1. A logarithmic function of the form $f(x) = \log_a x$ will always pass through the point $(1, 0)$.

   (a) True, and I am very confident.
   (b) True, but I am not very confident.
   (c) False, but I am not very confident.
   (d) False, and I am very confident.

2. Which is a graph of $y = \ln x$?

   ![Graph Options]

3. The graph below could be that of
4. Which equation matches this graph?

(a) $y = \ln x + \frac{1}{2}$  
(b) $y = \ln x - \frac{1}{2}$  
(c) $y = \ln (x + \frac{1}{2})$  
(d) $y = \ln (x - \frac{1}{2})$

5. Which equation matches this graph?

(a) $y = b^x$ with $b > 1$  
(b) $y = b^x$ with $0 < b < 1$  
(c) $y = \log_b x$ with $b > 1$  
(d) $y = \log_b x$ with $0 < b < 1$
6. Which of the following is a graph of $y = \log_2 x$?

- (a) $y = b^x$ with $b > 1$
- (b) $y = b^x$ with $0 < b < 1$
- (c) $y = \log_b x$ with $b > 1$
- (d) $y = \log_b x$ with $0 < b < 1$

7. Which of the following is a graph of $y = \log_{\frac{1}{2}} x$?

- (a) 
- (b) 
- (c) 
- (d)
8. Which of the following functions have vertical asymptotes of \( x = 3 \)?

(a) \( y = \ln(x/3) \)
(b) \( y = \ln(x - 3) \)
(c) \( y = \ln(x + 3) \)
(d) \( y = 3 \ln x \)

9. \( \log \left( \frac{M-N}{M+N} \right) = \)

(a) \( 2 \log M \)
(b) \( 2 \log N \)
(c) \( -2 \log N \)
(d) \( \log(M - N) - \log(M + N) \)

10. If \( \log_{10}(x-a) = n \), then \( x = \)

(a) \( 10^{a+n} \)
(b) \( a + 10^n \)
(c) \( n + 10^a \)
(d) \( n + a^{10} \)

11. What is the exponential form of \( \log_r m = j \)?

(a) \( r^j = m \)
(b) \( j^r = m \)
(c) \( m^j = r \)
(d) \( r^m = j \)

12. What is the logarithmic form of \( k^p = d \)?
(a) \( \log_d k = p \)
(b) \( \log_k d = p \)
(c) \( \log_p d = p \)
(d) \( \log_k p = d \)

13. What is the value of \( \log_{11} 86 \) ? (Calculators are allowed.)

(a) .4049  
(b) .5383  
(c) 1.8576  
(d) −2.0564

14. What is \( 3 = \log_2 8 \) in exponential form?

(a) \( 2^8 = 3 \)  
(b) \( 3^2 = 8 \)  
(c) \( 8^3 = 2 \)  
(d) \( 2^3 = 8 \)

15. What is \( k = \log_m q \) in exponential form?

(a) \( m^k = q \)  
(b) \( k^q = m \)  
(c) \( m^q = k \)  
(d) \( q^m = k \)

16. What is \( 4^2 = 16 \) in logarithmic form?

(a) \( \log_4 4 = 16 \)  
(b) \( \log_4 16 = 2 \)  
(c) \( \log_4 2 = 16 \)  
(d) \( \log_{16} 4 = 2 \)

17. What is \( 3^{-1} = \frac{1}{3} \) in logarithmic form?
(a) \( \log_3(-1) = \frac{1}{3} \)
(b) \( \log_{-\frac{1}{3}} 3 = 3 \)
(c) \( \log_{\frac{1}{3}} 3 = -1 \)
(d) \( \log_3 \frac{1}{3} = -1 \)

18. What is the inverse of the following function:

\[
P = f(t) = 16 \ln(14t)
\]

(a) \( f^{-1}(P) = \frac{1}{14} e^{16P} \)
(b) \( f^{-1}(P) = \frac{1}{14} e^{P/16} \)
(c) \( f^{-1}(P) = \frac{1}{14} \ln(P/16) \)
(d) \( f^{-1}(P) = \ln \frac{16}{14} P \)

19. Solve for \( x \) if \( 8y = 3e^x \).

(a) \( x = \ln 8 + \ln 3 + \ln y \)
(b) \( x = \ln 3 - \ln 8 + \ln y \)
(c) \( x = \ln 8 + \ln y - \ln 3 \)
(d) \( x = \ln 3 - \ln 8 - \ln y \)

20. Solve for \( x \) if \( y = e + 2^x \)

(a) \( x = \frac{\ln(y-1)}{\ln 2} \)
(b) \( x = \frac{\ln(y-1)}{\ln 2} \)
(c) \( x = \frac{\ln y}{\ln 2} - 1 \)
(d) \( x = \frac{\ln(y-e)}{\ln 2} \)

21. Write the following expression using a single logarithmic function:

\[
\ln(2x^3 + 1) + 5 \ln(3 - x) - \ln(6x^5 + 2x + 1).
\]

(a) \( \ln(-6x^5 + 2x^3 - 7x + 15) \)
(b) \( \ln[(2x^3 + 1)(15 - 5x)(-6x^5 - 2x - 1)] \)
(c) \( \ln \left( \frac{(2x^3 + 1)(3 - x)^5}{6x^5 + 2x + 1} \right) \)

(d) \( \ln \left( \frac{(2x^3 + 1)(15 - 5x)}{6x^5 + 2x + 1} \right) \)

22. \( \log \left( \frac{a^4 b^7}{c^5} \right) = \)

(a) \( \log(a^4) + \log(b^7) + \log(c^5) \)
(b) \( 4 \log a + 7 \log b - 5 \log c \)
(c) \( 28 \log ab - 5 \log c \)
(d) \( \frac{28}{5} (\log a + \log b - \log c) \)
(e) None of the above

23. Simplify the following expression: \( \ln \left( \frac{\sqrt{x^2 + 1}(x^3 - 4)}{(3x - 7)^2} \right) \).

(a) \( \frac{1}{2} \ln(x^2 + 1) + \ln(x^3 + 4) - 2 \ln(3x - 7) \)
(b) \( \ln \left( \frac{1}{2}(x^2 + 1) \right) + \ln(x^3 + 4) - 2 \ln(3x - 7) \)
(c) \( \ln(x^2 + 1) \ln(x^3 + 4) \ln(3x - 7) \)
(d) \( \ln[(x^2 + 1)(x^3 + 4)(3x - 7)] \)

24. 25 rabbits are introduced to an island, where they quickly reproduce and the rabbit population grows according to an exponential model \( P(t) = P_0 e^{kt} \) so that the population doubles every four months. If \( t \) is in months, what is the value of the continuous growth rate \( k \)?

(a) \( k = \frac{1}{2} \ln 4 \)
(b) \( k = \frac{1}{4} \ln 2 \)
(c) \( k = \frac{1}{50} \ln \frac{4}{25} \)
(d) \( k = \frac{4}{25} \ln \frac{1}{50} \)
(e) None of the above

25. Simplify \( (\log_{16} 4) \left( \log_3 \frac{1}{9} \right) \).
(a) \( \frac{16}{3} \)

(b) \( \frac{4}{9} \)

(c) 1

(d) -1