Warm Up Monday May 18, 2015

1) $2^x = 38$

$\log_2 38 = x$

5.248

2) $3^x = 65$

$\log_3 65 = x$

3.800

3) $5^x = 284$

$\log_5 284 = x$

3.510

4) $4^x + 6 = 90$

$4^x = 84$

$\log_4 84 = x$

3.196

5) $3^x - 2 = 45$

$3^x = 47$

$\log_3 47 = x$

3.505

6) $2 * 6^x = 198$

$6^x = 99$

$\log_6 99 = x$

2.565

1) $2^x = 16$ 4

2) $3^x = 21$ 2.77

3) $5^x = 645$ 4.02

4) $4^x + 5 = 43$ 2.62

5) $3^x - 8 = 99$ 4.25

6) $3 * 6^x = 396$ 2.73

7) $4^{x+2} = 24$ 0.29

$\log_4 24 = x+2$

$2.29\ldots = x+2$

$\text{Ans} - 2 = x$

8) $2 * 5^{x-5} + 4 = 250$ 7.99

9) $5^{x+2} = 7^x$ 9.57

$\log_5 7^x = x+2$

$x\log_5 7 = x+2$

$x\log_5 7 - x = 2$

10) $2^{x+5} = 8^{x-1}$ 4

$x(\log_5 7 - 1) = 2$

$x = \dfrac{2}{\log_5 7 - 1}$

10) $2^{x+5} = 8^{x-1}$

$\log_2 8^{x-1} = x+5$

$(x-1)\log_2 8 = x+5$

$x\log_2 8 - \log_2 8 = x+5$

$x\log_2 8 - x = 5 + \log_2 8$

$x(\log_2 8 - 1) = 5 + \log_2 8$

$x = \dfrac{5 + \log_2 8}{\log_2 8 - 1} = 4$

OR

$2^{x+5} = (2^3)^{x-1}$

$2^{x+5} = 2^{3x-3}$

$x+5 = 3x-3$

Unit 8: Exponential & Logarithmic Functions

Properties of Logarithms

Equality Property	If $\log_b x = \log_b y$, then $x = y$
Product Property	$\log_b xy = \log_b x + \log_b y$
Quotient Property	$\log_b x/y = \log_b x - \log_b$
Power Property	$\log_b x^p = p \log_b x$

Logarithmic Equations

We will cover 3 ways to get rid of the logs in an equation to isolate the variable.

Method 1 -- Evaluating

When?
There is a log with only numbers

Ex. $\log_4 256 = x$ $\quad \frac{\log 256}{\log 4} = x = 4$

Steps... Change of Base to Evaluate

Method 2 -- Rewrite

When?
There is a log or multiple logs on ONE side of the equation

Ex. $\log_3 x + \log_3 4 = 4$

① $\log_3 4x = 4$

② $3^4 = 4x$

③ $81 = 4x$

④ $x = 20.25$

Steps... Condense the side with logs
Rewrite as an exponential

Method 3 -- Drop

When?
There is a log or multiple logs on BOTH sides of the equation

Ex. $\log_2 x + \log_2 5 = 2\log_2 6$

$\log_2 5x = \log_2 6^2$

$5x = 36$

$x = 7.2$

Steps... Condense both sides
Drop the logs and solve

* one log on each side

Solve each equation.

7) $\log_x 64 = 3$

$x^3 = 64$

$x = 64^{1/3}$

$x = 4$

8) $\log_4 (2x - 1) = \log_4 16$

$2x - 1 = 16$

$2x = 17$

$x = 8.5$

9) $\log_4 4^8 = x$

$\frac{\log(4^8)}{\log 4} = x$

$x = 8$

10) $\log_{3x} 4 = -2$

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

$3x = 4^{-1/2}$

$3x = 0.5$

$x = 0.167$

Example: Solve for x.

a. $\log_3 5 + \log_3 x = \log_3 10$

$\log_3 5x = \log_3 10$

$5x = 10$

$x = 2$

① Factor
② Graph
③ Formula

Mistake

$5 + x = 10$

$x = 5$

b. $\log_2 x + \log_2 (x + 2) = 3$

$\log_2 (x^2 + 2x) = 3$

$2^3 = x^2 + 2x$

$0 = x^2 + 2x - 8$

$0 = (x + 4)(x - 2)$

$x \neq -4$

$x = 2$

c. $\log_{10} 16 - \log_{10} 2x = \log_{10} 2$

$\log_{10} \frac{16}{2x} = \log_{10} 2$

$\frac{16}{2x} = 2$

$16 = 4x$

$\boxed{x = 4}$

d. $\log_8 48 - \log_8 w = \log_8 4$

$\log_8 \frac{48}{w} = \log_8 4$

$\frac{48}{w} = 4$

$48 = 4w$

$\boxed{w = 12}$

e. $4 \log_2 x + \log_2 5 = \log_2 405$

$\log_2 x^4 + \log_2 5 = \log_2 405$

$\log_2 5x^4 = \log_2 405$

$5x^4 = 405$

$x^4 = 81$

$x = 81^{1/4}$

$\boxed{x = 3}$

f. $3\log_2 x - 2\log_2 5x = 2$

$\log_2 x^3 - \log_2 (5x)^2 = 2$

$\log_2 \frac{x^3}{25x^2} = 2$

$2^2 = \frac{x^3}{25x^2}$

$4 = \frac{x}{25}$

$\boxed{x = 100}$

g. $\log_3(4x + 5) - \log_3(3 - 2x) = 2$

$\log_3 \frac{4x+5}{3-2x} = 2$

$3^2 = \frac{4x+5}{3-2x}$

$9(3-2x) = 4x+5$

$27 - 18x = 4x + 5$

$-5 \qquad +18x$

$22 = 22x$

$\boxed{x = 1}$