pp. 241-242 (#6-18, x3; #20-24; #26-44 evens; #45-50)

6. -1

9. -2

12. 2

15. -3

18. $\frac{1}{128}$

20. The index and exponent were switched;
$256^{4/3} = \left(\sqrt[3]{256}\right)^4 \approx 6.35^4 \approx 1625.50$

21. B; The denominator of the exponent is 3 and the numerator is 4.

22. D; The denominator of the exponent is 4 and the numerator is 3.

23. A; The denominator of the exponent is 4 and the exponent is negative.

24. C; The denominator of the exponent is 4 and the expression is negative.

26. 2.89

28. 2.10

30. 0.02

32. 27.86

34. $r \approx 6.86$ cm

36. $x = 6$

38. $x = 1$ and $x = 9$

40. $x \approx \pm 1.68$

42. $x \approx -2.47$

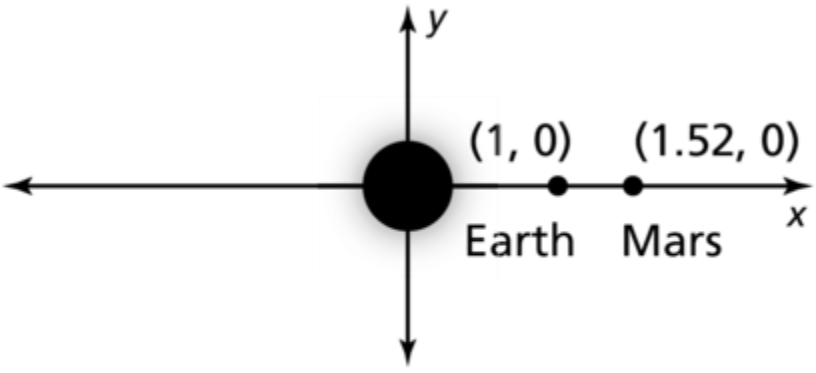
44. $x = -6$

45. potatoes: 3.7%; ham: 2.4%; eggs: 1.7%

46. n is an even integer; 2; Because n is even and a is positive, a has both a positive and a negative nth root.

47. 3, 4; $\sqrt[4]{81} = 3$ and $\sqrt[4]{256} = 4$

48.



Sample answer: $d = 1.88^{2/3} \approx 1.52$, so Mars must be approximately 1.52 astronomical units from the Sun.

49. about 753 ft^3/sec

50. 1.12 m/sec; 1.47 m/sec; 2.15 m/sec

pp. 248-249 (#3-27, x3; #30-54 evens)

3. $9^{2/3}$

6. $7^{2/3}$

9. $3^{1/3}$

12. $7^{5/4}$

15. $2\sqrt[4]{3}$

18. $\frac{1}{4}$

21. $3\sqrt[4]{7}$

24. $\frac{\sqrt[4]{12}}{3}$

27. $\frac{4\sqrt[3]{7}}{7}$

30. $-2 + \sqrt{5}$

32. $\frac{99 + 11\sqrt{6}}{75}$

34. $4\sqrt{2} - 2\sqrt{7}$

36. $\frac{\sqrt{70} + \sqrt{14}}{8}$

38. $-4\sqrt[6]{5}$

40. $9(8^{3/4})$

42. $62\sqrt{6}$

44. $3\sqrt[3]{2}$

46. $19(5^{1/4})$

48. A, B, C, and E

50. $4rt^2$

52. $\frac{k^4}{2|z|}$

54. $n^2|p|, n \neq 0, p \neq 0$

pp. 249-250 (#58-72 evens; #73, 74b, 75, 76b, 77-80)

58. $5rs^3t^2\sqrt[3]{rt}$

60. $3x\sqrt{y},\ y \neq 0$

62. $\sqrt[14]{v^{11}},\ v \neq 0$

64. $\dfrac{x^{3/4}y^{9/4}z^{1/3}}{8xz},\ y \neq 0$

66. $6\sqrt{2z}$

68. $10m^{7/3}$

70. $-p^{3/4}$

72. $P = 12x^{1/3}$

$A = 6x^{2/3}$

73. about 0.45 mm

74. **a.** about 579.56 cm^2

b. about 2204.57 cm^2

c. about 16,670.96 cm^2

75. no; The second radical can be simplified to $18\sqrt{11}$. The difference is $-11\sqrt{11}$.

76. **a.** about 1.98

b. about 1.56

c. about 3.08

77. $10 + 6\sqrt{5}$

78. The graph of g is A, the graph of f is B;
$f(x) = 8|x|,\ g(x) = 4x^2$

79. a. $r = \sqrt[3]{\frac{3V}{4\pi}}$

b. $S = 4\pi\left(\sqrt[3]{\frac{3V}{4\pi}}\right)^2$

$$S = \frac{4\pi(3V)^{2/3}}{(4\pi)^{2/3}}$$

$$S = (4\pi)^{3/3 - 2/3}(3V)^{2/3}$$

$$S = (4\pi)^{1/3}(3V)^{2/3}$$

c. The surface area of the larger balloon is $2^{2/3} \approx 1.59$ times as large as the surface area of the smaller balloon.

80. no; When x is negative, the expressions are different.

pp. 256-257 (#3-8, #10-44 evens)

3. B

4. D

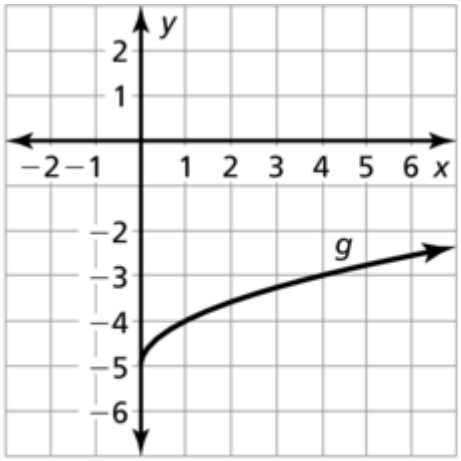
5. F

6. A

7. E

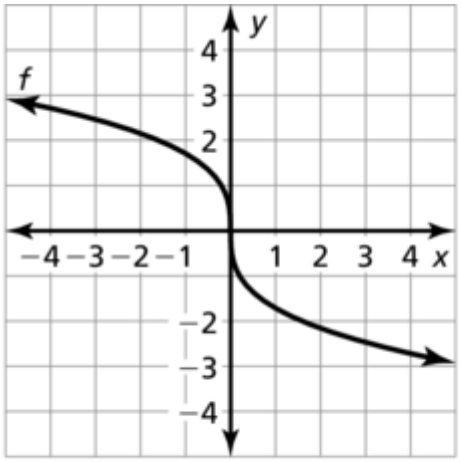
8. C

10.



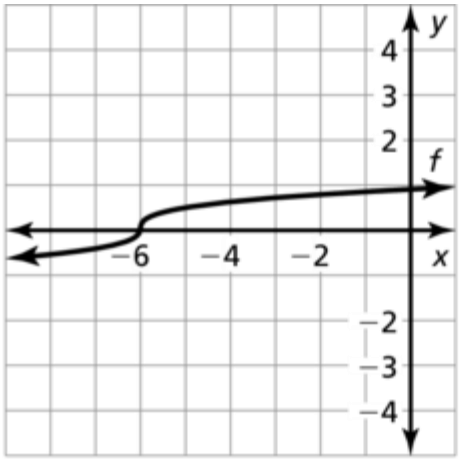
The domain is $x \geq 0$. The range is $y \geq -5$.

12.



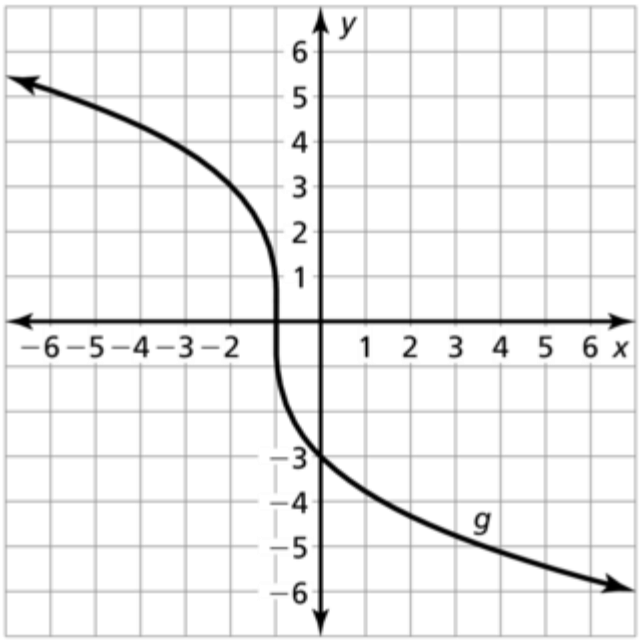
The domain and range are all real numbers.

14.



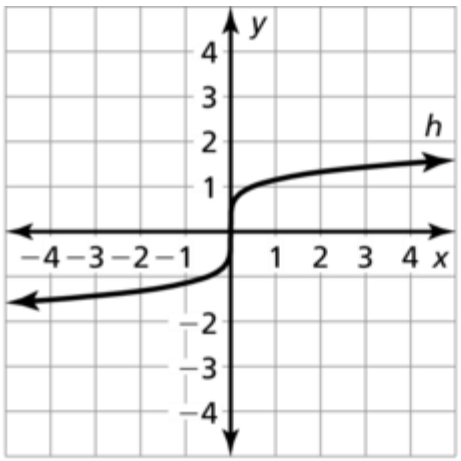
The domain and range are all real numbers.

16.



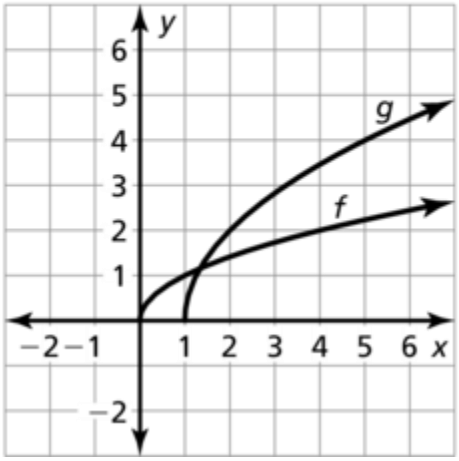
The domain and range are all real numbers.

18.

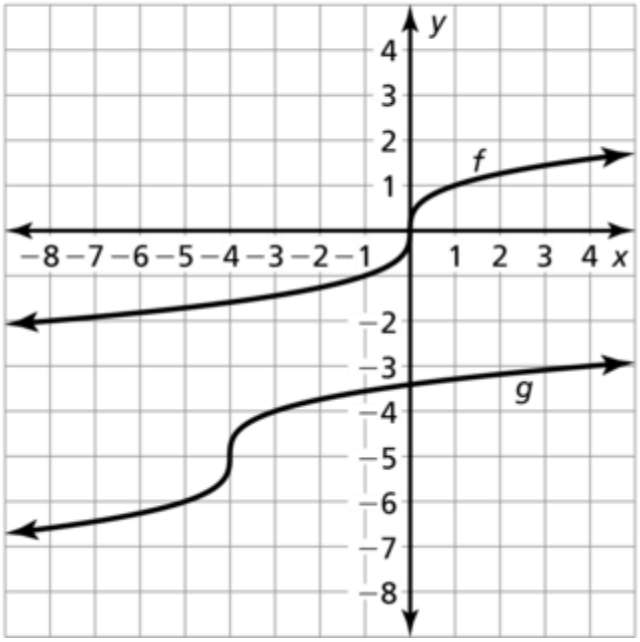


The domain and range are all real numbers.

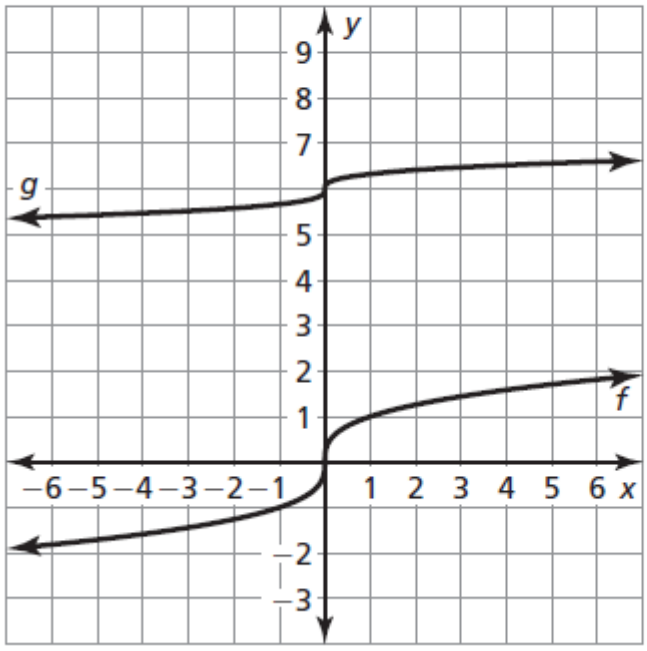
20. The graph of g is a vertical stretch by a factor of 2 followed by a translation 1 unit right of the graph of f.



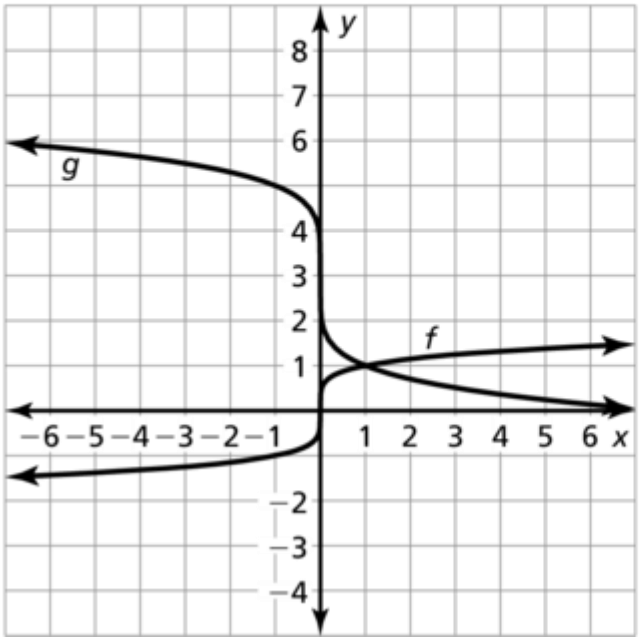
22. The graph of g is a translation 4 units left and 5 units down of the graph of f.



24. The graph of g is a vertical shrink by a factor of $\frac{1}{3}$ followed by a translation 6 units up of the graph of f.



26. The graph of g is a horizontal shrink by a factor of $\frac{1}{32}$ followed by a reflection in the y-axis and a translation 3 units up of the graph of f.



28. The function is a horizontal stretch by a factor of 2, not a horizontal shrink by a factor of $\frac{1}{2}$; The graph of g is a horizontal stretch by a factor of 2 and a translation 3 units up of the parent square root function.

30. The domain is $x \leq 0$ and $x \geq 2$. The range is $y \geq 0$.

32. The domain is all real numbers. The range is $y \geq -\frac{\sqrt[3]{144}}{12}$.

34. The domain is all real numbers. The range is $y \geq -\frac{\sqrt[3]{4}}{2}$.

36. sometimes

38. never

40. $(K) = \frac{643.855}{1.944}\sqrt{\frac{K}{273.15}}$; about 350 m/sec

42. $g(x) = 2\sqrt[3]{-x-2}$

44. $g(x) = \frac{1}{2}\sqrt[4]{x-5} - \frac{1}{2}$

pp. 257-258 (#46-62 evens, #63-68)

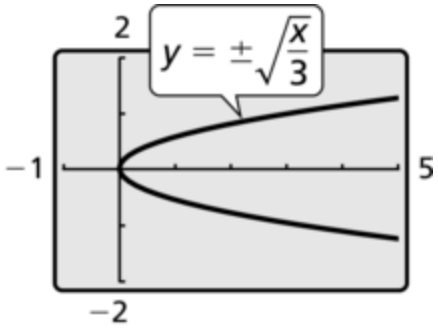
44. $g(x) = \frac{1}{2}\sqrt[4]{x - 5} - \frac{1}{2}$

46. $g(x) = -\sqrt[3]{x - 2}$

48. $g(x) = -\frac{1}{3}\sqrt{x - 1} + 9$

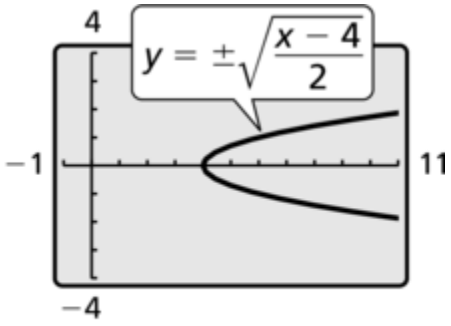
50. $g(x) = \frac{1}{4}\sqrt[3]{x^2 - 10x} + 6$

52.



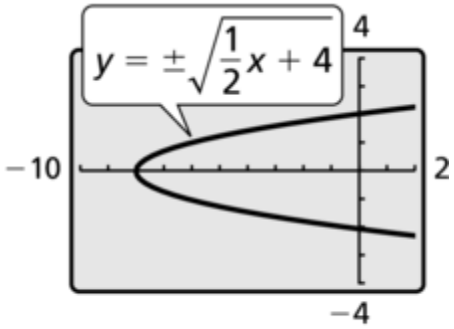
(0, 0), right

54.



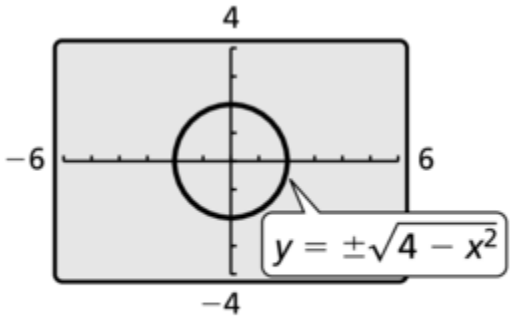
(4, 0), right

56.



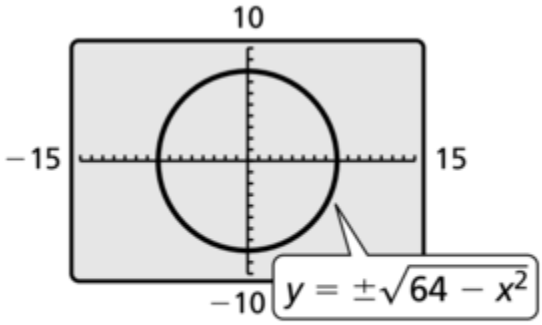
(−8, 0), right

58.



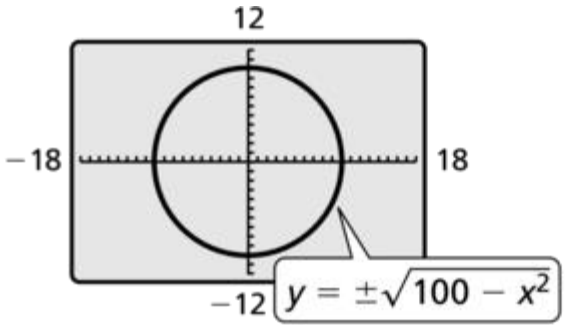
The radius is 2 units. The x-intercepts are ± 2. The y-intercepts are ± 2.

60.



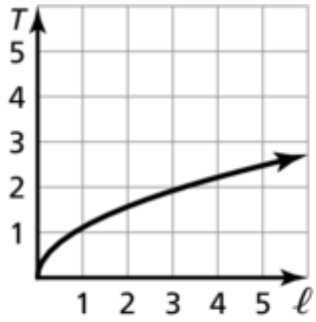
The radius is 8 units. The x-intercepts are ± 8. The y-intercepts are ± 8.

62.



The radius is 10 units. The x-intercepts are ± 10. The y-intercepts are ± 10.

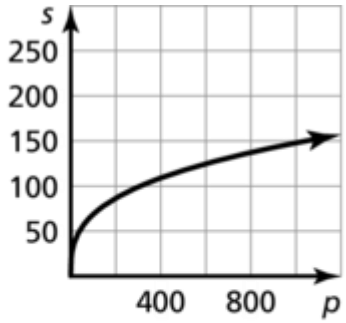
63.



about 3 ft; *Sample answer:* Locate the T-value 2 on the graph and estimate the ℓ-value.

64. square root; The domain and range are restricted; The domain is $x \geq -3$. The range is $y \geq 1$.

65.



a. about 2468 hp

b. about 0.04 mph/hp

66. *Sample answer:* $g(x) = \sqrt{-x + 2} + 1$, $h(x) = -\sqrt{x - 1} + 2$; f can be written as $f(x) = \sqrt{-x + 4}$ or $f(x) = -\sqrt{x - 3} + 1$.

67. **a.** the 165-lb skydiver

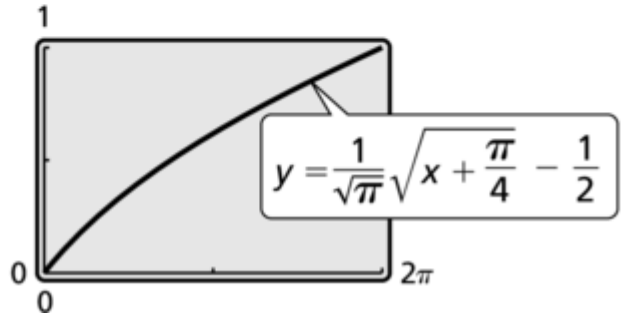
b. When $A = 1$, the diver is most likely vertical. When $A = 7$, the diver is most likely horizontal.

68. **a.** $\pi\left(r^2 + r + \frac{1}{4}\right) = S + \frac{\pi}{4}$

$$\left(r + \frac{1}{2}\right)^2 = \frac{1}{\pi}\left(S + \frac{\pi}{4}\right)$$

$$r = \frac{1}{\sqrt{\pi}}\sqrt{S + \frac{\pi}{4}} - \frac{1}{2}$$

b. 0.5 unit



p. 260 (#1-20)

1. ± 3

2. -4

3. **a.** 8; The fourth root of 16 is 2 and 2^3 is 8.

b. 25; The cube root of 125 is 5 and 5^2 is 25.

4. $x = \pm 3$

5. $x \approx -2.96$

6. $8^{3/2}$

7. 6

8. $\dfrac{3 - \sqrt{2}}{7}$

9. $-3\sqrt[3]{2}$

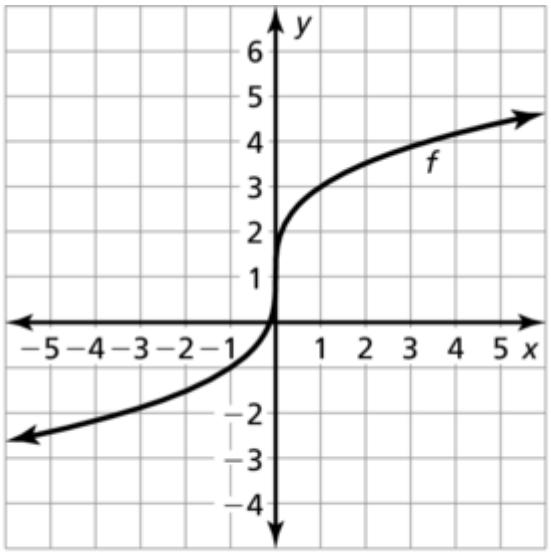
10. $x|y|z^2\sqrt[8]{x}$

11. $6p^3$

12. $\dfrac{2\sqrt[5]{m^2}}{m}$

13. $8n\sqrt[4]{q}$

14.



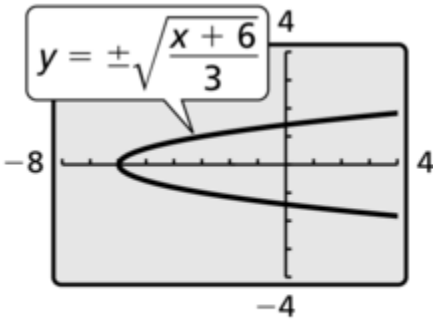
The domain and range are all real numbers.

15. The graph of g is a translation 1 unit left of the parent square root function; $g(x) = \sqrt{x + 1}$

16. The graph of g is a reflection in the x-axis followed by a translation 1 unit up of the parent cube root function; $g(x) = -\sqrt[3]{x} + 1$

17. The graph of g is a translation 1 unit right and 2 units down of the parent square root function; $g(x) = \sqrt{x - 1} - 2$

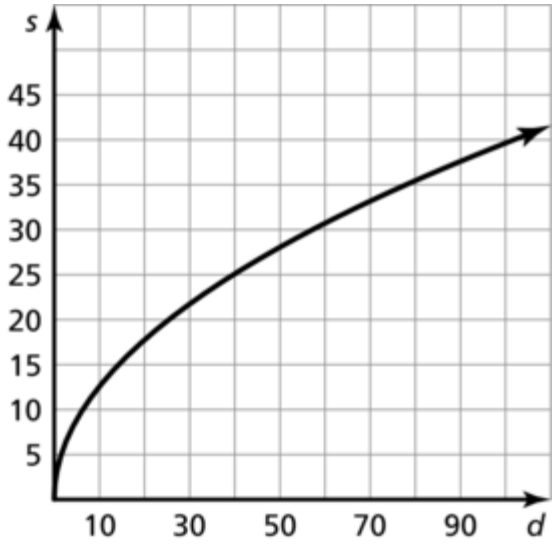
18.



$(-6, 0)$; right

19. 7.0 mm

20.



no; When $d = 90$, $s \approx 38$.

p. 266 (#2-36 evens)

2. First, subtract 10 from both sides of the inequality. Then square each side. Eliminate any solutions that would make the radicand negative.

4. $x = 18$

6. $x = 27$

8. $x = 6.4$

10. $x = \frac{2}{9}$

12. no real solution

14. about 11.5 m

16. $x = 25$

18. $x = 3$

20. $x = \frac{1}{2}$

22. $x = 7.5$

24. $x = -\frac{43}{15}$

26. $x = 0.25$

28. $x = 4$

30. $x = 81$

32. $x = 1$

34. $x = 1$ and $x = 2$

36. When raising each side to an exponent, the 8 was not included;

$$8x^{3/2} = 1000$$
$$(8x^{3/2})^{2/3} = 1000^{2/3}$$
$$4x = 1000$$
$$x = 25$$

p. 267-268 (#38-52 evens, #54b, #55, #57-59; #61-63)

38. $x \leq 129$

40. $0 \leq x < \frac{64}{49}$

42. $x \geq 20$

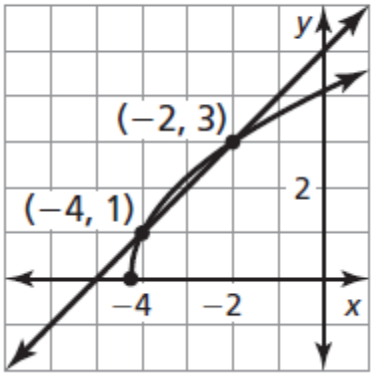
44. $x \geq 0$

46. **a.** about 5.9 ft, about 2.6 ft

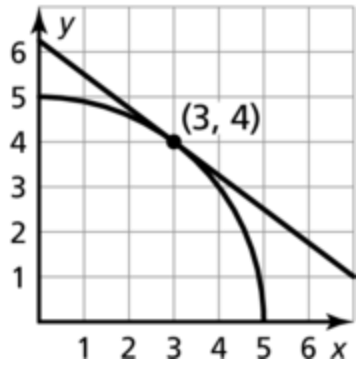
b. about 23.4 ft, about 10.5 ft

c. no; When the hang time doubles, the height increases by a factor of 4.

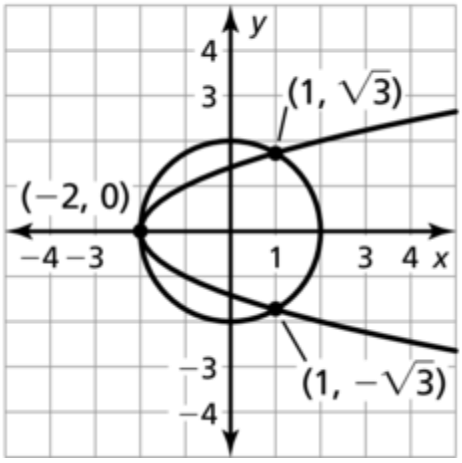
48. $(-4, 1)$ and $(-2, 3)$;



50. $(3, 4)$;

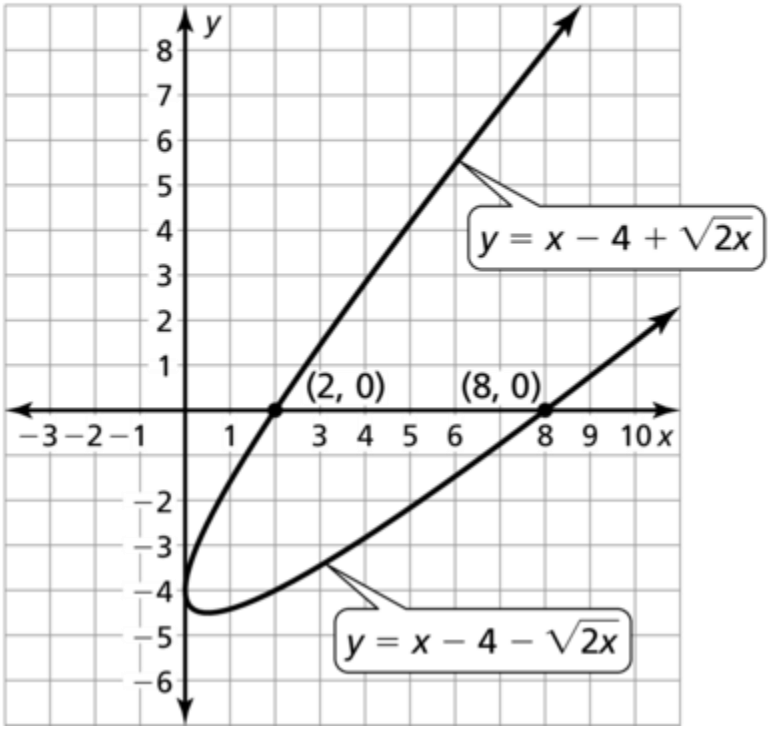


52. $(-2, 0)$, $(1, \sqrt{3})$, and $(1, -\sqrt{3})$;



55. **a.** When solving the first equation, the solution is $x = 8$ with $x = 2$ as an extraneous solution. When solving the second equation, the solution is $x = 2$ with $x = 8$ as an extraneous solution.

b.



57. The square root of a quantity cannot be negative.

58. $x = 5$; The solution of the equation is the x-value of the point of intersection of the graphs.

59. Raising the price would decrease demand.

61. $36\pi \approx 113.1$ ft^2

62. about 4.9

63. **a.** $h = h_0 - \frac{kt}{\pi r^2}$

b. about 5.75 in.

pp. 273-274 (#4-20 evens, #21-26)

4. $(f+g)(x) = -10\sqrt[3]{2x}$ and the domain is all real numbers; $(f-g)(x) = 12\sqrt[3]{2x}$ and the domain is all real numbers; $(f+g)(-4) = 20$; $(f-g)(-4) = -24$

6. $(f+g)(x) = -x^2 + 4x + 4$ and the domain is all real numbers; $(f-g)(x) = 5x^2 + 18x - 4$ and the domain is all real numbers; $(f+g)(2) = 8$; $(f-g)(2) = 52$

8. $(fg)(x) = 3x^{9/2}$ and the domain is $x \geq 0$; $\left(\frac{f}{g}\right)(x) = \frac{x^{7/2}}{3}$ and the domain is $x > 0$; $(fg)(4) = 1536$; $\left(\frac{f}{g}\right)(4) = \frac{128}{3}$

10. $(fg)(x) = 77x^{16/3}$ and the domain is all real numbers; $\left(\frac{f}{g}\right)(x) = \frac{11}{7}x^{2/3}$ and the domain is $x \neq 0$; $(fg)(-8) = 5{,}046{,}272$; $\left(\frac{f}{g}\right)(-8) = \frac{44}{7}$

12. $(fg)(x) = 8x^{7/4}$ and the domain is $x \geq 0$; $\left(\frac{f}{g}\right)(x) = 2x^{3/4}$ and the domain is $x > 0$; $(fg)(16) = 1024$; $\left(\frac{f}{g}\right)(16) = 16$

14. 245.62; −40.94; 14,663.04; 0.71

16. 29.01; −11.12; 179.44; 0.45

18. The domain is incorrect; The domain of $\left(\frac{f}{g}\right)(x)$ is all real numbers except $x = 2$ and $x = -2$.

20. **a.** $(W-F)(t) = -18.3333t^3 + 77.72t^2 + 372.5t + 6615$

b. the number of cruise ship departures around the world, excluding departures from Florida

21. yes; When adding or multiplying functions, the order in which they appear does not matter.

22. B; A; The y-intercept in A is less than in B.

23. $(f+g)(3) = -21$; $(f-g)(1) = -1$; $(fg)(2) = 0$; $\left(\frac{f}{g}\right)(0) = 2$

24. yes; *Sample answer:* $f(x) = \sqrt{x}$, $g(x) = 2\sqrt{x}$

25. $r(x) = x^2 - \frac{1}{2}x^2 = \frac{1}{2}x^2$

26. $r(w) = \dfrac{220w^{0.734}}{w}$, $r(6.5) \approx 133.7$, $r(300) \approx 48.3$,

$r(70{,}000) \approx 11.3$

pp. 281-282 (#6-36 evens)

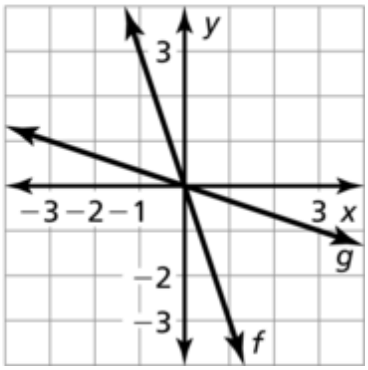
6. $x = \dfrac{y+2}{-7}; \dfrac{1}{7}$

8. $x = -\dfrac{3y-3}{2}; 6$

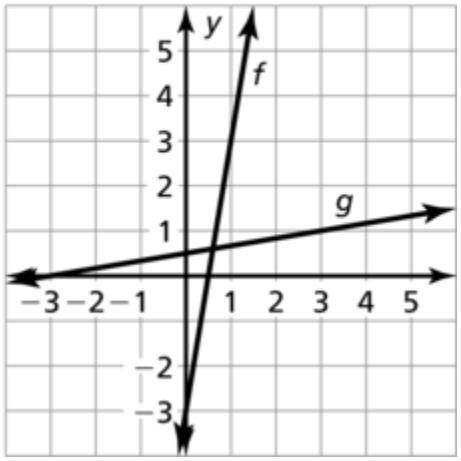
10. $x = \pm\sqrt[4]{\dfrac{y+5}{2}}; \pm 1$

12. $x = \sqrt[3]{y+1} + 5$; The input is $\sqrt[3]{-2} + 5$ when the output is -3.

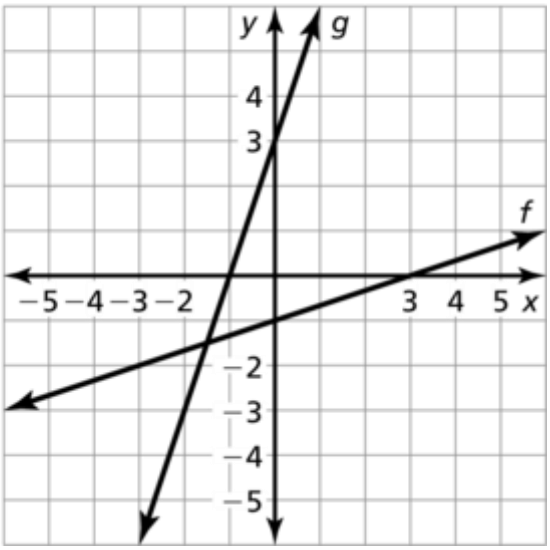
14. $g(x) = -\frac{1}{3}x$;



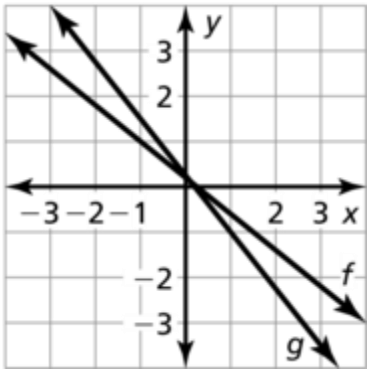
16. $g(x) = \dfrac{x+3}{6}$;



18. $g(x) = 3x + 3$;



20. $g(x) = \dfrac{5x - 1}{-4}$;

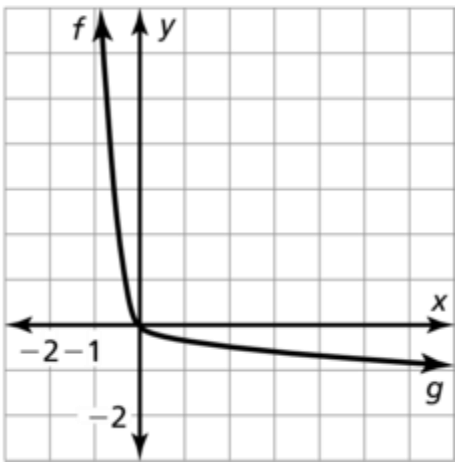


22. **a.** yes; The x- and y-coordinates are switched.

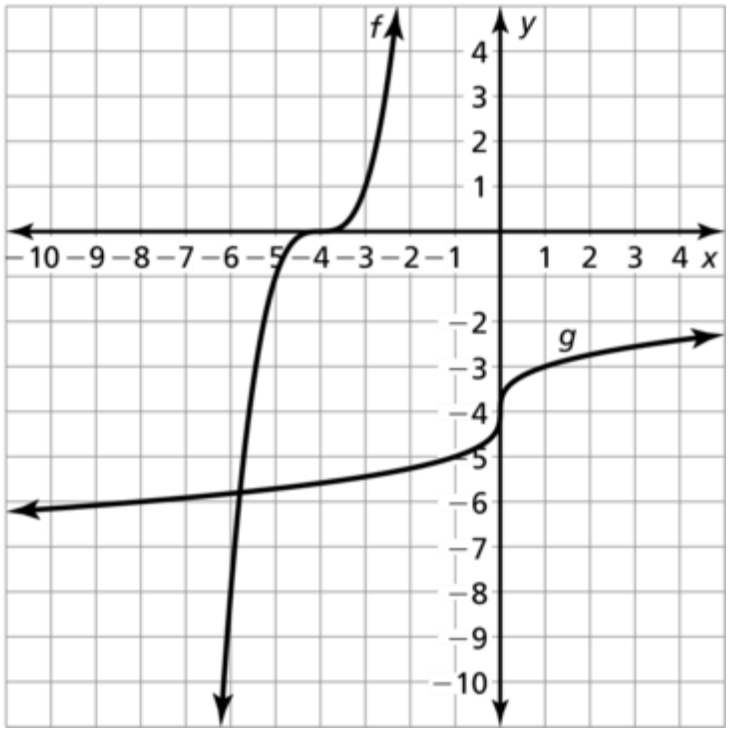
b. no; The x- and y-coordinates were not switched.

c. no; The x- and y-coordinates were not switched.

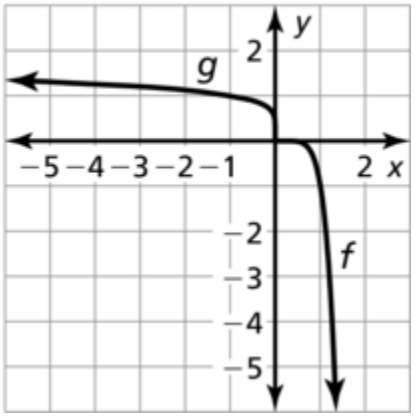
24. $g(x) = -\dfrac{\sqrt{x}}{3}$;



26. $g(x) = \sqrt[3]{x} - 4$;



28. $g(x) = \sqrt[6]{-x}$;



30. The inverse should only be $y = \sqrt{7x}$ because the domain of f is $x \geq 0$.

$f(x) = \frac{1}{7}x^2, x > 0$

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

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

$7x = y^2$

$\sqrt{7x} = y$

32. no; The function does not pass the horizontal line test.

34. yes; The function passes the horizontal line test.

36. yes; $g(x) = \sqrt[3]{-x + 3}$

pp. 282-284 (#38-54 evens; #55-63, #65-69, #71-72)

38. yes; $g(x) = x^2 + 6$, where $x \geq 0$

40. no; $y = \pm\sqrt{\frac{x + 5}{2}}$

42. yes; $g(x) = \sqrt[3]{\frac{x + 5}{2}}$

44. yes; $g(x) = \frac{-3x^3 - 4}{2}$

46. yes; $g(x) = \frac{x^2 + 21}{12}$, where $x \leq 0$

48. C

50. The functions are inverses.

52. The functions are not inverses.

54. $L = \frac{8}{3}R + \frac{40}{3}$; 64 in.

55. B

56. C

57. A

58. D

59. 5; When $x = 5$, $2x^2 + 3 = 53$.

60. no; *Sample answer:* $y = (x - 1)^2$, $x \geq 0$ does not have an inverse function.

61. **a.** $w = 2\ell - 6$; the weight of an object on a stretched spring of length ℓ

b. 5 lb

c. $0.5(2\ell - 6) + 3 = \ell$; $2(0.5w + 3) - 6 = w$

62. $y = x^{m/n}$ has an inverse function except when m is even and n is odd; *Sample answer:* Use a graphing calculator to graph $y = x^{2/3}$, $y = x^{3/2}$, $y = x^{2/6}$, and $y = x^{3/5}$ to see that only $y = x^{2/3}$ does not pass the horizontal line test.

63. a. $F = \frac{9}{5}C + 32$; The equation converts temperatures in Celsius to Fahrenheit.

b. start: 41° F; end: 14° F

c. $-40°$

65. B

66. C

67. A

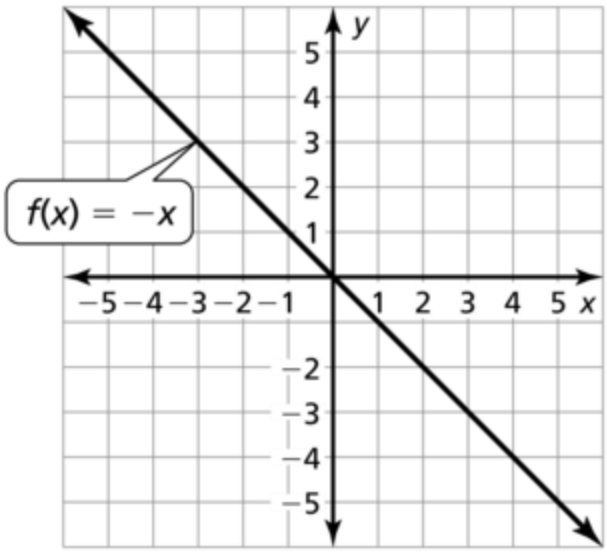
68. D

69. a. false; All functions of the form $f(x) = x^n$, where n is an even integer, fail the horizontal line test.

b. true; All functions of the form $f(x) = x^n$, where n is an odd integer, pass the horizontal line test.

71. The inverse $y = \frac{1}{m}x - \frac{b}{m}$ has a slope of $\frac{1}{m}$ and a y-intercept of $-\frac{b}{m}$.

72. a.



When the graph of $f(x) = -x$ is reflected across the line $y = x$, the result is the same graph;

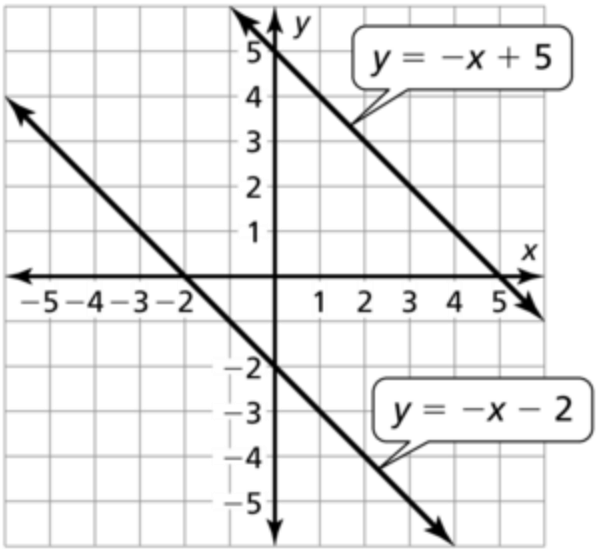
$f(x) = -x$

$y = -x$

$x = -y$

$-x = y$

b. *Sample answer:*



$y = -x + 5$ and $y = -x - 2$ are their own inverses.

c. A linear function of the form $y = -x + b$ or $y = x$ is its own inverse.

pp. 286-288 (#2-36 evens)

2. 243

4. $x \approx 1.78$

6. $x = -10$ and $x = -6$

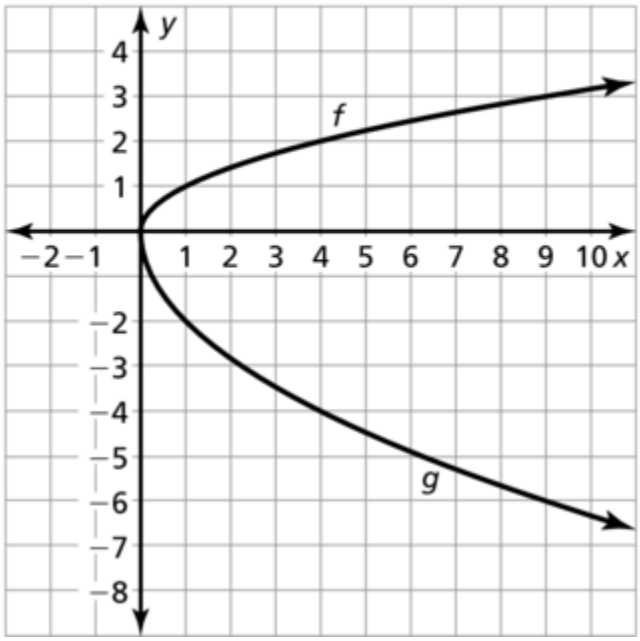
8. 4

10. $7\sqrt[5]{8}$

12. $5^{1/3} \cdot 2^{3/4}$

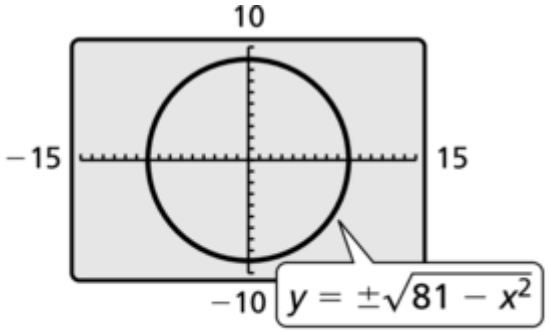
14. $\dfrac{\sqrt[4]{2z}}{6}$

16. The graph of g is a vertical stretch by a factor of 2 followed by a reflection in the x-axis of the graph of f;



18. $g(x) = \sqrt[3]{-x + 7}$

20.



The radius is 9. The x-intercepts are ± 9. The y-intercepts are ± 9.

22. $x = 2$ and $x = 10$

24. $x > 9$

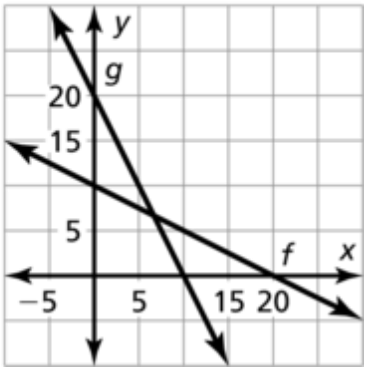
26. $x \geq 30$

28. $(fg)(x) = 8(3 - x)^{5/6}$ and the domain is $x \leq 3$;

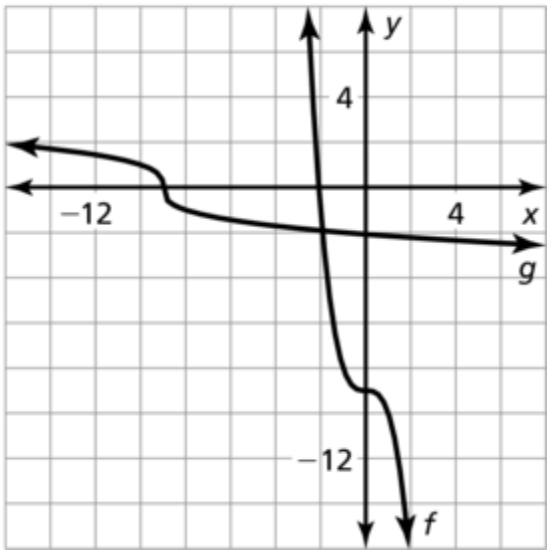
$\left(\frac{f}{g}\right)(x) = \frac{1}{2}(3 - x)^{1/6}$ and the domain is $x < 3$; $(fg)(2) = 8$;

$\left(\frac{f}{g}\right)(2) = \frac{1}{2}$

30. $g(x) = -2x + 20$;



32. $g(x) = \sqrt[3]{-x - 9}$;



34. no

36. $p = \frac{d}{1.587}$; about 63£