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	$\log_b m^n = n \log_b m$

Mar 15-7:07 AM

Properties of Logarithms

Write each expression as a single logarithm.

1. $\log_5 4 + \log_5 3$

$\log_5 (4)(3)$

$\log_5 12$

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

$\log_2 (4)(2) - \log_2 8$

$\log_2 8 - \log_2 8$

$\log_2 \frac{8}{8}$

$\log_2 1$

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

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

$\log \left(\frac{7}{3}\right)\left(\frac{6}{1}\right)^2$

$\log 14$

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

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

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

$\log 32 + \log 2$

$\log 64$

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

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

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

$\log (x^5)(x^6)$

$\log x^{11}$

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

$\log 8 - \log 7$

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

Mar 15-7:32 AM

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

$12 \log t^2$

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

$\log t^{24}$

Apr 16-7:26 AM

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. $\log\sqrt{\frac{2rst}{5w}}$

$\sqrt{x} = x^{1/2}$

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

$\frac{1}{2}(\log 2rst - \log 5w)$

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

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. $\log_4(3xyz)^2$

$2\log_4 3xyz$

$2(\log_4 3 + \log_4 x + \log_4 y + \log_4 z)$

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. $\log_3 5$

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

$5 \rightarrow \log \rightarrow \div \rightarrow 3 \rightarrow \log \rightarrow =$

27. $\log_6 17$

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

Use the properties of logarithms to evaluate each expression.

29. $\log_2 160 - \log_2 5$

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

$\log_2 32$

change of base

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

31. $\log_7 14 - \log_7 2$

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

If the base matches the number inside, it simplifies to 1.

$\log_7 7 = 1$

Mar 15-7:37 AM

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

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

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

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

$\log_3 \sqrt[4]{81} = \log_3 3 = 1$

$81 = 9 \cdot 9$, $9 = 3 \cdot 3$