
$= 937.332 - 433.926 + 590.214$
$= \$1093$ million or $\$1.093$ billion

(d) linear regression: $y = 33.75x + 312.5$

$y = 33.75(18) + 312.5 = \$920$ million in 2008.

55. **(a)** Because the circumference of the original circle was 8π and a piece of length x was removed.

(b) $r = \frac{8\pi - x}{2\pi} = 4 - \frac{x}{2\pi}$

(c) $h = \sqrt{16 - r^2}$

$$= \sqrt{16 - \left(4 - \frac{x}{2\pi}\right)^2}$$
$$= \sqrt{16 - \left(16 - \frac{4x}{\pi} + \frac{x^2}{4\pi^2}\right)}$$
$$= \sqrt{\frac{4x}{\pi} - \frac{x^2}{4\pi^2}}$$
$$= \sqrt{\frac{16\pi x}{4\pi^2} - \frac{x^2}{4\pi^2}}$$
$$= \frac{\sqrt{16\pi x - x^2}}{2\pi}$$

(d) $V = \frac{1}{3}\pi r^2 h$

$$= \frac{1}{3}\pi\left(\frac{8\pi - x}{2\pi}\right)^2 \cdot \frac{\sqrt{16\pi x - x^2}}{2\pi}$$
$$= \frac{(8\pi - x)^2\sqrt{16\pi x - x^2}}{24\pi^2}$$

56. **(a)** Note that 2 mi = 10,560 ft, so there are $\sqrt{800^2 + x^2}$ feet of river cable at \$180 per foot and $(10,560 - x)$ feet of land cable at \$100 per foot. The cost is

$C(x) = 180\sqrt{800^2 + x^2} + 100(10,560 - x)$

(b) $C(0) = \$1,200,000$
$C(500) \approx \$1,175,812$
$C(1000) \approx \$1,186,512$
$C(1500) = \$1,212,000$
$C(2000) \approx \$1,243,732$
$C(2500) \approx \$1,278,479$
$C(3000) \approx \$1,314,870$

Values beyond this are all larger. It would appear that the least expensive location is less than 2000 ft from point P.

57. False: $x^4 + x^2 + x \neq (-x)^4 + (-x)^2 + (-x)$.

58. True: $(-x)^3 = -x^3$

59. B: Since $9 - x^2 > 0$, the domain is $(-3, 3)$

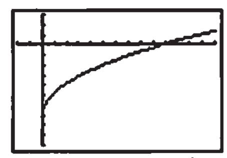
60. A: $y \neq 1$

61. D: $(f \circ g)(2) = f(x+3)(2) = 2(x+3) - 1$
$= 2(2+3) - 1 = 2(5) - 1 = 10 - 1 = 9$

62. C: $A(w) = Lw$
$L = 2w$
$A(w) = 2w^2$

63. **(a)** Enter $y_1 = f(x) = x - 7$, $y_2 = g(x) = \sqrt{x}$, $y_3 = (f \circ g)(x) = y_1(y_2(x))$, and $y_4 = (g \circ f)(x) = y_2(y_1(x))$

$f \circ g$:

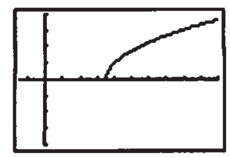


[−10, 70] by [−10, 3]

Domain: $[0, \infty)$

Range: $[-7, \infty)$

$g \circ f$:



[−3, 20] by [−4, 4]

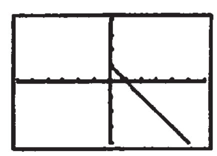
Domain: $[7, \infty)$

Range: $[0, \infty)$

(b) $(f \circ g)(x) = \sqrt{x} - 7$ $\qquad (g \circ f)(x) = \sqrt{x - 7}$

64. **(a)** Enter $y_1 = f(x) = 1 - x^2$, $y_2 = g(x) = \sqrt{x}$, $y_3 = (f \circ g)(x) = y_1(y_2(x))$, and $y_4 = (g \circ f)(x) = y_2(y_1(x))$

$f \circ g$:

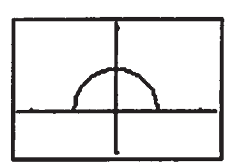


[−6, 6] by [−4, 4]

Domain: $[0, \infty)$

Range: $(-\infty, 1]$

$g \circ f$:



[−2.35, 2.35] by [−1, 2.1]

Domain: $[-1, 1]$

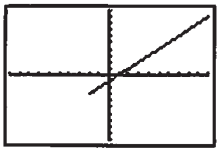
Range: $[0, 1]$

(b) $(f \circ g)(x) = 1 - (\sqrt{x})^2 = 1 - x, x \geq 0$

$(g \circ f)(x) = \sqrt{1 - x^2}$

65. (a) Enter $y_1 = f(x) = x^2 - 3, y_2 = g(x) = \sqrt{x+2},$
$y_3 = (f \circ g)(x) = y_1(y_2(x))$, and $y_4 = (g \circ f)(x)$
$= y_2(y_1(x))$.

$f \circ g$:

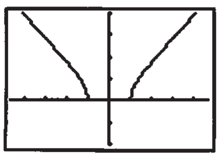


[−10, 10] by [−10, 10]

Domain: $[-2, \infty)$

Range: $[-3, \infty)$

$g \circ f$:



[−4.7, 4.7] by [−2, 4]

Domain: $(-\infty, -1] \cup [1, \infty)$

Range: $[0, \infty)$

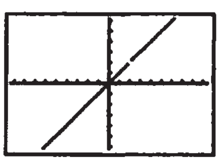
(b) $(f \circ g)(x) = (\sqrt{x+2})^2 - 3$
$= (x+2) - 3, x \geq -2$
$= x - 1, x \geq -2$

$(g \circ f)(x) = \sqrt{(x^2 - 3) + 2} = \sqrt{x^2 - 1}$

66. (a) Enter $y_1(x) = f(x) = \dfrac{2x-1}{x+3}, y_2 = \dfrac{3x+1}{2-x},$
$y_3 = (f \circ g)(x) = y_1(y_2(x))$, and $y_4 = (g \circ f)(x)$
$= y_2(y_1(x))$.

Use a "decimal window" such as the one shown.

$f \circ g$:

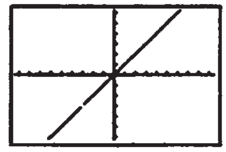


[−9.4, 9.4] by [−6.2, 6.2]

Domain: $(-\infty, 2) \cup (2, \infty)$

Range: $(-\infty, 2) \cup (2, \infty)$

$g \circ f$:



[−9.4, 9.4] by [−6.2, 6.2]

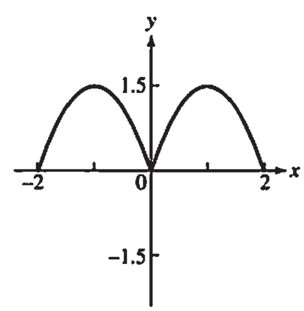
Domain: $(-\infty, -3) \cup (-3, \infty)$

Range: $(-\infty, -3) \cup (-3, \infty)$

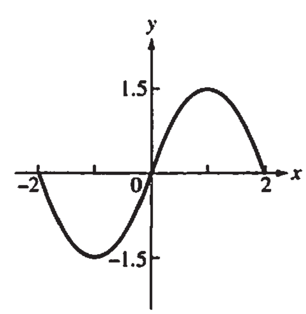
(b) $$(f \circ g)(x) = \frac{2\left(\frac{3x+1}{2-x}\right) - 1}{\frac{3x+1}{2-x} + 3}$$
$$= \frac{2(3x+1) - (2-x)}{(3x+1) + 3(2-x)}, x \neq 2$$
$$= \frac{7x}{7}, x \neq 2$$
$$= x, x \neq 2$$

$$(g \circ f)(x) = \frac{3\left(\frac{2x-1}{x+3}\right) + 1}{2 - \frac{2x-1}{x+3}}$$
$$= \frac{3(2x-1) + (x+3)}{2(x+3) - (2x-1)}, x \neq -3$$
$$= \frac{7x}{7}, x \neq -3$$
$$= x, x \neq -3$$

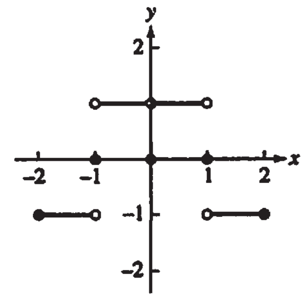
67. (a)



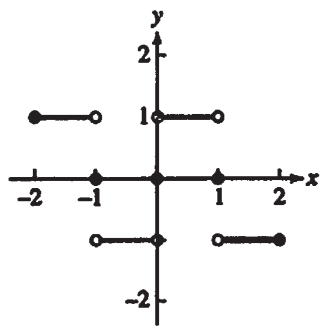
(b)



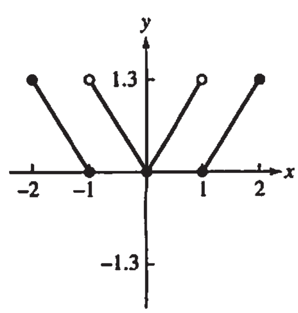
68. (a)



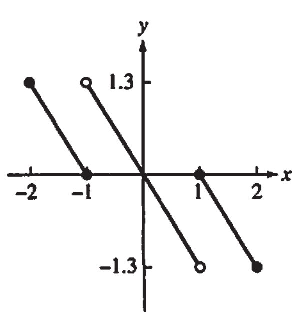
(b)



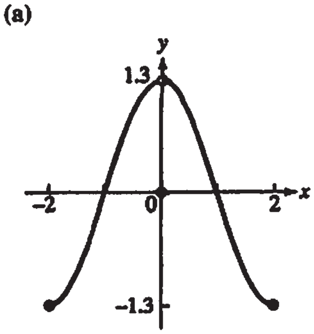
69. (a)



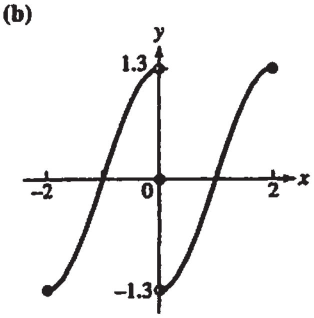
(b)



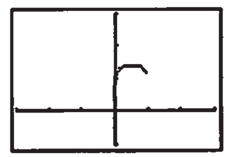
70. (a)



(b)



71. (a)



[–3, 3] by [–1, 3]

(b) Domain of y_1: $[0, \infty)$

Domain of y_2: $(-\infty, 1]$

Domain of y_3: $[0, 1]$

(c) The functions $y_1 - y_2$, $y_2 - y_1$, and $y_1 \cdot y_2$ all have domain $[0, 1]$, the same as the domain of $y_1 + y_2$ found in part (b).

Domain of $\frac{y_1}{y_2}$: $[0,1)$

Domain of $\frac{y_2}{y_1}$: $(0,1]$

(d) The domain of a sum, difference, or product of two functions is the intersection of their domains.
The domain of a quotient of two functions is the intersection of their domains with any zeros of the denominator removed.

72. (a) Yes. Since
$(f \cdot g)(-x) = f(-x) \cdot g(-x) = f(x) \cdot g(x) = (f \cdot g)(x)$, the function $(f \cdot g)(x)$ will also be even.

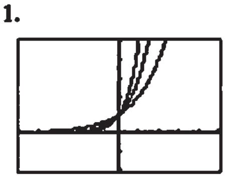
(b) The product will be even, since

$$\begin{aligned}(f \cdot g)(-x) &= f(-x) \cdot g(-x) \\ &= (-f(x)) \cdot (-g(x)) \\ &= f(x) \cdot g(x) \\ &= (f \cdot g)(x).\end{aligned}$$

Section 1.3 Exponential Functions (pp. 22–29)

Exploration 1 Exponential Functions

1.



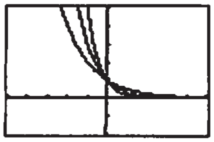
[–5, 5] by [–2, 5]

2. $x > 0$

3. $x < 0$

4. $x = 0$

5.



$[-5, 5]$ by $[-2, 5]$

6. $2^{-x} < 3^{-x} < 5^{-x}$ for $x < 0$; $2^{-x} > 3^{-x} > 5^{-x}$ for $x > 0$; $2^{-x} = 3^{-x} = 5^{-x}$ for $x = 0$.

Quick Review 1.3

1. Using a calculator, $5^{2/3} \approx 2.924$.

2. Using a calculator, $3^{\sqrt{2}} \approx 4.729$.

3. Using a calculator, $3^{-1.5} \approx 0.192$.

4. $x^3 = 17$

$$x = \sqrt[3]{17}$$
$$x \approx 2.5713$$

5. $x^5 = 24$

$$x = \sqrt[5]{24}$$
$$x \approx 1.8882$$

6. $x^{10} = 1.4567$

$$x = \pm\sqrt[10]{1.4567}$$
$$x \approx \pm 1.0383$$

7. $500(1.0475)^5 \approx \$630.58$

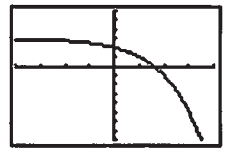
8. $1000(1.063)^3 \approx \$1201.16$

9. $$\frac{(x^{-3}y^2)^2}{(x^4y^3)^3} = \frac{x^{-6}y^4}{x^{12}y^9} = x^{-6-12}y^{4-9} = x^{-18}y^{-5} = \frac{1}{x^{18}y^5}$$

10. $$\left(\frac{a^3b^{-2}}{c^4}\right)^2\left(\frac{a^4c^{-2}}{b^3}\right)^{-1} = \frac{a^6b^{-4}}{c^8}\cdot\frac{b^3}{a^4c^{-2}} = \frac{a^6}{b^4c^8}\cdot\frac{b^3c^2}{a^4} = a^{6-4}b^{-4+3}c^{-8+2} = a^2b^{-1}c^{-6} = \frac{a^2}{bc^6}$$

Section 1.3 Exercises

1.

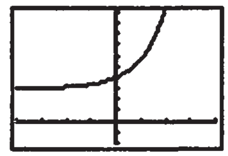


$[-4, 4]$ by $[-8, 6]$

Domain: $(-\infty, \infty)$

Range: $(-\infty, 3)$

2.

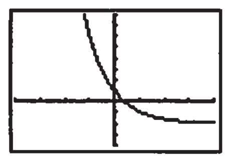


$[-4, 4]$ by $[-2, 10]$

Domain: $(-\infty, \infty)$

Range: $(3, \infty)$

3.

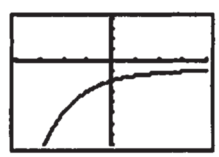


$[-4, 4]$ by $[-4, 8]$

Domain: $(-\infty, \infty)$

Range: $(-2, \infty)$

4.



$[-4, 4]$ by $[-8, 4]$

Domain: $(-\infty, \infty)$

Range: $(-\infty, -1)$

5. $9^{2x} = (3^2)^{2x} = 3^{4x}$

6. $16^{3x} = (2^4)^{3x} = 2^{12x}$

7. $\left(\frac{1}{8}\right)^{2x} = (2^{-3})^{2x} = 2^{-6x}$

8. $\left(\frac{1}{27}\right)^{x} = (3^{-3})^{x} = 3^{-3x}$

9. x-intercept: ≈ -2.322

y-intercept: -4.0

10. x-intercept: ≈ 1.386

y-intercept: -3.0