

Take note**Properties Properties of Logarithms**

For any positive numbers m , n , and b where $b \neq 1$, the following properties apply.

Product Property $\log_b mn = \log_b m + \log_b n$

Quotient Property $\log_b \frac{m}{n} = \log_b m - \log_b n$

Power Property $\log_b m^n = n \log_b m$

Properties of Logarithms

Write each expression as a single logarithm.

1. $\log_5 4 + \log_5 3$

$$\log_5 (4 \cdot 3)$$

$$\log_5 12$$

3. $\log_2 4 + \log_2 2 - \log_2 8$

$$\log_2 4 \cdot 2 - \log_2 8$$

$$\log_2 8 - \log_2 8$$

$$\log_2 \frac{8}{8} = \log_2 1$$

5. $\log 7 - \log 3 + \log 6$

$$\log \frac{7}{3} + \log 6$$

$$\log \frac{7}{3} \cdot \frac{6}{1}$$

$$\log 14$$

7. $\log_3 4x + 2 \log_3 5y$

$$\log_3 4x + \log_3 (5y)^2$$

$$\log_3 4x + \log_3 25y^2$$

$$\log_3 [(4x)(25y^2)]$$

$$\log_3 (100xy^2)$$

9. $2 \log 4 + \log 2 + \log 2$

$$\log 4^2 + \log 2 + \log 2$$

$$\log 16 + \log 2 + \log 2$$

$$\log 16 \cdot 2 + \log 2$$

$$\log 32 + \log 2$$

$$\log 32 \cdot 2 = \log 64$$

11. $5 \log x + 3 \log x^2$

$$\log x^5 + \log (x^2)^3$$

$$\log x^5 + \log x^6$$

$$\log x^5 \cdot x^6$$

$$\log x^{11}$$

13. $\log 2 + \log 4 - \log 7$

$$\log 8 - \log 7$$

$$\log \frac{8}{7}$$

15. $3(4 \log t^2)$

$$12 \log t^2$$

$$\log (t^2)^{12}$$

$$\log t^{24}$$

Expand each logarithm. Simplify if possible.

17. $\log_2 \frac{x}{yz}$

$$\log_2 x - \log_2 yz$$

$$\log_2 x - (\log_2 y + \log_2 z)$$

$$19. \log \sqrt{\frac{2rst}{5w}} = \log \left(\frac{2rst}{5w} \right)^{1/2} = \frac{1}{2} \left(\log \frac{2rst}{5w} \right)$$

$$\frac{1}{2} \left[\log 2rst - \log 5w \right]$$

$$\frac{1}{2} \left[(\log 2 + \log r + \log s + \log t) - (\log 5 + \log w) \right]$$

21. $\log_5 5x^{-5}$

$$\log_5 5 + \log_5 x^{-5}$$

$$\log_5 5 + (-5) \log_5 x$$

$$\log_5 5 - 5 \log_5 x$$

23. $\log_4(3xyz)^2$

Change of base formula

$$\log_b X = \frac{\log_c X}{\log_c b} \rightarrow \frac{\log X}{\log b}$$

$c=10$, to use calculator

Use the Change of Base Formula to evaluate each expression. Round your answer to the nearest thousandth.

25. $\log_3 5$

$$\frac{\log 5}{\log 3} = 1.465$$

27. $\log_6 17$

$$\frac{\log 17}{\log 6} = 1.581$$

In calculator: $5 \rightarrow \log \rightarrow \div \rightarrow 3 \rightarrow \log \rightarrow =$

Use the properties of logarithms to evaluate each expression.

29. $\log_2 160 - \log_2 5$

$$\log_2 \frac{160}{5}$$

$$\log_2 32 = \frac{\log 32}{\log 2} = 5$$

31. $\log_7 14 - \log_7 2$

$$\log_7 \frac{14}{2} = \log_7 7 = 1$$

$$2^x = 2^5$$

$$\log_2 2^x = \log_2 2^5$$

$$x \log_2 2 = 5 \log_2 2$$

$$x = 5$$

33. $\frac{1}{4} \log_3 162 - \log_3 \sqrt[4]{2}$

$$\log_3 (162)^{\frac{1}{4}} - \log_3 \sqrt[4]{2}$$

$$\log_3 \sqrt[4]{162} - \log_3 \sqrt[4]{2}$$

$$\log_3 \frac{\sqrt[4]{162}}{\sqrt[4]{2}} = \log_3 \sqrt[4]{\frac{162}{2}} = \log_3 \sqrt[4]{81} = \log_3 3 = \textcircled{1}$$

$\begin{matrix} & \wedge & & \wedge \\ & 9 & & 9 \\ & \wedge & & \wedge \\ 3 & & 3 & & 3 & & 3 \end{matrix}$

