Chapter 11 Practice Problems, Logarithms and Exponential Functions

Evaluate the logarithm.

1. \( \log_2 \left( \frac{1}{16} \right) \).  
   a. 4  
   b. \( \frac{1}{4} \)  
   c. \( -4 \)  
   d. \( \frac{1}{4} \)

2. \( \log_3 \frac{1}{81} \)  
   a. 4  
   b. \( -3 \)  
   c. 3  
   d. \( -4 \)

Solve the equation or inequality.

3. \( \log_2 102 = x \).  
   a. 10.100  
   b. 0.020  
   c. 6.672  
   d. 1.708

Write the equation in logarithmic form.

4. \( 6^x = 1,296 \)  
   a. \( \log_b 1,296 = 4 \)  
   b. \( \log_1 1,296 = 4 \)  
   c. \( \log 1,296 = 4 \cdot 6 \)  
   d. \( \log_4 1,296 = 6 \)

Write the expression as a single logarithm.

5. \( 5 \log_b q + 2 \log_b y \)  
   a. \( \log_b (q^5y^2) \)  
   b. \( (5 + 2) \log_b (q + y) \)  
   c. \( \log_b \left( q^5 + y^2 \right) \)  
   d. \( \log_b \left( qy^{5+2} \right) \)
6. \( \log_2 28 - \log_2 7 \)
   a. \( \log 21 \)       b. \( \log 4 \)       c. \( \log_2 21 \)       d. \( \log_2 4 \)

7. \( 9 \log x - 7 \log (x + 6) \)
   a. \(-63 \log \frac{x}{(x + 6)} \)
   b. \( \log \frac{x^7}{(x + 6)^9} \)
   c. \( 2 \log \frac{x}{(x + 6)} \)
   d. none of these

Expand the logarithmic expression.

8. \( \log_3 11p^3 \)
   a. \( \log_3 11 \cdot 3 \log_3 p \)
   b. \( \log_3 (11 - 3 \log_3 p) \)
   c. \( \log_3 11 + 3 \log_3 p \)
   d. \( 11 \log_3 p^3 \)

9. \( \log_b \sqrt{\frac{57}{74}} \)
   a. \( \frac{1}{2} \log_b 57 + \frac{1}{2} \log_b 74 \)
   b. \( \frac{1}{2} \log_b 57 - \frac{1}{2} \log_b 74 \)
   c. \( \sqrt{\log_b 57 - \log_b 74} \)
   d. \( \log_b \frac{1}{2} (57 - 74) \)

10. Use the properties of logarithms to evaluate \( \log_2 26 + \log_2 16 - \log_2 13 \).
    a. \( 9 \)       b. \( 5 \)       c. \( 7 \)       d. \( 6 \)

Write the expression as a single natural logarithm.

11. \( 3 \ln x - 2 \ln c \)
    a. \( \ln \frac{x^3}{c^2} \)
    b. \( \ln (x^3 + c^2) \)
    c. \( \ln (x^3 - c^2) \)
    d. \( \ln x^3 c^2 \)
12. \(3 \ln a - \frac{1}{2} (\ln b + \ln c^2)\)
   
   a. \(\ln \frac{3a}{0.5bc^2}\)
   b. \(\frac{3}{2} \ln \frac{a}{bc^2}\)
   c. \(\ln \frac{a^3}{bc}\)
   d. \(\ln \frac{a^3}{c \sqrt{b}}\)

13. The sales of lawn mowers \(t\) years after a particular model is introduced is given by the function \(y = 5500 \ln(9t + 4)\), where \(y\) is the number of mowers sold. How many mowers will be sold 2 years after a model is introduced? Round the answer to the nearest whole number.
   
   a. 37,897 mowers
   b. 7,383 mowers
   c. 15,901 mowers
   d. 17,000 mowers

**Short Answer**

14. Solve \(e^{4x} = 5.7\). Round to the nearest **ten-thousandth**.

15. Solve \(15^{2x} = 36\). Round to the nearest **ten-thousandth**.

16. Solve \(\log(4x + 10) = 3\).
   Round to the nearest thousandth if necessary.

17. Solve \(\log 3x + \log 9 = 0\).
   Round to the nearest **hundredth** if necessary.

18. Solve \(\log_5(x + 5) - \log_5 x = 6\).
   Round to the nearest ten thousandth if necessary.

19. Solve \(6 \log_2 2 - \log_8 8 + 7 \log_5 x - 4 = 0\).
   Round to the nearest ten thousandth.
20. Simplify \( \ln e^{1.75} \).

21. Solve \( \ln(2x - 1) = 8 \). Round to the nearest thousandth.

22. Solve \( \log_5 x + \log_5 7 = 1.65 \). Round to the nearest thousandth.

23. Solve \( \log_6 x - \log_6 2 = 3.05 \). Round to the nearest thousandth.

24. Use natural logarithms to solve the equation. Round to the nearest thousandth.

25. \( e^{2x} = 2.1 \)
   Round your answer to four decimal places.

26. Find all values of the solution set for the equation \(-4 = 7 - 2\sqrt{x^4}\).
   (Round to the nearest hundredth)

27. Find the exact value of \( x \): \( \log_2 x = 5 \).

28. A shipping company owns a fleet of heavy trucks. If the purchase price of each truck is $150,000 and its value depreciates by 11.7 percent per year, what is the value of each truck after 15 years? Round to the nearest dollar
29. The National Park Service has counted the number of wolves in Yellowstone National Park every year since their reintroduction to the park. The following table shows the number of wolves found in the park every year from 1994 on.

<table>
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<td>Wolves</td>
<td>8</td>
<td>12</td>
<td>17</td>
<td>23</td>
<td>37</td>
<td>52</td>
</tr>
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</table>

Determine the experimental growth constant for an exponential model in terms of base $e$. (i.e. if $N = N_0e^{kt}$, find $k$ to the nearest hundredth.)