Warm Up

Solve:

a) $log_5(x+2) + log_5(x-2) = 1$

b) $log_2(log_2(x)) = 1$

c) $log_{10}(x+3) + log_{10}(x) = 1$

Check your understanding

solve: $log_5(x+2) + log_5(x-2) = 1$

$\log_5(x^2 - 2x + 2x - 4) = 1$

$\log_5(x^2 - 4) = 1$

$5^1 = x^2 - 4$

$+4 \qquad +4$

$5 = x^2 - 4$

$\sqrt{9} = \sqrt{x^2}$

$x = \pm 3$ and -3

Check your understanding

Solve: $\log_2(\log_2(x)) = 1$

$2^1 = \log_2(x)$

$2 = \log_2(x)$

$2^2 = x$

$4 = x$

Check your understanding

Solve: $log_{10}(x + 3) + log_{10}(x) = 1$

$\log_{10}(x^2 + 3x) = 1$

$10^1 = x^2 + 3x$

$10 = x^2 + 3x$

$0 = x^2 + 3x - 10$

$(x+5)(x-2) = 0$

~~$x = -5$~~ and $x = 2$

Exponential Equations

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

Example: $3^x = 30$

$3^x = 27 \rightarrow 3^x = 3^3$ $x = 3$

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

?

$\log_3 30 = x$

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" ?

Exponential Equations

$$3^x = 30$$

$$\log_{10} 3^x = \log_{10} 30$$

$$x \log_{10} 3 = \log_{10} 30$$

$$\frac{x \log_{10} 3}{\log_{10} 3} = \frac{\log_{10} 30}{\log_{10} 3}$$

$$x = 3.095$$

Examples

$2^4 = 16$ $2^5 = 32$

B. 4.89

J 4.91

G = 4.90

M = 4.75

J = 4.87

1) $2^x = 30$

$\log_{10} 2^x = \log_{10} 30$

$x \log_{10} 2 = \log_{10} 30$

$x = \dfrac{\log_{10} 30}{\log_{10} 2}$

$x = 4.907$

2) $10^{2x} = 52$

$\log_{10} 10^{2x} = \log_{10} 52$

$2x \log_{10} 10 = \log_{10} 52$

$2x(1) = \log_{10} 52$

$\dfrac{2x}{2} = \dfrac{\log_{10} 52}{2}$

$x = 0.858$

Now Your Turn:

a) $12^x = 13$

$\log_{10} 12^x = \log_{10} 13$

$x \log_{10} 12 = \log_{10} 13$

$x = \frac{\log_{10} 13}{\log_{10} 12}$

$x = 1.03$

b) $\frac{3(2^{x-4})}{3} = \frac{360}{3}$

$2^{x-4} = 120$

$\log_{10} 2^{x-4} = \log_{10} 120$

$x-4 \log_{10} 2 = \log_{10} 120$

$x-4 = \log_{10} 120 / \log_{10} 2$

$x-4 = 6.9$

$x = 6.9+4$

c) $10^{x+5} - 8 = 60$

d) $\frac{4000}{2+7^{2x}} = 5$