

**Express as a single logarithm and simplify to an integer if possible.**

1.  $\log_6 9 + \log_6 24 =$

2.  $\log_3 108 - \log_3 4 =$

**Simplify.**

3.  $\log_2 8^5 =$

4.  $\log_4 4^{x-1} =$

5.  $10^{\log 125} =$

6.  $\log_{64} 128 =$

**Use the properties of logarithms to expand the expression.**

7.  $\log_a (MN) =$

8.  $\log_a \frac{M}{N} =$

9.  $\log_a M^N =$

10.  $\log_5 5x^2 =$

11.  $\log_5 (5x)^2 =$

12.  $\log xy^2z^3 =$

13.  $\log_2 \frac{xy^2}{z^4} =$

14.  $\log_5 \frac{5A}{BC} =$

15.  $\log_4 \frac{3ab}{cd} =$

16.  $\log_6 \frac{6a^2b^3}{5c^2} =$

**Condense the expression to the logarithm of a single quantity.**

17.  $\log x + \log y =$

18.  $\log_4 x - \log_4 y =$

19.  $2\log_2 x =$

20.  $3\log x + 2\log y - 4\log z =$

21.  $2\log_3 4 - \log_3 5 - \log_3 x =$

22.  $3\log x - 2\log y - 5\log z =$

**Find the exact value of the logarithm without using a calculator.**

23.  $\log_3 9 =$

24.  $\log_6 \sqrt{6} =$

25.  $\log_5 \frac{1}{125} =$

26.  $\log_5 75 - \log_5 3 =$

27.  $3\log 10 =$

28.  $\log_{16} 4 =$

**Write the expressions using the change of base formula, then use your calculator to give the approximate value of the expression to the nearest hundredths place.**

29.  $\log_7 60 =$

30.  $\log_8 5 =$