

$$\cancel{\log_b} b^r = r$$

$$\cancel{b^{\log_b}} M = M$$

$$\textcircled{3} \quad \cancel{e^{\ln}}(2) = 2$$

$$\begin{aligned} \textcircled{15} \quad & \textcircled{18} \log x + \textcircled{9} \log y - \log 10 \\ & \log x^{18} + \log y^9 - \log 10 \\ & \log \left(\frac{x^{18} y^9}{10} \right) \end{aligned}$$

9-3 Solving Exponential and Logarithmic equations

Objectives:

I can solve exponential and logarithmic equations both graphically and algebraically.

Solving Graphically

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

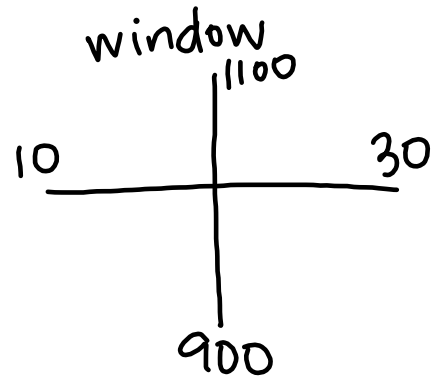
$$y_1 = 275e^{0.06x} \quad y_2 = 1000$$

$$x = 21.52$$

$$10^{2x} = 1500$$

$$y_1 = 10^{2x} \quad y_2 = 1500$$

$$x = 1.59$$



Inverses

Addition/Subtraction	Natural Log/ e^{\wedge}	Common Log/ 10^{\wedge}	Log base b/b^{\wedge}
$x - 5 = 10$ $\quad +5 \quad +5$ <hr/> $x = 15$	$e^x = 5$ $\ln(e^x) = \ln(5)$ $x = \ln(5)$	$10^x = 100$ $\log(10^x) = \log(100)$ $x = \log(100)$	$2^x = 16$ $\log_2(2^x) = \log_2(16)$ $x = \log_2 16$
$x + 7 = 21$ $\quad -7 \quad -7$ <hr/> $x = 14$	$(\ln x) = 7$ $e^{\ln x} = e^7$ $x = e^7$	$\log x = 3$ $10^{\log x} = 10^3$ $x = 10^3$	$\log_3 x = 4$ $3^{\log_3 x} = 3^4$ $x = 3^4$

Solve the following equations

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

$$\ln(2) = \ln(e^{4x})$$

$$\frac{\ln(2)}{4} = \frac{4x}{4} = 0.17$$

$$\frac{\log_3(2x-4)}{3} = 4$$

$$2x-4 = 3^4$$

$$2x-4 = 81$$

$$\frac{2x}{2} = \frac{85}{2}$$

$$x = 42.5$$

$$\frac{5^{x-1} - 4}{+4 + 4} = 7$$

$$\log_5(5^{x-1}) = \log_5(11)$$

$$x-1 = \log_5(11)$$

$$x = \frac{\log_5(11) + 1}{\frac{\log(11)}{\log(5)} + 1} = 2.49$$

$$6^{3x} = 12$$

$$\log_6(6^{3x}) = \log_6(12)$$

$$\frac{3x}{3} = \frac{\log_6(12)}{3}$$

$$\frac{\log(12)}{\log(6)} / 3 = 0.46$$

Solve the following

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

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

$$\ln(x+12) = \ln(8)$$

$$\frac{x+12}{-12 -12} = 8$$

$$x = -4$$

$$\log x^4 = 2$$

$$4 \cdot \log x = 2$$

$$\log x = 0.5$$

$$x = 10^{0.5}$$

$$\log x^4 = 2$$

$$\sqrt[4]{x^4} = \sqrt[4]{100}$$

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

$$\frac{4\ln(x+7)}{4} = \frac{6}{4}$$

$$\ln(x+7) = 1.5$$

$$x+7 = e^{1.5}$$

$$x = e^{1.5} - 7 = -2.52$$

Solve the following

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

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

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

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

$$500 = 250 \left(1 + \frac{0.045}{4}\right)^{4t}$$

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

$$\log_{1.01125} 2 = \frac{\log 2}{\log 1.01125}$$

How long will it take for a \$250 initial investment in an account that pays 4.5% compounded continuously to grow to \$750?

Comparing acidity: $pH = -\log[H^+]$

$[H^+]$ = hydrogen-ion concentration

Vinegar has a pH of 2.4. What is its hydrogen ion concentration?

Baking soda has a pH of 8.4. What is its hydrogen ion concentration?

Which has a higher hydrogen ion concentration?