PART I: TRUE or FALSE
Circle TRUE or FALSE, whichever is correct. (2 pts. each)

1. If \(-3x > 12\), then \(x < -4\). \hspace{1cm} TRUE \hspace{1cm} FALSE

2. The following relation represents a function:
\[(2, -1), (3, 5), (4, -1)\] \hspace{1cm} TRUE \hspace{1cm} FALSE

3. If \(|x| > 3\), then \(-3 < x < 3\). \hspace{1cm} TRUE \hspace{1cm} FALSE

4. The graphs of inverse functions are symmetric with respect to the y-axis. \hspace{1cm} TRUE \hspace{1cm} FALSE

5. \(\log 5 - \log 2 = \log 3\). \hspace{1cm} TRUE \hspace{1cm} FALSE

PART II: FILL-IN-THE-BLANK (2 pts. each)

6. Consider the following rational function.
\[R(x) = \frac{6x - 5}{2x + 4}\]

(a) Find the vertical asymptote. \hspace{1cm} answer __________________________

(b) Find the horizontal asymptote. \hspace{1cm} answer __________________________

7. Write the following inequality using interval notation.

\[ x < 3 \]

answer

8. The graph of a function appears below.

(a) What is the domain? 

(b) What is the range? 

(c) On what interval(s) of \( x \) is this function increasing? 

(d) On what interval(s) of \( x \) is this function decreasing?
9. Consider the following polynomial function.

\[ f(x) = 3x^4 - 5x^2 + 7x - 2 \]

List the potential rational zeros.  

10. If \( \log_2 x = 3 \), then \( x = \)  

11. Write the function whose graph is the graph of \( f(x) = |x| \), but is:

(a) Shifted vertically down 4 units.  \( \text{answer } \)  

(b) Shifted horizontally left 2 units.  \( \text{answer } \)  

(c) Reflected about the \( x \)-axis.  \( \text{answer } \)
12. Change the following exponential expression into an equivalent expression involving a logarithm.

\[ 3^2 = 9 \quad \text{answer } \quad \]

13. Change the following logarithmic expression into an equivalent expression involving an exponent.

\[ \ln 3 = x \quad \text{answer } \quad \]

14. Find the domain of the following function.

\[ f(x) = \ln(x + 2) \quad \text{answer } \quad \]
PART III: MULTIPLE CHOICE. Circle the letter of the correct answer. (2 pts. each)

15. Consider the following quadratic function.

\[ f(x) = 2x^2 - 8x + 3 \]

What is the vertex?

(a) \((-2, 27)\)  
(b) \((-2, 11)\)  
(c) \((2, -5)\)  
(d) \((2, 27)\)  
(e) none of these

16. What is the amount that would result if $200 is invested at 2% compounded continuously after a period of 5 years? \( A = Pe^{rt} \)

(a) $220.00  
(b) $243.66  
(c) $221.03  
(d) $180.97  
(e) $543.66
PART IV: For problems 17-36, you must show all your work clearly on the exam for full credit. You must circle your final answer!!

17. Solve each equation. Your solutions should be simplified, if possible.

(a) (5 pts.) \( x^2 + 2x - 4 = 0 \)  
(b) (5 pts.) \( x = \sqrt{3x + 10} \)

(c) (5 pts.) \( |2x - 3| + 2 = .7 \)  
(d) (5 pts.) \( x^{-2} - 4x^{-1} + 3 = 0 \)
18. Solve each inequality. Graph the solution set on a real number line.

(a) (5 pts.) $3 - 2x \geq 9$

(b) (5 pts.) $|x - 2| > 3$

(c) (5 pts.) $x^3 - 3x^2 \leq 0$
19. (5 pts.) Find the domain of the following function.

\[ f(x) = \frac{x - 3}{x^2 - 3x - 10} \]

20. (6 pts.) Graph the following function.

\[ f(x) = \begin{cases} \sqrt{x} & \text{if } x > 1 \\ x - 2 & \text{if } x \leq 1 \end{cases} \]
21. (6 pts.) Graph \( f(x) = \sqrt{x+2} - 3 \) using transformations. Start with the graph of \( f(x) = \sqrt{x} \).

22. (5 pts.) Determine, without graphing, whether the given quadratic function has a maximum value or a minimum value and then find the value. \textit{Do not graph!!!}

\[ f(x) = 3x^2 + 6x - 2 \]
23. Consider the following function.
\[ f(x) = x^2 + 2x - 8 \]

(a) (2 pts.) Find the vertex.

(b) (2 pts.) Write the equation of the axis of symmetry.

(c) (2 pts.) Find the \( x \)-intercept(s).

(d) (2 pts.) Find the \( y \)-intercept.

(e) (2 pts.) Use the information obtained above to graph \( f(x) = x^2 + 2x - 8 \).
24. Consider the following polynomial function.

\[ f(x) = (x - 1)^3(x + 2)^2 \]

(a) (3 pts.) Find the y-intercept.

(b) (5 pts.) Find the x-intercepts and determine whether the graph of \( f(x) \) crosses or touches at each x-intercept.

25. (5 pts.) Use synthetic division to find the quotient and remainder.

\[ 4x^3 - x^2 + 3x - 5 \] divided by \( x - 1 \)

Quotient = _____________________

Remainder = _____________________
26. (6 pts.) Solve the following equation by factoring. (Hint: Use synthetic division.)

\[ x^3 + 4x^2 - 7x - 10 = 0 \]

27. Consider the following pair of functions.

\[ f(x) = x^2 - 5 \quad ; \quad g(x) = x + 3 \]

Find and simplify the following.

(a) (6 pts.) \( f(g(x)) \) 

(b) (5 pts.) \( f(g(-7)) \)

28. (5 pts.) Consider the following function.

\[ f(x) = 5x + 2 \]

Find its inverse.

\[ f^{-1}(x) = \]
29. (5 pts.) The graph of a one-to-one function \( f \) is given. Draw the graph of the inverse function \( f^{-1} \).

\[ y = f(x) \]

30. (5 pts.) Solve the following equation.

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

31. (5 pts.) Find the value of the logarithm by hand. (Do not use a calculator.)

\[ \log_4 \left( \frac{1}{2} \right) \]

32. (6 pts.) Write the following expression as a sum and/or difference of logarithms. Express powers as factors.

\[ \ln \left( \frac{\sqrt{x}}{y^3} \right) \]
33. (5 pts.) Write the following expression as a single logarithm. Simplify if possible.

$$2 \log x - \log(x^2 + 3x)$$

34. Solve each equation.

(a) (5 pts.) \( \log(x^2 - 10) = \log(2x + 5) \)  
(b) (6 pts.) \( \log_7(x + 2) + \log_7(x - 4) = 1 \)

(c) (6 pts.) \( 3^{x+1} = 7 \)
35. (6 pts.) The population of a colony of fruit flies obeys the law of uninhibited growth. If there are 800 fruit flies initially, and there are 900 after one day, find $k$, the growth constant.

[round answer to 4 decimal places]

36. (5 pts.) Solve the following system using either elimination or substitution.

\[
\begin{align*}
2x - 3y &= 9 \\
x + 4y &= 10
\end{align*}
\]