# Exponential Equations

$\left(\frac{1}{9}\right)^{4x} = 27^{x+2}$

Make Common Bases!

$\left(\frac{1}{3^2}\right)^{4x} = (3^3)^{x+2}$

$(3^{-2})^{4x} = (3^3)^{x+2}$

$3^{-8x} = 3^{3x+6}$

$-8x = 3x + 6$

$+8x \quad +8x$

$-6 = 11x$

$\boxed{\frac{-6}{11} = x}$

* Solve exp. equations
* e!
* Intro to logs
* Evaluate logs
* Graph logs??

$\sqrt[3]{4^x} = \left(\frac{1}{8}\right)^{5-x}$

$\sqrt[3]{2^{2x}} = \left(\frac{1}{2^3}\right)^{5-x}$

$2^{\frac{2x}{3}} = (2^{-3})^{5-x}$

$2^{\frac{2x}{3}} = 2^{-15+3x}$

$\frac{2x}{3} = -15 + 3x$

$2x = -45 + 9x$

$45 = 7x$

$\frac{45}{7} = x$

Make common bases!

$e \approx 2.718$

$2e^2 \cdot e^5 = 2e^7$

$\frac{7e^7}{2^{\cancel{8}}\, e^{9-7}} = \frac{1}{7e^2}$

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# LOGARITHMS -

Used to solve for exponents

astronomer John Napier 1614

Exp Func

$y = b^x$

$b > 0, b \neq 1$

Logarithms - inverse of an exp func (switch x + y)

$y = b^x$

$x = b^y$

$y = \log_b x$

Exponential Form

$y = b^x$

Logarithmic Form

$x = \log_b y$

$2^5 = 32$ $\quad$ $\log_7 49 = 2$

$5 = \log_2 32$ $\quad$ $7^2 = 49$

**Logarithms represent EXPONENTS!**

$5^3 = 125$

$3 = \log_5 125$

$\log_7 49 = 2$

$7^2 = 49$

$8^{\log_8 4} = 4$

$\log_6 36 = \log_6 6^2 = 2$

$\log_2 16 = \log_2 2^4 = 4$

$\log_3 \sqrt[5]{3^1} = \log_3 3^{1/5} = \frac{1}{5}$

$\log_{12} \frac{1}{144} = \log_{12} \frac{1}{12^2} = \log_{12} 12^{-2} = -2$

$\log_{11} \sqrt[3]{\frac{1}{121}} = \log_{11} \sqrt[3]{\frac{1}{11^2}}$

$= \log_{11} \sqrt[3]{11^{-2}}$

$= \log_{11} 11^{-2/3} = -2/3$

Make common bases!

| Common Logs | $3.25 \times 10^7$ | Natural Logs |
|---|---|---|
| $\log_{10} x = \log x$ | | $\log_e x = \ln x$ |

$\log 1000 = \log_{10} 10^3 = 3$

$\log 0.01 = \log_{10} 10^{-2} = -2$

$\ln e^8 = \ln_e e^8 = 8$

$\ln e^{2.63} = 2.63$

$e^{\ln 17} = 17$

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