Section 4.6

1. Let \( f(x) = \frac{2x - 3}{5x + 4} \).
   (a) What is the domain?   (b) Give the \( x \)-intercept(s), if any.   (c) Give the \( y \)-intercept(s), if any.   (d) Give the equation(s) of the vertical asymptote(s), if any.   (e) Give the equation(s) of the horizontal asymptote(s), if any.

2. Let \( f(x) = \frac{9x^2 - 16}{x^2 - 6x + 9} \).
   (a) What is the domain?   (b) Give the \( x \)-intercept(s), if any.   (c) Give the \( y \)-intercept(s), if any.   (d) Give the equation(s) of the vertical asymptote(s), if any.   (e) Give the equation(s) of the horizontal asymptote(s), if any.

3. Let \( f(x) = \frac{3x + 5}{x^2 - 2x - 15} \).
   (a) What is the domain?   (b) Give the \( x \)-intercept(s), if any.   (c) Give the \( y \)-intercept(s), if any.   (d) Give the equation(s) of the vertical asymptote(s), if any.   (e) Give the equation(s) of the horizontal asymptote(s), if any.

4. Use transformations of the memorized graph for \( y = \frac{1}{x} \) to graph \( y = -\frac{1}{x} + 2 \) on the coordinate system at the right.

5. Use transformations of the memorized graph for \( y = \frac{1}{x^2} \) to graph \( y = \frac{1}{(x + 2)^2} - 4 \) on the coordinate system at the right.
6. The braking distance (in feet) for a car traveling 50 miles per hour on a wet uphill road is given by the formula 
\[ D(x) = \frac{2500}{30x + 9}, \]
where \( x \) is the grade (slope) of the road. If the braking distance is 250 feet, what is the grade of the road? Round your answer to the nearest tenth of a percent.

Section 4.7 (Excluding Polynomial Inequalities)

7. Solve for \( x \):
\[ \frac{2}{x - 4} + \frac{3}{x + 1} = 5 \]

8. The graph of \( f(x) \) is shown at the right. For what values of \( x \) is \( f(x) \geq 0 \)? Give your answer in interval notation. (Note: All intercepts and asymptotes occur at integers.)

9. Solve for \( x \) and give your answer in interval notation:
\[ \frac{x - 3}{x^2 - 1} < 0 \]

10. Solve for \( x \) and give your answer in interval notation:
\[ \frac{x^2 - x - 6}{x^2 + 3x - 4} \geq 0 \]

Section 4.8

11. Use laws of exponents to write the following as a single power of \( x \):
\[ \sqrt[4]{x} \cdot \frac{3\sqrt{x}}{4\sqrt[3]{x}} \]

12. Solve for \( x \): \( \sqrt{4 - 3x} - 8 = x \)

13. Solve for \( x \): \( \frac{3\sqrt{2x - 5}}{3} + 1 = -3 \)

14. Suppose that the surface area \( S \) of a bird's wings (in square feet) can be modeled by the function \( S(w) = 1.25w^{2/3} \), where \( w \) is the weight of the bird (in pounds). Estimate the weight of a bird with wings having a surface area of 2.5 square feet. Round your answer to the nearest tenth of a pound.

Section 5.1

15. Let \( f(x) = 2x - 3 \) and \( g(x) = 4x + 5 \). Determine each of the following.

(a) \((f + g)(x)\)  
(b) \((f - g)(x)\)  
(c) \((fg)(x)\)  
(d) \((f/g)(x)\)

(e) \((f \circ g)(x)\)  
(f) \((g \circ f)(x)\)  
(g) \((f + g)(1)\)  
(h) \((f \circ g)(-1)\)
16. The graphs of \( f(x) \) and \( g(x) \) are shown at the right. Use the graphs to evaluate each of the following.
   (a) \((f + g)(2)\)
   (b) \((f / g)(-1)\)
   (c) \((f - g)(3)\)
   (d) \((f g)(-2)\)
   (e) \((f \circ g)(1)\)
   (f) \((g \circ f)(-1)\)
   (g) \((g \circ g)(-1)\)

17. Ray recorded a CD of a song he wrote and performs. It cost him $1,500 to have the song recorded and it cost him $2.00 for each CD he had duplicated. He sold the CD’s for $4.00 each.
   (a) What was Ray’s total cost function for recording the CD and having \( x \) copies made?
   (b) What was Ray’s revenue function for the sale of \( x \) copies of the CD?
   (c) What was Ray’s profit function for the sale of \( x \) copies of the CD? (Reminder: Profit = Revenue – Cost)
   (d) If Ray had 1,000 copies of the CD made and sold them all, what was his profit?

Section 5.2

18. The table at the right is a complete representation of the function \( f \).
   \[
   \begin{array}{c|c|c|c|c|c}
   x & -2 & -1 & 0 & 1 & 2 \\
   \hline
   f(x) & 0 & 1 & 2 & 3 & 4 \\
   \end{array}
   \]
   (a) Is \( f \) a one-to-one function? Explain how you determined your answer.
   (b) Does \( f \) have an inverse function? (c) Evaluate \( f^{-1}(3) \), if possible.

19. If \( f(x) = 5x^3 - 4 \), find the symbolic representation (the formula) for \( f^{-1}(x) \).

20. Determine the formula for the inverse function of \( f(x) = \frac{2x - 5}{7} \).

21. The graph of \( y = f(x) \) is shown on the coordinate system at the right.
   (a) Is \( f(x) \) a one-to-one function? Explain how you determined your answer.
   (b) On the same coordinate system, sketch the graph of \( y = f^{-1}(x) \).
   (c) What is the relationship between the graphs of \( y = f(x) \) and \( y = f^{-1}(x) \)?

22. For the function \( f(x) \) shown in Problem 23, determine (a) \( f^{-1}(0) \) and (b) \( f^{-1}(-1) \).

Section 5.3

23. Determine \( C \) and \( a \) so that the function \( f(x) = Ca^x \) satisfies the following conditions:
   \( f(0) = 40 \) and \( f(3) = 5 \)
24. A company offers a college graduate $50,000 for the first year of employment with a guaranteed 6\% raise each year thereafter. Determine a function $f(n)$ that computes the graduate’s salary for the $n$-th year.

25. The formula for continuously compounded interest is $A = Pe^{rt}$, where $A$ is the final value of the account, $P$ is the principal with which the account was started, $r$ is the interest rate (in decimal form), and $t$ is the number of years. Determine the final value of a savings account started with a deposit of $2,000 if the account earns interest at a rate of 6\% compounded continuously for 12 years. Round your answer to the nearest cent.

26. The formula for interest compounded $n$ times a year is $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where $A$ is the final value of the account, $P$ is the principal with which the account was started, $r$ is the interest rate (in decimal form), $n$ is the number of compounding periods in a year, and $t$ is the number of years. Determine the final value of a savings account started with a deposit of $5,000 if the account earns interest at a rate of 6\% compounded quarterly for 10 years. Round your answer to the nearest cent.

**Section 5.4**

27. Evaluate each of the following expressions exactly:
   (a) $\log_2 \frac{1}{10}$
   (b) $\log_2 16$
   (c) $\log 100$
   (d) $\log_3 \frac{1}{9}$

28. Determine the domain for each of the following. Give your answers in interval notation.
   (a) $\log(2x - 3)$
   (b) $\ln(x^2 - 9)$

29. Solve for $x$ and round your answer to the three decimal places:
   (a) $e^x + 2 = 29$
   (b) $10^{2x-3} = 7$

30. Solve for $x$ and round your answer to the three decimal places:
   (a) $2\log x + 3 = 8$
   (b) $3\ln(x - 5) = 6$

**Section 5.5**

31. Use Properties of Logarithms to expand each of the following expressions into as many terms as possible. If possible, write your answer without exponents.
   (a) $\log \frac{3x^5}{4y}$
   (b) $\ln \sqrt[5]{x^2 y^3}$

32. Use Properties of Logarithms to write the following expression as a logarithm of a single expression:
   (a) $2\log x + 4\log y$
   (b) $4\ln x - 2\ln y$
33. Use the Change of Base Formula to approximate the following logarithm to the nearest thousandth:
(a) \( \log_3 100 \)
(b) \( \log_8 32 \)

**Answers**

1. (a) \( \left\{ x \mid x \neq \frac{-4}{5} \right\} \)
   (b) \( \left( \frac{3}{2}, 0 \right) \)
   (c) \( \left( 0, \frac{3}{4} \right) \)
   (d) \( x = \frac{-4}{5} \)
   (e) \( y = \frac{2}{5} \)

2. (a) \( \left\{ x \mid x \neq 3 \right\} \)
   (b) \( \left( \pm \frac{4}{3}, 0 \right) \)
   (c) \( \left( 0, -\frac{16}{9} \right) \)
   (d) \( x = 3 \)
   (e) \( y = 9 \)

3. (a) \( \left\{ x \mid x \neq -3, 5 \right\} \)
   (b) \( \left( -\frac{5}{3}, 0 \right) \)
   (c) \( \left( 0, -\frac{1}{3} \right) \)
   (d) \( x = -3, x = 5 \)
   (e) \( y = 0 \)

4.

5.

6. \( \frac{1}{30} = \frac{1}{30} \times 100\% = \frac{100}{30} \% = \frac{10}{3} \% = \frac{3}{3} \% \)

7. \( 2 \pm \sqrt{6} \)

8. \( (-\infty, -3] \cup (-2, 2] \cup (4, \infty) \)

9. \( (-\infty, -1) \cup (1, 3) \)

10. \( (-\infty, -4) \cup [-2, 1) \cup [3, \infty) \)

11. \( x^{1/12} \)

12. \( -4 \)

13. \( \frac{-59}{2} \)

14. 2.8 pounds

15. (a) \( 6x + 2 \)  (b) \( -2x - 8 \)  (c) \( 8x^2 - 2x - 15 \)  (d) \( \frac{2x - 3}{4x + 5} \)  (e) \( 8x + 7 \)  (f) \( 8x - 7 \)  (g) \( 8 \)  (h) \( -1 \)

16. (a) 1  (b) 0  (c) undefined  (d) \( -4 \)  (e) \( -3 \)  (f) 0  (g) \( -4 \)
17. (a) \( C(x) = 1500 + 2x \)  (b) \( R(x) = 4x \)  (c) \( P(x) = 2x - 1500 \)  (d) $500

18. (a) Yes, because no \( x \) value is repeated as an \( x \) value and no \( y \) value is repeated as a \( y \) value.  (b) Yes.  (c) 1

19. \( f^{-1}(x) = \frac{\sqrt[3]{x + 4}}{5} \)  

20. \( f^{-1}(x) = \frac{7x + 5}{2} \)

21. (a) It is a function because it passes the Vertical Line Test and it is a one-to-one function because it passes the Horizontal Line Test.  

(b) The graphs of \( y = f(x) \) and \( y = f^{-1}(x) \) are symmetric to each other about the line \( y = x \).

22. (a) \(-2\)  (b) \(-4\)

23. \( f(x) = 40\left(\frac{1}{2}\right)^x \)

24. \( f(n) = 50,000(1.06)^{n-1} \)

25. $4,108.87

26. $9,070.09

27. (a) \(-1\)  (b) 4  (c) 2  (d) \(-2\)

28. (a) \(\left[\frac{3}{2}, \infty\right)\)  (b) \(\left(-\infty, -3\right) \cup (3, \infty)\)

29. (a) 3.296  (b) 1.923

30. (a) 316.228  (b) 12.389

31. (a) \( \log_3 5 + 5 \log x - \log 4 - \log y \)  (b) \( \frac{2}{5} \ln x + \frac{3}{5} \ln y \)

32. (a) \( \log \left(x^2 y^4\right) \)  (b) \( \ln \frac{x^4}{y^2} \)

33. (a) 4.192  (b) \( \frac{5}{3} \)