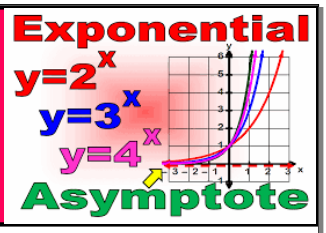
Unit 2

Exponents and Logarithms



2.8 Solving Exponential Equations with Non-Like Bases

Like Bases:

$4^x=64$

$4^x = 4^3$

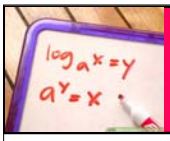
$x=3$

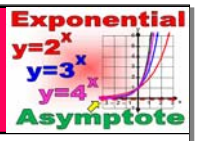
Non-Like Bases:

$3^x=5$

$\log_3 5 = x$ (exact)

$x = 1.46$ (approx.)





Ex.) Solve. Leave your answer as an exact value.

a) $\log 3^x = \log 5$

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

$\log_b c = \frac{\log_a c}{\log_a b}$

$x = \log_3 5$

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

$\log 5^{3x} = \log 3^{(2x-1)}$ * log both sides *

$3x\log 5 = (2x-1)\log 3$

$3x\log 5 = 2x\log 3 - \log 3$

$-2x\log 3 \quad -2x\log 3$

$3x\log 5 - 2x\log 3 = -\log 3$

$\frac{x(3\log 5 - 2\log 3)}{3\log 5 - 2\log 3} = \frac{-\log 3}{3\log 5 - 2\log 3}$

$x = \frac{-\log 3}{3\log 5 - 2\log 3}$

c) $3^{x+2} = 8^{2x-3}$

$\log 3^{(x+2)} = \log 8^{(2x-3)}$

$(x+2)\log 3 = (2x-3)\log 8$

$x\log 3 + 2\log 3 = 2x\log 8 - 3\log 8$

$-2\log 3 \quad -2x\log 8 - 2\log 3$

$-2x\log 8$

$x\log 3 - 2x\log 8 = -3\log 8 - 2\log 3$

$\frac{x(\log 3 - 2\log 8)}{(\log 3 - 2\log 8)} = \frac{-3\log 8 - 2\log 3}{\log 3 - 2\log 8}$

$x = \frac{(-3\log 8 - 2\log 3)}{(\log 3 - 2\log 8)}$

$x = \frac{-1(3\log 8 + 2\log 3)}{-1(2\log 8 - \log 3)}$ $\quad \frac{-1}{-1}$

d) $6(3^{x-2}) = 2^x$

$\log[6(3^{x-2})] = \log 2^x$

$\log 6 + \log 3^{(x-2)} = \log 2^x$

$\log 6 + (x-2)\log 3 = x\log 2$

$\log 6 + x\log 3 - 2\log 3 = x\log 2$

$\quad -x\log 3 \qquad\qquad -x\log 3$

$\log 6 - 2\log 3 = x\log 2 - x\log 3$

$\log 6 - 2\log 3 = x(\log 2 - \log 3)$

$\frac{\log 6 - 2\log 3}{\log 2 - \log 3} = x$

e) $\frac{8(3^{2x})}{8} = \frac{568}{8}$

$3^{2x} = 71$

$\log 3^{2x} = \log 71$

$\frac{2x \log 3}{2 \log 3} = \frac{\log 71}{2 \log 3}$

$x = \frac{\log 71}{2 \log 3}$

$\frac{\log_3 71}{2} = \frac{2x}{2}$

$x = \frac{\log_3 71}{2}$