

1. Evaluate each of the following.

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|-----|------------------------------------|-----|------------------------------------|-----|--|
| (a) | $\log_3 81$ | (j) | $\log_5(0.04)$ | (s) | $3^{\log_3 4}$ |
| (b) | $\log_4 64$ | (k) | $\log_5 25\sqrt{5}$ | (t) | $5^{\log_5 4}$ |
| (c) | $\log_{10}(0.0001)$ | (l) | $\log_8 2$ | (u) | $4^{\log_3 9}$ |
| (d) | $\log_9 1$ | (m) | $\log_{81} 9$ | (v) | $\log_5 \left(\frac{1}{25}\right)$ |
| (e) | $\log_2 \left(\frac{1}{32}\right)$ | (n) | $\log_4 \left(\frac{1}{16}\right)$ | (w) | $9^{\log_4 2}$ |
| (f) | $\log_{\frac{1}{2}} 1$ | (o) | $\log_8 4$ | (x) | $\log_{\sqrt{2}} \left(\frac{1}{4}\right)$ |
| (g) | $\log_4(16)^3$ | (p) | $\log_9 27$ | (y) | $\log_{16}(0.125)$ |
| (h) | $\log_{\frac{1}{2}} 4$ | (q) | $\log_4 8\sqrt{2}$ | (z) | $16^{\log_3 \sqrt{3}}$ |
| (i) | $\log_2(0.125)^3$ | (r) | $\log_8(0.25)$ | | |

2. Find an equivalent expression for each of the following by applying the laws of logarithms.

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|-----|---------------------------------|-----|--|-----|-------------------------|
| (a) | $2 \log_{12}(82 \times 28)$ | (g) | $\frac{1}{2} \log 49$ | (k) | $\log_a 5x$ |
| (b) | $\log_9(9 \times 13 \times 14)$ | (h) | $\log_2 \left(\frac{937}{1005}\right)$ | (l) | $-\log_3 8$ |
| (c) | $\log_5 9^{20}$ | (i) | $\log_7 \left(\frac{1}{67}\right)$ | (m) | $\log_2 6 + \log_2 7$ |
| (d) | $\log_3(79 \div 53)$ | (j) | $\log_5 \sqrt{83}$ | (n) | $\log_b 28 - \log_b 4$ |
| (e) | $2 \log 6$ | (o) | | (o) | $3 \log_2 8 + \log_2 9$ |
| (f) | $\log_2(LMN)$ | | | | |

3. Express each of the following as a single logarithm.

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| (a) | $\log_2 5 + \log_2 7 + \log_2 6$ | (f) | $2 \log_m \frac{1}{4} + \frac{1}{2} \log_m 32$ |
| (b) | $\log_7 4 + \log_7 6 - \log_7 3$ | (g) | $\log_a b^m - p \log_a c$ |
| (c) | $3 \log_5 3 + 2 \log_5 4$ | (h) | $\frac{1}{2} [\log_8 x + \log_8 y] - 2 \log_8 c$ |
| (d) | $2 \log_3 7 - (\log_3 14 + \log_3 2)$ | | |
| (e) | $3 \log_2 6^2 + \log_2 5 - 4 \log_2 3$ | | |

4. Evaluate each of the following.

(a) $\log_5 2.5 + \log_5 50$

(b) $\log_3 243 - \log_3 81$

(c) $\log_2 96 - \log_2 24 + \log_3 81$

(d) $2 \log_5 15 - \log_5 9$

(e) $\log_8 6 - \log_8 3 + \log_8 2$

(f) $\log_3 54 + \log_3 \left(\frac{3}{2}\right)$

(g) $\log_8 2 + 3 \log_8 2 + \frac{1}{2} \log_8 16$

(h) $\log_2 32 - \log_3 9\sqrt{3}$

(i) $\log_2 \sqrt{5} - \log_2 \sqrt{40}$

(j) $\log_2 \left(\frac{1}{128}\right) - \log_8 16$

(k) $2 \log_3 \sqrt[4]{27} + \log_1 64$

(l) $\log_4 8 + \log_4 6 + \log_4 \left(\frac{1}{128}\right)$