1.4.2 Exercises

To see all of the help resources associated with this section, click OSttS Chapter 1b.
In Exercises 1 - 10, find an expression for $f(x)$ and state its domain.

For help with these exercises, click on the resource below:

- Writing an expression for $f(x)$.

1. f is a function that takes a real number x and performs the following three steps in the order given: (1) multiply by 2; (2) add 3; (3) divide by 4.

2. f is a function that takes a real number x and performs the following three steps in the order given: (1) add 3; (2) multiply by 2; (3) divide by 4.

3. f is a function that takes a real number x and performs the following three steps in the order given: (1) divide by 4; (2) add 3; (3) multiply by 2.

4. f is a function that takes a real number x and performs the following three steps in the order given: (1) multiply by 2; (2) add 3; (3) take the square root.

5. f is a function that takes a real number x and performs the following three steps in the order given: (1) add 3; (2) multiply by 2; (3) take the square root.

6. f is a function that takes a real number x and performs the following three steps in the order given: (1) add 3; (2) take the square root; (3) multiply by 2.

7. f is a function that takes a real number x and performs the following three steps in the order given: (1) take the square root; (2) subtract 13; (3) make the quantity the denominator of a fraction with numerator 4.

8. f is a function that takes a real number x and performs the following three steps in the order given: (1) subtract 13; (2) take the square root; (3) make the quantity the denominator of a fraction with numerator 4.

9. f is a function that takes a real number x and performs the following three steps in the order given: (1) take the square root; (2) make the quantity the denominator of a fraction with numerator 4; (3) subtract 13.

10. f is a function that takes a real number x and performs the following three steps in the order given: (1) make the quantity the denominator of a fraction with numerator 4; (2) take the square root; (3) subtract 13.

In Exercises 11 - 18, use the given function f to find and simplify the following:

- $f(3)$
- $f(-1)$
- $f\left(\frac{3}{2}\right)$
- $f(4x)$
- $4f(x)$
- $f(-x)$
- $f(x-4)$
- $f(x)-4$
- $f\left(x^2\right)$

For help with these exercises, click on the resource below:

- Evaluating functions.

11. $f(x) = 2x+1$
12. $f(x) = 3-4x$
13. $f(x) = 2-x^2$
14. $f(x) = x^2-3x+2$
15. $f(x) = \dfrac{x}{x-1}$
16. $f(x) = \dfrac{2}{x^3}$
17. $f(x) = 6$
18. $f(x) = 0$

In Exercises 19 - 26, use the given function f to find and simplify the following:

- $f(2)$
- $f(-2)$
- $f(2a)$
- $2f(a)$
- $f(a+2)$
- $f(a)+f(2)$
- $f\left(\frac{2}{a}\right)$
- $\frac{f(a)}{2}$
- $f(a+h)$

For help with these exercises, click on the resource below:

- Evaluating functions.

19. $f(x) = 2x-5$
20. $f(x) = 5-2x$
21. $f(x) = 2x^2-1$
22. $f(x) = 3x^2+3x-2$
23. $f(x) = \sqrt{2x+1}$
24. $f(x) = 117$
25. $f(x) = \dfrac{x}{2}$
26. $f(x) = \dfrac{2}{x}$

In Exercises 27 - 34, use the given function f to find $f(0)$ and solve $f(x) = 0$

27. $f(x) = 2x - 1$
28. $f(x) = 3 - \frac{2}{5}x$
29. $f(x) = 2x^2 - 6$
30. $f(x) = x^2 - x - 12$
31. $f(x) = \sqrt{x+4}$
32. $f(x) = \sqrt{1-2x}$
33. $f(x) = \dfrac{3}{4-x}$
34. $f(x) = \dfrac{3x^2 - 12x}{4 - x^2}$

For help with Exercises 35 - 36, click evaluating piecewise defined functions.

35. Let $f(x) = \begin{cases} x+5, & x \leq -3 \\ \sqrt{9-x^2}, & -3 < x \leq 3 \\ -x+5, & x > 3 \end{cases}$ Compute the following function values.
    (a) $f(-4)$
    (b) $f(-3)$
    (c) $f(3)$
    (d) $f(3.001)$
    (e) $f(-3.001)$
    (f) $f(2)$

36. Let $f(x) = \begin{cases} x^2 & \text{if} \quad x \leq -1 \\ \sqrt{1-x^2} & \text{if} \quad -1 < x \leq 1 \\ x & \text{if} \quad x > 1 \end{cases}$ Compute the following function values.
    (a) $f(4)$
    (b) $f(-3)$
    (c) $f(1)$
    (d) $f(0)$
    (e) $f(-1)$
    (f) $f(-0.999)$

In Exercises 37 - 62, find the (implied) domain of the function.
For help with these exercises, click on the resource below:

- Finding domain

37. $f(x) = x^4 - 13x^3 + 56x^2 - 19$
38. $f(x) = x^2 + 4$
39. $f(x) = \dfrac{x-2}{x+1}$
40. $f(x) = \dfrac{3x}{x^2 + x - 2}$
41. $f(x) = \dfrac{2x}{x^2 + 3}$
42. $f(x) = \dfrac{2x}{x^2 - 3}$
43. $f(x) = \dfrac{x+4}{x^2 - 36}$
44. $f(x) = \dfrac{x-2}{x-2}$

45. $f(x) = \sqrt{3-x}$

46. $f(x) = \sqrt{2x+5}$

47. $f(x) = 9x\sqrt{x+3}$

48. $f(x) = \dfrac{\sqrt{7-x}}{x^2+1}$

49. $f(x) = \sqrt{6x-2}$

50. $f(x) = \dfrac{6}{\sqrt{6x-2}}$

51. $f(x) = \sqrt[3]{6x-2}$

52. $f(x) = \dfrac{6}{4-\sqrt{6x-2}}$

53. $f(x) = \dfrac{\sqrt{6x-2}}{x^2-36}$

54. $f(x) = \dfrac{\sqrt[3]{6x-2}}{x^2+36}$

55. $s(t) = \dfrac{t}{t-8}$

56. $Q(r) = \dfrac{\sqrt{r}}{r-8}$

57. $b(\theta) = \dfrac{\theta}{\sqrt{\theta-8}}$

58. $A(x) = \sqrt{x-7} + \sqrt{9-x}$

59. $\alpha(y) = \sqrt[3]{\dfrac{y}{y-8}}$

60. $g(v) = \dfrac{1}{4-\dfrac{1}{v^2}}$

61. $T(t) = \dfrac{\sqrt{t}-8}{5-t}$

62. $u(w) = \dfrac{w-8}{5-\sqrt{w}}$

For help with Exercises 63 - 71, click writing an expression for $f(x)$.

63. The area A enclosed by a square, in square inches, is a function of the length of one of its sides x, when measured in inches. This relation is expressed by the formula $A(x) = x^2$ for $x > 0$. Find $A(3)$ and solve $A(x) = 36$. Interpret your answers to each. Why is x restricted to $x > 0$?

64. The area A enclosed by a circle, in square meters, is a function of its radius r, when measured in meters. This relation is expressed by the formula $A(r) = \pi r^2$ for $r > 0$. Find $A(2)$ and solve $A(r) = 16\pi$. Interpret your answers to each. Why is r restricted to $r > 0$?

65. The volume V enclosed by a cube, in cubic centimeters, is a function of the length of one of its sides x, when measured in centimeters. This relation is expressed by the formula $V(x) = x^3$ for $x > 0$. Find $V(5)$ and solve $V(x) = 27$. Interpret your answers to each. Why is x restricted to $x > 0$?

66. The volume V enclosed by a sphere, in cubic feet, is a function of the radius of the sphere r, when measured in feet. This relation is expressed by the formula $V(r) = \frac{4\pi}{3}r^3$ for $r > 0$. Find $V(3)$ and solve $V(r) = \frac{32\pi}{3}$. Interpret your answers to each. Why is r restricted to $r > 0$?

67. The height of an object dropped from the roof of an eight story building is modeled by: $h(t) = -16t^2 + 64$, $0 \leq t \leq 2$. Here, h is the height of the object off the ground, in feet, t seconds after the object is dropped. Find $h(0)$ and solve $h(t) = 0$. Interpret your answers to each. Why is t restricted to $0 \leq t \leq 2$?

68. The temperature T in degrees Fahrenheit t hours after 6 AM is given by $T(t) = -\frac{1}{2}t^2 + 8t + 3$ for $0 \leq t \leq 12$. Find and interpret $T(0)$, $T(6)$ and $T(12)$.

69. The function $C(x) = x^2 - 10x + 27$ models the cost, in *hundreds* of dollars, to produce x *thousand* pens. Find and interpret $C(0)$, $C(2)$ and $C(5)$.

70. Using data from the Bureau of Transportation Statistics, the average fuel economy F in miles per gallon for passenger cars in the US can be modeled by $F(t) = -0.0076t^2 + 0.45t + 16$, $0 \leq t \leq 28$, where t is the number of years since 1980. Use your calculator to find $F(0)$, $F(14)$ and $F(28)$. Round your answers to two decimal places and interpret your answers to each.

71. The population of Sasquatch in Portage County can be modeled by the function $P(t) = \frac{150t}{t+15}$, where t represents the number of years since 1803. Find and interpret $P(0)$ and $P(205)$. Discuss with your classmates what the applied domain and range of P should be.

72. For n copies of the book *Me and my Sasquatch*, a print on-demand company charges $C(n)$ dollars, where $C(n)$ is determined by the formula

$$C(n) = \begin{cases} 15n & \text{if } 1 \leq n \leq 25 \\ 13.50n & \text{if } 25 < n \leq 50 \\ 12n & \text{if } n > 50 \end{cases}$$

   (a) Find and interpret $C(20)$.

   (b) How much does it cost to order 50 copies of the book? What about 51 copies?

   (c) Your answer to 72b should get you thinking. Suppose a bookstore estimates it will sell 50 copies of the book. How many books can, in fact, be ordered for the same price as those 50 copies? (Round your answer to a whole number of books.)

73. An on-line comic book retailer charges shipping costs according to the following formula

$$S(n) = \begin{cases} 1.5n + 2.5 & \text{if } 1 \leq n \leq 14 \\ 0 & \text{if } n \geq 15 \end{cases}$$

where n is the number of comic books purchased and $S(n)$ is the shipping cost in dollars.

   (a) What is the cost to ship 10 comic books?

   (b) What is the significance of the formula $S(n) = 0$ for $n \geq 15$?

74. The cost C (in dollars) to talk m minutes a month on a mobile phone plan is modeled by

$$C(m) = \begin{cases} 25 & \text{if} \quad 0 \leq m \leq 1000 \\ 25 + 0.1(m - 1000) & \text{if} \quad m > 1000 \end{cases}$$

   (a) How much does it cost to talk 750 minutes per month with this plan?
   (b) How much does it cost to talk 20 hours a month with this plan?
   (c) Explain the terms of the plan verbally.

75. In Section 1.1.1 we defined the set of **integers** as $\mathbb{Z} = \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$.[15] The **greatest integer of** $\boldsymbol{x}$, denoted by $\lfloor x \rfloor$, is defined to be the largest integer k with $k \leq x$.

   For help with these exercises, click on the resource below:

   - Understanding the greatest integer function

   (a) Find $\lfloor 0.785 \rfloor$, $\lfloor 117 \rfloor$, $\lfloor -2.001 \rfloor$, and $\lfloor \pi + 6 \rfloor$
   (b) Discuss with your classmates how $\lfloor x \rfloor$ may be described as a piecewise defined function.
   HINT: There are infinitely many pieces!
   (c) Is $\lfloor a + b \rfloor = \lfloor a \rfloor + \lfloor b \rfloor$ always true? What if a or b is an integer? Test some values, make a conjecture, and explain your result.

76. We have through our examples tried to convince you that, in general, $f(a + b) \neq f(a) + f(b)$. It has been our experience that students refuse to believe us so we'll try again with a different approach. With the help of your classmates, find a function f for which the following properties are always true.

   (a) $f(0) = f(-1 + 1) = f(-1) + f(1)$
   (b) $f(5) = f(2 + 3) = f(2) + f(3)$
   (c) $f(-6) = f(0 - 6) = f(0) - f(6)$
   (d) $f(a + b) = f(a) + f(b)$ regardless of what two numbers we give you for a and b.

   How many functions did you find that failed to satisfy the conditions above? Did $f(x) = x^2$ work? What about $f(x) = \sqrt{x}$ or $f(x) = 3x + 7$ or $f(x) = \dfrac{1}{x}$? Did you find an attribute common to those functions that did succeed? You should have, because there is only one extremely special family of functions that actually works here. Thus we return to our previous statement, **in general**, $f(a + b) \neq f(a) + f(b)$.

[15] The use of the letter $\mathbb{Z}$ for the integers is ostensibly because the German word *zahlen* means 'to count.'

Checkpoint Quiz 1.4

1. Suppose f is a function that takes a real number x and performs the following steps in the order given:

   (1) add 4

   (2) take the square root

   (3) subtract 5

   (4) divide into 10

   Find an expression for $f(x)$ and state the domain of f using interval notation.

2. Let $f(x) = \dfrac{x^2}{x-3}$. Find and simplify the following:

   (a) $f(-1)$ (b) $f(7x)$ (c) $7f(x)$ (d) $f(x-1)$

3. Let $f(x) = \begin{cases} 3x-1, & x \le -4 \\ -x^2, & x > -4 \end{cases}$. Find $f(-2)$, $f(-4)$, and $f(-5)$.

For worked out solutions to this quiz, click the link below:

- Quiz Solution

1.4.3 Answers

1. $f(x) = \frac{2x+3}{4}$
   Domain: $(-\infty, \infty)$

2. $f(x) = \frac{2(x+3)}{4} = \frac{x+3}{2}$
   Domain: $(-\infty, \infty)$

3. $f(x) = 2\left(\frac{x}{4}+3\right) = \frac{1}{2}x + 6$
   Domain: $(-\infty, \infty)$

4. $f(x) = \sqrt{2x+3}$
   Domain: $\left[-\frac{3}{2}, \infty\right)$

5. $f(x) = \sqrt{2(x+3)} = \sqrt{2x+6}$
   Domain: $[-3, \infty)$

6. $f(x) = 2\sqrt{x+3}$
   Domain: $[-3, \infty)$

7. $f(x) = \frac{4}{\sqrt{x}-13}$
   Domain: $[0, 169) \cup (169, \infty)$

8. $f(x) = \frac{4}{\sqrt{x-13}}$
   Domain: $(13, \infty)$

9. $f(x) = \frac{4}{\sqrt{x}} - 13$
   Domain: $(0, \infty)$

10. $f(x) = \sqrt{\frac{4}{x}} - 13 = \frac{2}{\sqrt{x}} - 13$
    Domain: $(0, \infty)$

11. For $f(x) = 2x + 1$

    - $f(3) = 7$
    - $f(-1) = -1$
    - $f\left(\frac{3}{2}\right) = 4$
    - $f(4x) = 8x + 1$
    - $4f(x) = 8x + 4$
    - $f(-x) = -2x + 1$
    - $f(x-4) = 2x - 7$
    - $f(x) - 4 = 2x - 3$
    - $f\left(x^2\right) = 2x^2 + 1$

12. For $f(x) = 3 - 4x$

    - $f(3) = -9$
    - $f(-1) = 7$
    - $f\left(\frac{3}{2}\right) = -3$
    - $f(4x) = 3 - 16x$
    - $4f(x) = 12 - 16x$
    - $f(-x) = 4x + 3$
    - $f(x-4) = 19 - 4x$
    - $f(x) - 4 = -4x - 1$
    - $f\left(x^2\right) = 3 - 4x^2$

13. For $f(x) = 2 - x^2$

- $f(3) = -7$
- $f(-1) = 1$
- $f\left(\frac{3}{2}\right) = -\frac{1}{4}$
- $f(4x) = 2 - 16x^2$
- $4f(x) = 8 - 4x^2$
- $f(-x) = 2 - x^2$
- $f(x-4) = -x^2 + 8x - 14$
- $f(x) - 4 = -x^2 - 2$
- $f\left(x^2\right) = 2 - x^4$

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

- $f(3) = 2$
- $f(-1) = 6$
- $f\left(\frac{3}{2}\right) = -\frac{1}{4}$
- $f(4x) = 16x^2 - 12x + 2$
- $4f(x) = 4x^2 - 12x + 8$
- $f(-x) = x^2 + 3x + 2$
- $f(x-4) = x^2 - 11x + 30$
- $f(x) - 4 = x^2 - 3x - 2$
- $f\left(x^2\right) = x^4 - 3x^2 + 2$

15. For $f(x) = \frac{x}{x-1}$

- $f(3) = \frac{3}{2}$
- $f(-1) = \frac{1}{2}$
- $f\left(\frac{3}{2}\right) = 3$
- $f(4x) = \frac{4x}{4x-1}$
- $4f(x) = \frac{4x}{x-1}$
- $f(-x) = \frac{x}{x+1}$
- $f(x-4) = \frac{x-4}{x-5}$
- $f(x) - 4 = \frac{x}{x-1} - 4 = \frac{4-3x}{x-1}$
- $f\left(x^2\right) = \frac{x^2}{x^2-1}$

16. For $f(x) = \frac{2}{x^3}$

- $f(3) = \frac{2}{27}$
- $f(-1) = -2$
- $f\left(\frac{3}{2}\right) = \frac{16}{27}$
- $f(4x) = \frac{1}{32x^3}$
- $4f(x) = \frac{8}{x^3}$
- $f(-x) = -\frac{2}{x^3}$
- $f(x-4) = \frac{2}{(x-4)^3} = \frac{2}{x^3-12x^2+48x-64}$
- $f(x) - 4 = \frac{2}{x^3} - 4 = \frac{2-4x^3}{x^3}$
- $f\left(x^2\right) = \frac{2}{x^6}$

17. For $f(x) = 6$

- $f(3) = 6$
- $f(-1) = 6$
- $f\left(\frac{3}{2}\right) = 6$
- $f(4x) = 6$
- $4f(x) = 24$
- $f(-x) = 6$
- $f(x-4) = 6$
- $f(x) - 4 = 2$
- $f\left(x^2\right) = 6$

18. For $f(x) = 0$

- $f(3) = 0$
- $f(-1) = 0$
- $f\left(\frac{3}{2}\right) = 0$
- $f(4x) = 0$
- $4f(x) = 0$
- $f(-x) = 0$
- $f(x-4) = 0$
- $f(x) - 4 = -4$
- $f\left(x^2\right) = 0$

19. For $f(x) = 2x - 5$

- $f(2) = -1$
- $f(-2) = -9$
- $f(2a) = 4a - 5$
- $2f(a) = 4a - 10$
- $f(a+2) = 2a - 1$
- $f(a) + f(2) = 2a - 6$
- $f\left(\frac{2}{a}\right) = \frac{4}{a} - 5 = \frac{4-5a}{a}$
- $\frac{f(a)}{2} = \frac{2a-5}{2}$
- $f(a+h) = 2a + 2h - 5$

20. For $f(x) = 5 - 2x$

- $f(2) = 1$
- $f(-2) = 9$
- $f(2a) = 5 - 4a$
- $2f(a) = 10 - 4a$
- $f(a+2) = 1 - 2a$
- $f(a) + f(2) = 6 - 2a$
- $f\left(\frac{2}{a}\right) = 5 - \frac{4}{a} = \frac{5a-4}{a}$
- $\frac{f(a)}{2} = \frac{5-2a}{2}$
- $f(a+h) = 5 - 2a - 2h$

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

- $f(2) = 7$
- $f(-2) = 7$
- $f(2a) = 8a^2 - 1$
- $2f(a) = 4a^2 - 2$
- $f(a+2) = 2a^2 + 8a + 7$
- $f(a) + f(2) = 2a^2 + 6$
- $f\left(\frac{2}{a}\right) = \frac{8}{a^2} - 1 = \frac{8-a^2}{a^2}$
- $\frac{f(a)}{2} = \frac{2a^2-1}{2}$
- $f(a+h) = 2a^2 + 4ah + 2h^2 - 1$

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

- $f(2) = 16$
- $f(-2) = 4$
- $f(2a) = 12a^2 + 6a - 2$
- $2f(a) = 6a^2 + 6a - 4$
- $f(a+2) = 3a^2 + 15a + 16$
- $f(a) + f(2) = 3a^2 + 3a + 14$
- $f\left(\frac{2}{a}\right) = \frac{12}{a^2} + \frac{6}{a} - 2 = \frac{12+6a-2a^2}{a^2}$
- $\frac{f(a)}{2} = \frac{3a^2+3a-2}{2}$
- $f(a+h) = 3a^2 + 6ah + 3h^2 + 3a + 3h - 2$

23. For $f(x) = \sqrt{2x+1}$

- $f(2) = \sqrt{5}$
- $f(-2)$ is not real
- $f(2a) = \sqrt{4a+1}$
- $2f(a) = 2\sqrt{2a+1}$
- $f(a+2) = \sqrt{2a+5}$
- $f(a) + f(2) = \sqrt{2a+1} + \sqrt{5}$
- $f\left(\frac{2}{a}\right) = \sqrt{\frac{4}{a} + 1} = \sqrt{\frac{a+4}{a}}$
- $\frac{f(a)}{2} = \frac{\sqrt{2a+1}}{2}$
- $f(a+h) = \sqrt{2a + 2h + 1}$

24. For $f(x) = 117$

- $f(2) = 117$
- $f(-2) = 117$
- $f(2a) = 117$
- $2f(a) = 234$
- $f(a+2) = 117$
- $f(a) + f(2) = 234$
- $f\left(\frac{2}{a}\right) = 117$
- $\frac{f(a)}{2} = \frac{117}{2}$
- $f(a+h) = 117$

25. For $f(x) = \frac{x}{2}$

- $f(2) = 1$
- $f(-2) = -1$
- $f(2a) = a$
- $2f(a) = a$
- $f(a+2) = \frac{a+2}{2}$
- $f(a) + f(2) = \frac{a}{2} + 1 = \frac{a+2}{2}$
- $f\left(\frac{2}{a}\right) = \frac{1}{a}$
- $\frac{f(a)}{2} = \frac{a}{4}$
- $f(a+h) = \frac{a+h}{2}$

26. For $f(x) = \frac{2}{x}$

- $f(2) = 1$
- $f(-2) = -1$
- $f(2a) = \frac{1}{a}$
- $2f(a) = \frac{4}{a}$
- $f(a+2) = \frac{2}{a+2}$
- $f(a) + f(2) = \frac{2}{a} + 1 = \frac{a+2}{2}$
- $f\left(\frac{2}{a}\right) = a$
- $\frac{f(a)}{2} = \frac{1}{a}$
- $f(a+h) = \frac{2}{a+h}$

27. For $f(x) = 2x - 1$, $f(0) = -1$ and $f(x) = 0$ when $x = \frac{1}{2}$

28. For $f(x) = 3 - \frac{2}{5}x$, $f(0) = 3$ and $f(x) = 0$ when $x = \frac{15}{2}$

29. For $f(x) = 2x^2 - 6$, $f(0) = -6$ and $f(x) = 0$ when $x = \pm\sqrt{3}$

30. For $f(x) = x^2 - x - 12$, $f(0) = -12$ and $f(x) = 0$ when $x = -3$ or $x = 4$

31. For $f(x) = \sqrt{x+4}$, $f(0) = 2$ and $f(x) = 0$ when $x = -4$

32. For $f(x) = \sqrt{1-2x}$, $f(0) = 1$ and $f(x) = 0$ when $x = \frac{1}{2}$

33. For $f(x) = \frac{3}{4-x}$, $f(0) = \frac{3}{4}$ and $f(x)$ is never equal to 0

34. For $f(x) = \frac{3x^2-12x}{4-x^2}$, $f(0) = 0$ and $f(x) = 0$ when $x = 0$ or $x = 4$

35. (a) $f(-4) = 1$ (b) $f(-3) = 2$ (c) $f(3) = 0$
(d) $f(3.001) = 1.999$ (e) $f(-3.001) = 1.999$ (f) $f(2) = \sqrt{5}$

36. (a) $f(4) = 4$ (b) $f(-3) = 9$ (c) $f(1) = 0$
(d) $f(0) = 1$ (e) $f(-1) = 1$ (f) $f(-0.999) \approx 0.0447$

37. $(-\infty, \infty)$

38. $(-\infty, \infty)$

39. $(-\infty, -1) \cup (-1, \infty)$

40. $(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$

41. $(-\infty, \infty)$

42. $(-\infty, -\sqrt{3}) \cup (-\sqrt{3}, \sqrt{3}) \cup (\sqrt{3}, \infty)$

43. $(-\infty, -6) \cup (-6, 6) \cup (6, \infty)$

44. $(-\infty, 2) \cup (2, \infty)$

45. $(-\infty, 3]$

46. $\left[-\frac{5}{2}, \infty\right)$

47. $[-3, \infty)$

48. $(-\infty, 7]$

49. $\left[\frac{1}{3}, \infty\right)$

50. $\left(\frac{1}{3}, \infty\right)$

51. $(-\infty, \infty)$

52. $\left[\frac{1}{3}, 3\right) \cup (3, \infty)$

53. $\left[\frac{1}{3}, 6\right) \cup (6, \infty)$

54. $(-\infty, \infty)$

55. $(-\infty, 8) \cup (8, \infty)$

56. $[0, 8) \cup (8, \infty)$

57. $(8, \infty)$

58. $[7, 9]$

59. $(-\infty, 8) \cup (8, \infty)$

60. $\left(-\infty, -\frac{1}{2}\right) \cup \left(-\frac{1}{2}, 0\right) \cup \left(0, \frac{1}{2}\right) \cup \left(\frac{1}{2}, \infty\right)$

61. $[0, 5) \cup (5, \infty)$

62. $[0, 25) \cup (25, \infty)$

63. $A(3) = 9$, so the area enclosed by a square with a side of length 3 inches is 9 square inches. The solutions to $A(x) = 36$ are $x = \pm 6$. Since x is restricted to $x > 0$, we only keep $x = 6$. This means for the area enclosed by the square to be 36 square inches, the length of the side needs to be 6 inches. Since x represents a length, $x > 0$.

64. $A(2) = 4\pi$, so the area enclosed by a circle with radius 2 meters is 4π square meters. The solutions to $A(r) = 16\pi$ are $r = \pm 4$. Since r is restricted to $r > 0$, we only keep $r = 4$. This means for the area enclosed by the circle to be 16π square meters, the radius needs to be 4 meters. Since r represents a radius (length), $r > 0$.

65. $V(5) = 125$, so the volume enclosed by a cube with a side of length 5 centimeters is 125 cubic centimeters. The solution to $V(x) = 27$ is $x = 3$. This means for the volume enclosed by the cube to be 27 cubic centimeters, the length of the side needs to 3 centimeters. Since x represents a length, $x > 0$.

66. $V(3) = 36\pi$, so the volume enclosed by a sphere with radius 3 feet is 36π cubic feet. The solution to $V(r) = \frac{32\pi}{3}$ is $r = 2$. This means for the volume enclosed by the sphere to be $\frac{32\pi}{3}$ cubic feet, the radius needs to 2 feet. Since r represents a radius (length), $r > 0$.

67. $h(0) = 64$, so at the moment the object is dropped off the building, the object is 64 feet off of the ground. The solutions to $h(t) = 0$ are $t = \pm 2$. Since we restrict $0 \leq t \leq 2$, we only keep $t = 2$. This means 2 seconds after the object is dropped off the building, it is 0 feet off the ground. Said differently, the object hits the ground after 2 seconds. The restriction $0 \leq t \leq 2$ restricts the time to be between the moment the object is released and the moment it hits the ground.

68. $T(0) = 3$, so at 6 AM (0 hours after 6 AM), it is 3° Fahrenheit. $T(6) = 33$, so at noon (6 hours after 6 AM), the temperature is 33° Fahrenheit. $T(12) = 27$, so at 6 PM (12 hours after 6 AM), it is 27° Fahrenheit.

69. $C(0) = 27$, so to make 0 pens, it costs[16] \$2700. $C(2) = 11$, so to make 2000 pens, it costs \$1100. $C(5) = 2$, so to make 5000 pens, it costs \$2000.

70. $F(0) = 16.00$, so in 1980 (0 years after 1980), the average fuel economy of passenger cars in the US was 16.00 miles per gallon. $F(14) = 20.81$, so in 1994 (14 years after 1980), the average fuel economy of passenger cars in the US was 20.81 miles per gallon. $F(28) = 22.64$, so in 2008 (28 years after 1980), the average fuel economy of passenger cars in the US was 22.64 miles per gallon.

71. $P(0) = 0$ which means in 1803 (0 years after 1803), there are no Sasquatch in Portage County. $P(205) = \frac{3075}{22} \approx 139.77$, so in 2008 (205 years after 1803), there were between 139 and 140 Sasquatch in Portage County.

72. (a) $C(20) = 300$. It costs \$300 for 20 copies of the book.
    (b) $C(50) = 675$, so it costs \$675 for 50 copies of the book. $C(51) = 612$, so it costs \$612 for 51 copies of the book.
    (c) 56 books.

73. (a) $S(10) = 17.5$, so it costs \$17.50 to ship 10 comic books.
    (b) There is free shipping on orders of 15 or more comic books.

74. (a) $C(750) = 25$, so it costs \$25 to talk 750 minutes per month with this plan.
    (b) Since $20\,\text{hours} = 1200\,\text{minutes}$, we substitute $m = 1200$ and get $C(1200) = 45$. It costs \$45 to talk 20 hours per month with this plan.
    (c) It costs \$25 for up to 1000 minutes and 10 cents per minute for each minute over 1000 minutes.

75. (a) $\lfloor 0.785 \rfloor = 0$, $\lfloor 117 \rfloor = 117$, $\lfloor -2.001 \rfloor = -3$, and $\lfloor \pi + 6 \rfloor = 9$

[16] This is called the 'fixed' or 'start-up' cost. We'll revisit this concept on page 86.