Exponential Equation

Range: $y>0$

Domain: Any real number

$y = b^x$

$b>0,\ b\neq 1$

Logarithmic Equation

$\log_b y = x$

Range: Any real number

Domain: Pos #'s only

$b>0,\ b\neq 1$

You can only input positive numbers to a logarithm and you can get anything out of a logarithm.

Solve. $10^x = 800$

$\log 800 = x$

$x = 2.90$

Solve. $\frac{3 \cdot 10^{2x}}{3} = \frac{45}{3}$

$10^{2x} = 15$

$\frac{\log 15}{2} = \frac{2x}{2}$

$x = .59$

Solve. $10^{x+7} - 51 = 123$

$+51 \quad +51$

$10^{x+7} = 174$

$\text{Log } 174 = x+7$

do Log174 then subtract 7.

$x = -4.76$

If the LOG button the calculator means Common Logarithm (Log_{10})

what does LN mean? Natural Logarithm

It stands for Log base e.

$Log_e = LN$

This can also be written in lower case: ln

Evaluate each:

1. ln1 = 0

$e^? = 1$

2. lne = 1

$e^? = e$

3. $\ln(e^5) = 5$

$e^? = e^5$

Solve.

$e^{3x} - 10 = 130$

+10 +10

$e^{3x} = 140$

$\ln 140 = 3x$ do ln140 then divide by 3.

$x = 1.65$

Solve. $9^x = 100$

1. Write into Logarithmic form:

$Log_9 100 = x$

But I still don't know how to find this value!!

2. Apply the Change of base formula.

See next page

$\frac{}{\log 9}$

Property — **Change of Base Formula**

For any positive numbers, M, b, and c, with $b \neq 1$ and $c \neq 1$,

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

$\log_9 100 = x$ ⟶ $\frac{\log 100}{\log 9}$ or $\frac{\ln 100}{\ln 9}$ $= 2.10$

Solve each equation. Round to the nearest hundredth as necessary.

$4^x - 3 = 50$

$+3 \quad +3$

$4^x = 53$ ⟶ $\log_4 53 = x$

$\frac{\ln 53}{\ln 4} = x$

$x = 2.86$

Solve.

$2(7^{x+1}) + 5 = 97$

$-5 \quad -5$

$\frac{2(7^{x+1})}{2} = \frac{92}{2}$

$7^{x+1} = 46$ ⟶ $\log_7 46 = x+1$

$\frac{\ln 46}{\ln 7} = x+1$

$x = \frac{\ln 46}{\ln 7} - 1$

$x = .97$

The number of invasive species of fish in a lake is increasing 12.7% each year. The last time a count was made showed that there were 680 of that species in the lake. Find the number of years, to the nearest hundredth, it will take for there first to be 10,000 of these fish in the lake.

$100\% + 12.7\% = 112.7\%$

$\frac{680}{680}(1.127)^x = \frac{10{,}000}{680}$

$1.127^x = \frac{1000}{68}$

$\log_{1.127}\left(\frac{1000}{68}\right) = x$

$\frac{\log\left(\frac{1000}{68}\right)}{\log 1.127} = x \quad 22.48$

You invest $20,000 in an account that pays 7% annual interest.
If interest is compounded monthly find the number of years,
to the nearest hundredth, that it will take to end up with $500,000.

$$\frac{20000\left(1+\frac{.07}{12}\right)^{12t}}{20{,}000} = \frac{500{,}000}{20{,}000}$$

$$\left(1+\frac{.07}{12}\right)^{12t} = 25$$

$$\log_{1+\frac{.07}{12}}(25) = 12t$$

$$\frac{\log 25}{\log\left(1+\frac{.07}{12}\right)} = 12t$$

calculate the Left side then ÷ by 12.

$t = 46.12 \text{ yrs}$