4. \( f(x) = \frac{x}{x^2 + 1} \quad f(0) = \frac{0}{1} = 0 \quad f(1) = \frac{1}{2} = \frac{1}{2} \quad f(-1) = \frac{-1}{2} = \frac{-1}{2} \)

6. \( g(u) = \frac{u}{u + 1} \quad g(0) = \frac{0}{1} = 0 \quad g(-1) = \frac{-1}{0} \quad g(2) = \frac{2}{3} = \frac{2}{3} \)

8. \( g(x) = 4 + 1x \quad g(-2) = 4 - 2 = 2 \quad g(0) = 4 + 0 = 4 \quad g(2) = 4 + 2 = 6 \)

10. \( h(x) = \begin{cases} \sqrt{x + 4} & x \geq 1 \\ x^2 + 1 & x > 1 \end{cases} \quad h(3) = \sqrt{3 + 4} = 10 \quad h(0) = \sqrt{0 + 4} = 4 \quad h(-3) = (-3)^2 + 1 = 10 \)

14. \( f(t) = \frac{t + 1}{t^2 - t - 2} \) Domain is all real numbers \( t \) so that denom \( \neq 0 \).

\( t^2 - t - 2 \neq 0 \)

\( (t - 2)(t + 1) \neq 0 \)

Domain is all real \( t \) except \( t = 2, t = -1 \).

16. \( g(x) = \sqrt{2x - 6} \) Domain is all real \( x \) so that inside \( \sqrt{\ } \) is \( \geq 0 \).

\( 2x - 6 \geq 0 \)

\( 2x \geq 6 \)

\( x \geq 3 \) Domain is all \( x \geq 3 \).

24. \( f(u) = (2u + 10)^2 \quad g(x) = x\cdot -5 \)

\( f(g(x)) = f(x\cdot -5) \)

\( = (2(x\cdot -5) + 10)^2 \)

\( = (2x - 10 + 10)^2 \)

\( = (2x)^2 \)

\( = 4x^2 \)

38. \( f(x) = 3x + \frac{2}{x} \) Find \( f(\frac{1}{x}) \).

\( f(x) = 3(\frac{1}{x}) + \frac{2}{(\frac{1}{x})} = \frac{3}{x} + 2x \)

\( f(\frac{1}{x}) = \frac{3}{x} + 2x \).
Chapter 1, Section 1

44. \( f(x) = \sqrt{3x-5} \). If \( g(x) = \sqrt{x} \) and \( h(u) = 3u - 5 \), then
\[
g(h(x)) = g(3x-5) = \sqrt{3x-5} = f(x).
\]

48. \( C(g) = g^3 - 30g^2 + 400g + 500 \).

Cost for first 20 units is \( C(20) = 20^3 - 30(20)^2 + 400(20) + 500 \)
\[= 4500. \]

Cost of the 20th unit is \( C(20) - C(19) = 4500 - 19^3 - 30(19)^2 + 400(19) + 500 \)
\[= 371. \]

52. \( f(n) = 3 + \frac{12}{n} \), \( n = \text{trial #} \), \( f(n) = \text{time to finish maze on nth trial} \).

a) theoretical domain is all \( n \neq 0 \).
b) practical domain is all integers \( n > 0 \), \( n \), so \( n = 1, 2, 3, \ldots \)
negative numbered trials, trial number zero, fractions, don't make sense.
c) on the third trial, time was \( f(3) = 3 + \frac{12}{3} = 7 \) minutes.
d) notice that as \( n \) gets larger, \( \frac{12}{n} \) gets smaller, so time decreases with each trial. The 12th trial is completed in \( f(12) = 3 + \frac{12}{12} = 4 \) minutes, so \( n = 12 \) is the first to finish in 4 minutes or less.
e) in part(d), we noticed \( f(n) \) consistently decreases with each trial. Time never reaches 3 minutes (always \( 3 + \text{something} \)), but we can get as close as we like to 3 minutes by doing more & more trials.
Chapter 1, Section 2

6. \( f(x) = 2x - 1 \)
   \( x\)-int: \( (\frac{1}{2}, 0) \)
   \( y\)-int: \( (0, -1) \)

8. \( f(x) = \sqrt{x} \)
   \( x\)-int: \( (0, 0) \)
   \( y\)-int: \( (0, 0) \)

10. \( f(x) = \begin{cases} 
        x^2 - 1 & x \leq 2 \\
        3 & x > 2 
      \end{cases} \)
    \( x\)-int: \( (-1, 0) \) and \( (1, 0) \)
    \( y\)-int: \( (0, -1) \)

14. \( f(x) = x^2 + 2x - 8 \) (parabola)
    \( y\)-int: \( y = 0 + 0 - 8 = -8 \) \( (0, -8) \)
    \( x\)-int: \( 0 = x^2 + 2x - 8 \)
    \( 0 = (x + 4)(x - 2) \)
    \( (-4, 0) \) and \( (2, 0) \)
    vertex at \( x = -\frac{b}{2a} = -1 \)
    If \( x = -1 \), \( y = (-1)^2 + 2(-1) - 8 = -9 \)
    \( (-1, -9) \)
    opens up.
Chapter 1, Section 2

20. Find intersection points of \( y = x^2 \) and \( y = 2x + 2 \).

If \((x, y)\) is an intersection point, it's on both graphs and satisfies both equations, so \( y = x^2 = 2x + 2 \).

\[
x^2 = 2x + 2, \quad x^2 - 2x - 2 = 0
\]

Use quadratic formula: \( x = \frac{-(-2) \pm \sqrt{4 + 8}}{2} = \frac{2 \pm 2\sqrt{3}}{2} = 1 \pm \sqrt{3}.
\]

If \( x = 1 + \sqrt{3} \), \( y = 2(1 + \sqrt{3}) + 2 = 4 + 2\sqrt{3} \)

If \( x = 1 - \sqrt{3} \), \( y = 2(1 - \sqrt{3}) + 2 = 4 - 2\sqrt{3} \).

Intersection points: \((1 + \sqrt{3}, 4 + 2\sqrt{3})\), and \((1 - \sqrt{3}, 4 - 2\sqrt{3})\).

32. \( y = x^2 \), \( y = x^2 + 3 \)

a) Second graph looks just like first one, only moved up 3 units.

b) Graph of \( y = x^2 - 5 \) looks like first one moved down 5 units.

c) If \( g(x) = f(x) + c \), g's graph looks like f's graph, only moved up c units.

34. \( y = x^2 \), \( y = (x - 2)^2 \)

a) And is first moved forward 2 units

b) \( y = (x+1)^2 \) looks like first moved back 1 unit.

c) If \( g(x) = f(x-c) \), g looks like f moved forward c units.
Chapter 1, Section 3

4. \((5, -1)\) and \((-2, -1)\). \(m = \frac{-1 - (-1)}{-2 - 5} = \frac{0}{-7} = 0\).

8. \(y = 5x + 2\)
   - Slope \(m = 5\)
   - \(y\)-int: \((0, 2)\)
   - \(x\)-int: \((-\frac{2}{5}, 0)\)

12. \(2x - 4y = 12\)
    - \(4y = 2x - 12\)
    - \(y = \frac{1}{2}x - 3\)
    - Slope \(m = \frac{1}{2}\)
    - \(y\)-int: \((0, -3)\)
    - \(x\)-int: \((6, 0)\)

20. \((-1, 2)\), \(m = \frac{2}{3}\).
    - \(y - 2 = \frac{2}{3}(x + 1)\)
    - \(y = \frac{2}{3}x + \frac{8}{3}\)

24. \((2, 5)\), parallel to \(y\)-axis:
    - \(x = 2\)

30. \((1, 5)\) and \((1, -4)\)
    - \(m = \frac{-4 - 5}{1 - 1} = \frac{-9}{0}\) undefined. \(x = 1\)

34. Through \((-\frac{1}{3}, 1)\), perp. to \(2x + 5y = 3\)
    - \(5y = -2x + 3\)
    - \(y = \frac{-2}{5}x + \frac{3}{5}\) \(\rightarrow \text{Our slope is } m = \frac{5}{2}\).
    - \(y - 1 = \frac{5}{2}(x + \frac{1}{3})\)
    - \(y = \frac{5}{2}x + \frac{9}{2} \)
Chapter 1, Section 3

36. $35 per day + .55 per mile.
   a) Let \( x \) = # miles, then amount in a day is
      \[ C(x) = 35 + .55x. \]
   b) \( C(50) = 35 + .55(50) \)
      \[ = 35 + 27.50 \]
      \[ = 62.50 \]
   c) \( 72 = 35 + .55x \)
      \[ 37 = .55x \]
      \[ 67.27 = x \]
      67.27 miles, approx.

40. At year 0, value is $20,000. At year 10, value is $1000.
    (10, 20000), (10, 1000).
   a) \( m = \frac{10000 - 20000}{10 - 0} = \frac{-10000}{10} = -1000 \)
      \[ y - 20000 = -1000(x - 0) \]
      \[ y = -1000x + 20000 \]
   b) \( y = -1000(4) + 20000 \)
      \[ = 10,400 \]
   c) When is \( y = 0? \)
      \[ 0 = -1000x + 20000 \]
      \[ 1000x = 20000 \]
      \[ x = 10,526 \text{ years} \]
      (discuss factors in deciding to sell equip.)
Chapter 1, Section 3

48. Ethyl alcohol is metabolized at a rate of 10 ml/hour.

a) \[ \text{1 liter beer} \times \frac{1000 \text{ml}}{1 \text{liter}} \times \frac{0.03 \text{g alcohol}}{1 \text{g alcohol}} \times \frac{1 \text{hour}}{1 \text{hour}} = 3 \text{ hours to metabolize} \]

b) Time to metabolize = \[ \frac{\text{A ml alcohol}}{10 \text{ ml alcohol}} \times \frac{1 \text{ hour}}{1 \text{ hour}} = \frac{A}{10} \]

c) (Discuss) if party is 4 hours long, maybe 30 ml ethyl alcohol could be allowed so it's mostly metabolized when party is over (30 ml ethyl alcohol is 1 liter of beer).