Slide 1 (Kickoff)

Lesson 60 Objective: SWBAT solve exponential equations using logs.

Kickoff

1) Condense each of the following:

a) $\dfrac{\log_7 x}{3} + \dfrac{\log_7 y}{3} + \dfrac{\log_7 z}{3}$

b) $2(\log 2x - \log y) - (\log 3 + 2\log 5)$

2) Expand each of the following:

a) $\log_3\left(z^4\sqrt{x}\right)$

b) $\log_8\left(\dfrac{a}{b^4}\right)$

$4\log_3 z + \tfrac{1}{2}\log_3 x$

$5\log_8 a - 20\log_8 b$

$\log\dfrac{\left(\frac{2x}{y}\right)^2}{75}$ $\log\dfrac{\left(\frac{2x}{y}\right)^2}{75}$

① a) $\dfrac{\log_7 x}{3} + \dfrac{\log_7 y}{3} + \dfrac{\log_7 z}{3}$

$\dfrac{\log_7 xyz}{3} = \tfrac{1}{3}\log_7 xyz$

$\log_7 (xyz)^{1/3}$

$\log_7 \sqrt[3]{xyz}$

$\log\dfrac{\left(\frac{2x}{y}\right)^2}{75} \rightarrow \dfrac{\frac{2^2x^2}{y^2}}{75} = \dfrac{\frac{4x^2}{y^2}}{\frac{75}{1}}$

$\boxed{\log\dfrac{4x^2}{75y^2}} \leftarrow \dfrac{4x^2}{y^2}\cdot\dfrac{1}{75}$

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Recall: Solve for x.

1) $3^{3x+4} = 3^{x+10}$

2) $2^{x+6} = 8^{x-3}$

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Using Logs to Solve Exponential Equations

Recall using common bases to solve for a variable in the exponent of an equation...

Common Bases
$64^x = 16$

$(2^6)^x = 2^4$

$6x = 4$

$x = \dfrac{2}{3}$

$(4^3)^x = 4^2$

$3x = 2$

$x = 2/3$

Using Logs
$64^x = 16$

$\log 64^x = \log 16$

$\dfrac{x\log 64}{\log 64} = \dfrac{\log 16}{\log 64}$

$x = 2/3$

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When you __can't__ find a __common__ base, then you must use logs to solve!

Steps:
1) Isolate the base with the variable in the exponent.
2) Log both sides
3) Drop it like it's hot!
4) Solve

Examples: Solve each equation to the nearest hundredth.

1) $3^x = 5$

$\log 3^x = \log 5$

$\dfrac{x\log 3}{\log 3} = \dfrac{\log 5}{\log 3}$

$x = 1.46$

2) $12(12^x) = 500$

$\dfrac{12(12^x)}{12} \quad \dfrac{500}{12}$

$\log 12^x \quad \log\dfrac{125}{3}$

$\dfrac{x\log 12}{\log 12} = \dfrac{\log\frac{125}{3}}{\log 12}$

$\boxed{x = 1.50}$

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3) $6^{2x} - 3 = 100$

$\dfrac{+3 \quad +3}{6^{2x} = 103}$

$\dfrac{2x\log 6}{2\log 6} = \dfrac{\log 103}{(2\log 6)}$

$x = 1.29$

4) $5e^{2x} = 50$

$\dfrac{5e^{2x}}{5} = \dfrac{50}{5}$

$\ln e^{2x} = \ln 10$

$\dfrac{2x\ln e}{2} = \dfrac{\ln 10}{2}$

$x = 1.15$

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5) $4 + e^{\cdot 3x} = 9$

$\dfrac{-4 \quad -4}{e^{\cdot 3x} = 5}$

$\dfrac{.3x\ln e}{.3} = \dfrac{\ln 5}{.3}$

$x = 5.36$

6) $2(3)^{2x+1} = 30$

$\dfrac{2(3)^{2x+1}}{2} = \dfrac{30}{2}$

$3^{2x+1} = 15$

$\dfrac{(2x+1)\log 3}{\log 3} = \dfrac{\log 5}{\log 3}$

Wait: $\dfrac{(2x+1)\log 3}{\log 3} = \dfrac{\log 15}{\log 3}$

$2x+1 = 2.4649738$

$\dfrac{-1 \quad -1}{}$

$\dfrac{2x}{2} = \dfrac{1.4649738}{2}$

$\boxed{x = .73}$