

## 7-3 Solving Exponential and Logarithmic equations

Objectives:

- I can solve exponential and logarithmic equations

add / subtraction	$\ln / e^{\wedge}$	$\log / 10^{\wedge}$	$\log_b / b^{\wedge}$
$\begin{array}{r} x - 5 = 10 \\ + 5 \quad + 5 \\ \hline x = 15 \end{array}$	$m e^{x \ln} = 5$ $x = 1.6$	$\log 10^x = 6$ $x = .778$	$\log_2 2^x = 9$ $x = 3.16$
$\begin{array}{r} x + 7 = 20 \\ - 7 \quad - 7 \\ \hline x = 13 \end{array}$	$\ln x = 7$ $x = 1096.6$	$\log x = 3$ $x = 1000$	$\log_3 x = 10$ $x = 59,049$

## Solving Graphically

$$275e^{0.06x} = 1000$$

$$y_1 = 275e^{.06x} \quad y_2 = 1000$$

$$x = 21.5$$

$$\frac{275e^{.06x}}{275} = \frac{1000}{275}$$

$$\ln e^{.06x} = \ln 3.636$$

$$\frac{.06x}{.06} = \frac{1.290}{.06}$$

$$x = 21.516$$

Solve the following equation graphically

$$\frac{5e^x}{5} = \frac{8}{5}$$

$$\cancel{\ln e^x} = \ln 1.6$$

$$x = .470$$

## Solving Equations Algebraically

- get logarithm/exponent by itself

~~- re-write in logarithmic/exponential form~~

~~- use the property of equality~~

- use the inverse property

~~- use properties to condense to one logarithm~~

Solve the following equations

$$\frac{10}{5} = \frac{5e^{4x}}{5}$$

$$\ln 2 = \frac{4x}{4}$$

$$\frac{.693}{4} = \frac{4x}{4}$$

$$.173 = x$$

$$5^x - 4 = 7$$

$$+4 \quad +4$$

$$\log_5 5^x = \log_5 11$$

$$x = 1.489$$

Solve the following equations

$$2e^{x-1} + 5 = 80$$

~~-5 -5~~

~~$$2e^{x-1} = \frac{75}{2}$$~~

~~$$\ln e^{x-1} = \ln 37.5$$~~

~~$$x - 1 = 3.624$$~~

$$x = 4.624$$

~~$$\log_6 6^{3x} = 12$$~~

$$\frac{3x}{3} = \frac{1.386}{3}$$

$$x = .462$$

$$\cancel{e} \ln(x+3) = 7$$

$$x+3 = 1096.633$$

$$x = 1093.633$$

$$\cancel{2} \log_2(4x+1) = 3$$

$$4x+1 = 8$$

$$4x = 7$$

$$x = 1.75$$

Suppose that \$250 is deposited into an account that pays 4.5% compounded quarterly. Solve for  $t$  to find how long it will take for the account to contain at least \$500.

$$A(t) = P \left( 1 + \frac{r}{n} \right)^{nt}$$

$$500 = 250 \left( 1 + \frac{.045}{4} \right)^{4t}$$

$$\frac{500}{250} = \frac{250}{250} (1.01125)^{4t}$$

$$\log_{1.01125} 2 = \frac{1.01125^{4t}}{1.01125^{4t}}$$

$$\frac{63.359}{4} = t$$

$$\boxed{15.839 = t}$$



Suppose that you deposit \$2500 into an account that earns a 4.5% interest rate. How long will it take to reach \$4200.

$$4200 = 2500(1.045)^t$$

$$\frac{4200}{2500} = \frac{2500}{2500}(1.045)^t$$

$$\log_{1.045} 1.68 = \frac{\log_{1.045} 4200}{\log_{1.045} 2500} = t$$

$$11.786 = t$$

Solve the following

$$\ln(x + 12) = \underline{\underline{3}} \ln 2$$

$$\ln(x + 12) = \ln 2^3$$

$$\cancel{e^{-1}} \ln(x + 12) = \cancel{e^{-1}} \ln 8$$

$$x + 12 = 8$$

$$\boxed{x = -4}$$

Solve the following

$$\log x^4 = 2$$

$$4 \ln(x + 7) - 5 = 1$$

Solve the following

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

$$\log_4(1 - x) = 1$$