1. a) What is the independent variable?
b) What is the domain?
c) What is the range?
d) What is \( f(3) \)?
   ans: \( r, (-3, 4), [-1, 5], 1 \)

2. Find the domain of \( f(x) = \frac{\sqrt{9 - 3x}}{x^2 - 5} \) and write your answer in inequality notation.
   ans: \( \mathbb{R}, x \leq 3, x \neq \pm \sqrt{5} \)

3. Find the domain of \( g(x) = \frac{2x^2 + x - 3}{3x^2 - x - 2} \) and write your answer in interval form.
   ans: Domain: \( \mathbb{R}, (-\infty, -\frac{2}{3}) \cup (-\frac{2}{3}, 1) \cup (1, \infty) \)

4. Find the average rate of change between the points \((8, -2)\) and \((-5, 4)\).
   ans: \( \frac{-6}{13} \)

5. Determine the x- and y-intercepts for the graph of \( f(x) = \frac{75 - 10x}{5 - x} \).
   ans: \((0, 15), (7.5, 0)\)

6. Given \( f(x) = 2x - 3x^2 \), use the difference quotient to determine the slope of the secant line where \( x = -2 \) and \( \Delta x = 3 \).
   ans: \(-5\)

7. Given \( f(x) = \sqrt{x} \), \( g(x) = x + 4 \). Find \( (f \circ g)(x) \) and its domain.
   ans: \( \sqrt{x + 4}, [-4, \infty) \)

8. Given \( f(x) = \frac{x^2}{2x + 5} \)
   a. Find the intercepts \( (0, 0) \)
   b. Find any horizontal asymptotes. none
   c. Find any vertical asymptotes. \( x = -2.5 \)
   d. Graph

9. Rewrite the radical function \( f(x) = \sqrt[3]{(x^2 - 4)^3} \) in exponential form and state the domain.
   ans: \( f(x) = (x^2 - 4)^\frac{1}{3}, \mathbb{R}, x \geq 2, x \leq -2 \)

10. Classify the functions below as exponential growth or decay:
    \( f(x) = \left(\frac{2}{3}\right)^x \) \hspace{1cm} ans: decay
    \( g(x) = \left(\frac{2}{3}\right)^{-x} \) \hspace{1cm} ans: decay
    \( h(x) = e^{0.7x} \) \hspace{1cm} ans: growth

11. Kyle deposits $2400 into an account that pays interest at a rate of 6.25% compounded weekly.
    a. How long before the account reaches $4,000?
       ans: \( 8.18 \) yrs.
    b. How much is in the account after 3 years?
       ans: \$2,894.63

12. J.J. deposits $1500 into an account paying \( 6\frac{3}{4}\% \) compounded continuously.
    a. How long before the balance is $2500?
       ans: \( 7.6 \) yrs.
    b. What is the balance after 2 years?
       ans: \$1,716.81

13. Given \( f(x) = 2.5e^{0.02x} \) where \( x \) is the time in minutes and \( f(x) \) is the number of bacteria in the culture in thousands. Find the number of bacteria in the culture after 2 hrs, rounded to the nearest hundred.
    ans: 27,600 bacteria

14. Rewrite in logarithmic form:
    a. \( 10^x = 2.4 \) \hspace{1cm} ans: \( \log 2.4 = x \)
    b. \( 5^{x+1} = 3 \) \hspace{1cm} ans: \( \log_{3} 3 = x + 1 \)
    c. \( e^{x^2} = 14 \) \hspace{1cm} ans: \( \ln 14 = x^2 \)

15. Given \( \log_b 2 = -3 \), and \( \log_b 5 = 4 \), evaluate \( \log_b 20b^3 \).
    ans: \( 1 \)

16. Given \( f(x) = \frac{2100}{1 + 20e^{-2x}} \)
    a. What is the initial population?
    b. What is the upper limiting population?
    ans: \( a. 100, b. 2100 \)

17. Given the following data for the average cost of a new home in thousands of dollars, let \( x \) represent the year 1960.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>21.5</td>
<td>26.6</td>
<td>40.1</td>
<td>75.5</td>
<td>110.2</td>
<td>145.6</td>
<td>176.2</td>
</tr>
</tbody>
</table>

    a. Find the best fitting model, using quadratic, cubic or logistic, and explain why you think this is the best model.

    ans: \( a. \ \) logistic, best fit of the data, and eventually levels off.
    
    Quad rises too fast, Cubic actually becomes neg.
    
    ans: b. \$213,880
18. An item sells for $9. If the fixed costs are $600 and the total costs are $2000 when 200 items are made and sold, find the cost equation.

\[ C = 7x + 600 \]

19. Find the profit when 400 items are made and sold. (See #18)

\[ \text{ans: } 200 \]

20. Find the best fitting curve between exponential and cubic regression for the following table of data, where \( x \) = number of years since 1980, and \( y \) = number of cases of menigitus in Houston.

<table>
<thead>
<tr>
<th>Year</th>
<th>'82</th>
<th>'85</th>
<th>88</th>
<th>90</th>
<th>'97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Popul</td>
<td>8</td>
<td>12</td>
<td>25</td>
<td>30</td>
<td>56</td>
</tr>
</tbody>
</table>

\[ \text{ans: cubic has the highest } r^2 \text{ value and decreases as time increases, which is likely if a cure is found.} \]

21. \( y^2 + 3x = 5 \), does this equation describe a function?

\[ \text{ans: no, when you solve for } y, \text{ you get two solutions, } y = \pm \text{ therefore it fails a vertical line test.} \]

22. Find the difference quotient for:

\[ f(x) = x^2 + 5x - 10 \]

\[ \text{ans: } 2x + h + 5 \]

23. Solve \( \log_7(\log(\ln(x))) = 1 \)

\[ \text{ans: } x = e^{10^7} \]

24. Given \( \log x = 8 \) and \( \log y = 12 \), evaluate:

\[ \log(x^2y) \]

\[ \text{ans: } 28 \]

25. Solve: \( 5 \cdot 3^{2x - 1} = 2 \)

\[ \text{ans: } x = \frac{1}{2} \left( 1 + \frac{\log 4}{\log 3} \right) \]

26. Solve: \( \log_8 (x - 3) = 2 \)

\[ \text{ans: } x = 67 \]

27. Solve: \( \log_2 x + \log_2 (x - 7) = 3 \)

\[ \text{ans: } x = 8 \]

28. If planted with 100 trees, each tree produces $50 per year. Due to overcrowding, for each additional tree planted the yield drops 50 cents. How many trees should be planted to maximize the revenue?

\[ \text{ans: } 100 \text{ trees} \]

If the cost to care for the trees (fertilizer and water) run $15 per year per tree, how many trees should be planted to maximize profit?

\[ \text{ans: } 85 \text{ trees} \]

29. Find the domain of \( f(x) = \frac{2x^2 + 7x - 15}{x + 5} \)

\[ \text{ans: } \mathbb{R}, x \neq -5 \]

30. Given the graphs of \( f(x) \) and \( g(x) \) below, show the graph of \( f(x - 3) + 2 \) and \(-g(x + 1) - 5\)

\[ \text{31. Which of the following are polynomials?} \]

a) \( f(x) = 3x^2 - \frac{2}{x} + 6 \)

b) \( g(x) = 3\sqrt{x} + 2 \)

c) \( h(x) = e^x \)

d) \( F(x) = 5x^3 - \frac{3}{x-4} \)

\[ \text{ans: d} \]

32. Given the logistic model: \( y = \frac{28}{1 + 6e^{-0.01x}} \).

a) what is the limiting value?

\[ \text{ans: } 28 \]

b) what is the initial value?

\[ \text{ans: } 4 \]

33. How long does it take for an account earning 10\% \% compounded quarterly to double?

\[ \text{ans: } 6.53 \text{ years} \]

34. Graph the piecewise defined function

\[ f(x) = \begin{cases} 
|x - 2|, & \text{if } x < -2 \\
5, & \text{if } -2 \leq x \leq 1 \\
x^2 + 1, & \text{if } x > 2
\end{cases} \]

35. A machine purchased for $1800 has a useful life of 6 years and a scrap value of $500. Assuming a straight line depreciation, find its value at 4 years old.

\[ \text{ans: } $933.33 \]

36. Solve: \( 25^{3x} = 125^{x-4} \)

\[ \text{ans: } x = -4 \]