

## 7.5 EXPONENTIAL AND LOGARITHMIC EQUATIONS

Ex: Solve  $4^x = 8^{x-1}$

$$4^x = 8^{x-1}$$

$$(2^2)^x = (2^3)^{x-1}$$

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

$$2x = 3x - 3$$

$$-x = -3$$

$$x = 3$$

Ex: Solve  $3^x = 7$

$$\log 3^x = \log 7$$

$$x \log 3 = \log 7$$

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

$$\approx \frac{.8451}{.4771} \approx 1.7712$$

Ex: Solve  $3^{2x-1} = 5$

$$\log 3^{2x-1} = \log 5$$

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

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

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

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

$$= \frac{\log 15}{\log 9}$$

$$\text{Ex: } \log(7x+1) = \log(x-2) + 1$$

$$\log(7x+1) - \log(x-2) = 1$$

$$\log\left(\frac{7x+1}{x-2}\right) = 1$$

$$10^1 = \frac{7x+1}{x-2}$$

$$10(x-2) = 7x+1$$

$$10x - 20 = 7x + 1$$

$$3x = 21$$

$$x = 7$$

## CHANGE OF BASE FORMULA

$$\log_b M = \frac{\log_c M}{\log_c b}$$

$$\begin{aligned} \text{Ex: } \log_4 7 &= \frac{\log 7}{\log 4} = \frac{\ln 7}{\ln 4} \\ &= \frac{\log_5 7}{\log_5 4} \end{aligned}$$

Ex: Solve  $\log(2x-2) = 4$

$$\log_{10}(2x-2) = 4$$

$$10^4 = 2x-2$$

$$10000 = 2x-2$$

$$\rightarrow 2x = 10002$$

$$x = 5001$$

Ex: Solve  $2 \log_5(3x) = 4$

$$2 \log_5(3x) = 4$$

$$\log_5(3x) = 2$$

$$5^2 = 3x$$

$$\rightarrow 25 = 3x$$

$$x = \frac{25}{3}$$

Ex:  $\ln(x-2) + \ln(2x-3) = 2 \ln x$

$$\ln[(x-2)(2x-3)] = \ln x^2$$

$$\ln(2x^2 - 7x + 6) = \ln x^2$$

$$2x^2 - 7x + 6 = x^2$$

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$x = 6, 1$$

$$x = 6$$

SINCE  $x=1$  IS NOT  
VALID