Warm Up

1. If $\log_r x = 3$, $\log_r y = 2$ and $\log_r z = -12$, then evaluate $\log_r\left(\frac{\sqrt[4]{z}}{x^3 y^5}\right)$

$\log_r z^{\frac{1}{4}} - \log_r x^3 - \log_r y^5$

$\frac{1}{4}\log_r z - 3\log_r x - 5\log_r y$

$\frac{1}{4}(-12) - 3(3) - 5(2)$

$= -3 - 9 - 10$

$= -22$

$r^3 = x \quad r^2 = y \quad r^{-12} = z$

$\log_r\left(\frac{z^{1/4}}{x^3 y^5}\right)$

$\log_r\left(\frac{(r^{-12})^{1/4}}{(r^3)^3 (r^2)^5}\right)$

$\log_r\left(\frac{r^{-3}}{r^9 r^{10}}\right)$

$\log_r\left(\frac{r^{-3}}{r^{19}}\right) = \log_r r^{-22}$

$= -22$

2. Solve the following: $\log_3(x+3)-2=\log_3(x-5)$

$\log_3(x+3)-\log_3(x-5)=2$

$\log_3\left(\frac{x+3}{x-5}\right)=2$

$(x-5)\,3^2=\frac{x+3}{x-5}(x-5)$ or $\log_3\left(\frac{x+3}{x-5}\right)=\log_3 3^2$

$9x-45=x+3$

$\frac{8x}{8}=\frac{48}{8}$

$x=6$ ← Verified ✓

Exponential Equations

What if both sides can not be written to powers of a common base?

Example: $3^x = 30$

What would this equation be if expressed as a logarithmic statement?

?

Can this be determined using a calculator?

Here is a new method to solve exponential equations...

- Particularly effective when unable to express both sides as a power of a common base

Key property of equations...

- As long as you perform the same operation to BOTH sides of an equation, equality will be maintained

$3^x = 30$

Take the common logarithm of both sides...or natural logarithm

Why base 10 or base "e" ?

Example: $6^{2x-3} = 8^{x+1}$

$\log 6^{2x-3} = \log 8^{x+1}$

$(2x-3)\log 6 = (x+1)\log 8$

$x(2\log 6) - 3\log 6 = x\log 8 + \log 8$

$x(2\log 6) - x\log 8 = \log 8 + 3\log 6$

$\frac{x(2\log 6 - \log 8)}{2\log 6 - \log 8} = \frac{\log 8 + 3\log 6}{2\log 6 - \log 8} = \frac{\log(8 \cdot 6^3)}{\log(6^2/8)}$

$x =$

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(log(8)+3log(6))
      3.237543738
Ans/(2log(6)-log
(8))
      4.956340655
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Example: $\dfrac{2^{4x}}{6^{2x+5}} = 5^{x-1}$

Practice Sheet #6

$\log\left(\dfrac{2^{4x}}{6^{2x+5}}\right) = \log 5^{x-1}$

$\log 2^{4x} - \log 6^{2x+5} = \log 5^{x-1}$

$4x\log 2 - (2x+5)\log 6 = (x-1)\log 5$

$4x\log 2 - 2x\log 6 - 5\log 6 = x\log 5 - \log 5$

$\dfrac{x(4\log 2 - 2\log 6 - \log 5)}{4\log 2 - 2\log 6 - \log 5} = \dfrac{5\log 6 - \log 5}{4\log 2 - 2\log 6 - \log 5}$

$x =$

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(5log(6)-log(5))
/(4log(2)-2log(6
)-log(5))
      -3.036463481
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