1. **Evaluate without using a calculator.**

   (a) \( \log_{1000} \)  
   
   (b) \( \log_2 \frac{1}{8} \)  
   
   (c) \( \ln e \)  
   
   (d) \( \log_3 3^{16} \)  
   
   (e) \( \log 10^{3x} \)  
   
   (f) \( e^{\ln(2x)} \)  
   
   (g) \( \log_3 (\log_8 8) \)  
   
   (h) \( \log 0.01 \)  
   
   (i) \( \log_5 125 \)  
   
   (j) \( \log_7 \sqrt{7} \)  
   
   (k) If \( f(x) = b^x \) then \( f^{-1}(x) = \log_b x \). True or False?  

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2.  
(a) Graph \( f(x) = \left(\frac{1}{3}\right)^x \) in the coordinate system. Plot at least five points.

(b) Determine the domain and range of \( f \) by looking at the graph. Express in interval or set notation.

(c) Use the graph of \( f \) above to graph the inverse function of \( f \) in the same coordinate system. Make sure you label your graphs \( f(x) \) and \( f^{-1}(x) \) respectively.

(d) What would be the name of the inverse function?

3. Given the function \( g(x) = \log_2(x - 7) \), determine the domain of \( g \).

4. Expand and simplify the logarithmic expression as much as possible.

\[
\log_5 \left( \frac{xy^2}{125} \right)
\]
5. Solve the logarithmic equation

\[ \log_2(x+1) + \log_2(x-2) = 2 \]

6. Solve the exponential equation by expressing each side as powers of the same base. That is, you do not need to use your calculator.

\[ 9^x = \frac{1}{27} \]

7. Solve the exponential equation by taking the natural logarithm on each side. Round to four decimal places.

\[ 8^x = 12,143 \]

8. Use common logarithms or natural logarithms and a calculator to evaluate the expression (change of base formula). Round to four decimals.

\[ \log_5 164 \]
9. Solve using appropriate compound formula and round answer to nearest cent.

Suppose you have $4000 to invest. Find the accumulated value of your investment after 3 years if the money is compounded monthly and the interest rate is 6.1%.

10. Given \( f(x) = 2x^2 \) and \( g(x) = \frac{\sqrt{x}}{2} \)

    (a) Find \( (f \circ g)(x) \)

    (b) From your answer in (a), can you conclude that \( f \) and \( g \) are inverses of each other? Why or why not?

11. Given \( f(x) = \frac{1}{x} \), find \( f^{-1}(x) \)
12. Solve by first making appropriate substitution
\[ x + 7\sqrt{x} - 8 = 0 \]

13. Solve the equation. If it has no solution, so state.
\[ \frac{x^2}{3} - x - \frac{1}{6} = 0 \]

14. Solve the polynomial inequality
\[ x^3 + 2x^2 < 3x \]

15. Write a quadratic equation in standard form with the solution set \( \left\{ -2, \frac{1}{3} \right\} \)
16. Given \( f(x) = 14(x + 1)^2 + 9 \)

(a) Find the vertex for the parabola defined by \( f \)

(b) Does the parabola open upwards or downwards?

(c) Find any possible \( x \)-intercepts or state that there aren’t any

(d) Find the \( y \)-intercept

(e) Sketch the graph of \( f \) in the coordinate system above.

17. Last night I launched a bottle rocket from the top of my house. The rocket's height above ground, \( h(t) \), \( t \) seconds after it was launched, can be modeled by the function \( h(t) = -16t^2 + 128t + 30 \), in feet.

(a) When did the rocket reach its maximum height?

(b) What was the rocket’s maximum height?

(c) When did the rocket land? (Round to the nearest tenth of a second.)

(d) How tall is my house?
18. Among all pairs of numbers whose difference is 14, find a pair whose product is as small as possible. What is the minimum product?

19. According to the U.S. Bureau of Census, in 1990 there were 22.4 million residents of Hispanic origin living in the United States. By 2000, the number had increased to 35.3 million. The exponential growth function $A = 22.4e^{0.045t}$ describes the U.S. Hispanic population, $A$, in millions, $t$ years after 1990.

(a) Project the Hispanic resident population in 2010.

(b) In which year will the Hispanic resident population reach 60 million?

(c) Suppose you were given the above information except for the exponential growth function. Show/explain how you could find that model on your own.