Key

# Review Logarithms

1) Rewrite the following exponentials as logarithms.

a) $216 = 6^3$

$\log_6(216) = 3$

b) $1331 = 11^3$

$\log_{11}(1331) = 3$

2) Rewrite the following logarithms as exponentials.

a) $\log_2 2 = 1$

$2 = 2^1$

b) $\log_8 64 = 2$

$64 = 8^2$

3) Evaluate the following logarithms.

a) $\log_3 9$ 2

b) $\log_5 10$ 1.43

4) Using the formula $\log(I) = M_1 - M_2$ how many more times intense is an Earthquake measured at 7.5 compared to one measured at 5.4?

$\log I = 7.5 - 5.4$

$\log_{10} I = 2.1$

$I = 10^{2.1} =$ 125.89 times more intense

5) Write as a single logarithm.

a) $3\log_5(9) - \log_5(3)$

$\log_5\left(\frac{9^3}{3}\right)$

b) $\log_9(8) - 2\log_9(6) + \log_9(3)$

$\log_9\left(\frac{8}{6^2} \cdot 3\right)$

c) $\log_5(3) - x \cdot \log_5(4)$

$\log_5\left(\frac{3}{4^x}\right)$

d) $\frac{1}{2}\log_9(x) + 2\log_9(y) - \log_9(3)$

$\log_9\left(\frac{x^{1/2}\, y^2}{3}\right)$

6) Expand the following logarithms.

a) $\log_5(m^3z^5)$

$3\log_5(m) + 5\log_5(z)$

b) $\log_2(\frac{r}{s})$

$\log_2(r) - \log_2(5)$

c) $\log_3 7\sqrt{x}$ Remember $\sqrt{x} = x^{1/2}$

$\log_3(7x^{1/2})$

$\log_3(7) + \frac{1}{2}\log_3(x)$

d) $\log_5(\frac{x^2y^6}{w^4})$

$2\log_5 x + 6\log_5 y - 4\log_5 w$

7) Solve the following for x. You may or may not need to use logarithms.

a) $9^x = 729$

$9^x = 9^3$

$x = 3$

b) $3^{-2x+1} = 3^{5x+4}$

$-2x+1 = 5x+4$

$+2x \quad +2x$

$1 = 7x+4$

$-3 = 7x$

$\frac{-3}{7} = x$

c) $3^{-2x+2} = 81$

$3^{-2x+2} = 3^4$

$-2x+2 = 4$

$-2x = 2$

$x = -1$

d) $3^{x+2} = 9^x$

$3^{x+2} = 3^{2x}$

$x+2 = 2x$

$-x \quad -x$

$2 = x$

e) $2 - 4^x = -40$

$-2 \quad -2$

$-4^x = -42$

$\frac{-4^x}{-1} = \frac{-42}{-1}$

$4^x = 42$

$x = \log_4(42) \approx 2.7$

f) $-3 \cdot 4^x = -3$

$\frac{-3}{-3} \quad \frac{-3}{-3}$

$4^x = 1$

$x = \log_4(1) = 0$

8) Write the following with only one natural log.

a) $\ln 10 \div \ln 4$

$\ln(10 \cdot 4)$

b) $5\ln x - 3\ln y$

$\ln\left(\frac{x^5}{y^3}\right)$

c) $\ln a - 2\ln b + (1/2)\ln c$

$\ln\left(\frac{a}{b^2} \cdot e^{1/2}\right)$

9) Solve the following for x. You may need to use the natural log. $\ln = \log_e$

a) $\ln 3x = 6$

$\log_e(3x) = 6$

$3x = e^6$

$x = e^6/3 \approx 134.5$

b) $\ln(4x - 1) = 36$

$\log_e(4x-1) = 36$

$4x - 1 = e^{36}$

$4x = e^{36} + 1$

$x = \frac{e^{36}+1}{4}$

c) $-3\ln 2x^2 = -9$

$\frac{-3\ln 2x^2}{-3} = \frac{-9}{-3}$

$\ln 2x^2 = 3$

$2x^2 = e^3$

$x^2 = e^3/2$

$x = \pm\sqrt{e^3/2}$

d) $\ln(x-1)^2 = 3$

$(x-1)^2 = e^3$

$x - 1 = \pm\sqrt{e^3}$

$x = 1 \pm \sqrt{e^3}$

e) $e^x = 10$

$x = \ln 10$

f) $e^{\frac{x}{3}} = 7$

$\frac{x}{3} = \ln 7$

$x = 3\ln 7$

g) $e^{x-4} = 6$

$x - 4 = \ln 6$

$x = \ln(6) + 4$

h) $4 - 4e^{5x} = 2$

$-4 \quad -4$

$-4e^{5x} = -2$

$e^{5x} = \frac{1}{2}$

$5x = \ln\frac{1}{2}$

$x = \frac{\ln\frac{1}{2}}{5}$

10) Graph the following. Start at 1 on the x-axis.

a) $y = \log_2(x - 1) + 1$ Right 1 up 1

b) $y = \log_3(x + 2) - 4$ left 2 down 4