SOLVE EXPONENTIAL EQUATIONS

Exponential Equations

Equations Requiring Log

Equations Requiring LN

If you can get the same base on both sides

To solve exponential equations:

1. Rewrite the bases as the same number $\boxed{base^{exp} = base^{exp}}$
2. Use the power to the power property to simplify the exponents on each side
3. Set the exponents equal to each other and solve

EXAMPLE 1:

$6^{2b} = 6^{b-1}$

same base on each side so set exponents equal to each other

$2b = b-1$

$b = -1$

EXAMPLE 2:

$\left(\frac{1}{25}\right)^{3n} = 625$

$25^{-1(3n)} = 25^{2}$

$-1(3n) = 2$

$-3n = 2$

$n = -2/3$

Example 3:

$5^{3x} = \frac{1}{125}$

$5^{3x} = 5^{-3}$

$3x = -3$

$x = -1$

Example 4:

$\left(\frac{1}{9}\right)^{-n-1} = 81^{-n}$

$9^{-1(-n-1)} = 9^{2(-n)}$

$-1(-n-1) = 2(-n)$

$n+1 = -2n$

$\frac{1}{-3} = \frac{-3n}{-3}$

$n = -\frac{1}{3}$

Exponential Equations

Equations Requiring Log

Equations Requiring LN

When you can't get the same base on each side

Equations Requiring Logs:

1. Isolate the base with its exponent $base^{exp} = \#$
2. Rewrite into log form $\log_{base} \# = exp$
3. Solve by using change of base

*to enter in calculator $\log(\#) \div \log(base)$ or shortcut Math A: LOGBASE

Example 5:

$13^m = 2$

exp. # base

$\log_{13} 2 = m$ Solve in calculator $\log \# \div \log base$

Calc: $\log 2 \div \log 13 = m$

$m \approx .270$

Example 6:

$2^{-5.6b} - 5 = 28$

exp b

$+5 \quad +5$

$2^{-5.6b} = 33$ Isolate $b^{exp} = \#$

$\log_2 33 = -5.6b$ Rewrite $\log_b \# = exp$

Calc $\log 33 \div \log 2 = -5.6b$ Solve

calc Ans $\div -5.6 = b$

$b \approx -.901$

Example 7:

$20^{5n+5} - 3 = 93$

$+3 \quad +3$

$20^{5n+5} = 96$

exp b #

$\log_{20} 96 = 5n+5$

$\log 96 \div \log 20 = 5n+5$

-5

Ans $-5 = 5n$

Ans $\div 5 = n$

Keep decimals in calc

$n = -.695$

Example 8:

$-3 \cdot 8^{k+0.1} = -81$

exp. b

$-3 \quad -3$

$8^{k+0.1} = 27$ Isolate $base^{exp}$

$\log_8 27 = k+0.1$ Rewrite $\log_b exp = \#$

Calc

Ans $- 0.1 = k$

$k = 1.485$

Equations Requiring Log

Equations Requiring LN

Equations Requiring LN:

1. Isolate the base with its exponent
2. Rewrite into log form
3. Solve by using LN

★ Remember $\log_e \rightarrow \ln$

EXAMPLE 7:

$e^{6m} = 48$ #

exp

base

$\log_e 48 = 6m$

$\ln 48 = 6m$

$\frac{\ln 48}{6} = \frac{6m}{6}$

$m \approx .645$

Example 8:

$6e^{a+2.7} = 47$

$\frac{6e^{a+2.7}}{6} = \frac{47}{6}$ #

exp

b

$\ln \frac{47}{6} = a + 2.7$

-2.7

Ans - 2.7

$a \approx -.642$

EXAMPLE 9:

$e^{-7x-2} - 7 = 62$

$+7 \quad +7$

$e^{-7x-2} = 69$

$\log_e 69 = -7x - 2$

$\ln 69 = -7x - 2$

$+2$

calc.

Ans + 2 = -7x

Ans ÷ -7 = x

$x = -.891$

Example 10:

$4e^{0.8n+5} + 6 = 104$

$-6 \quad -6$

$\frac{4e^{0.8n+5}}{4} = \frac{98}{4}$

exp

$e^{0.8n+5} = 24.5$ #

b

$\ln 24.5 = 0.8n + 5$

Ans - 5

Ans ÷ 0.8

$n = -2.252$

Equations Requiring LN