AGS 3 Name: _____ Period: ____ Date: _____

Notes 2.4 – Using Log Properties

Warmup – Solve for x by using equal bases

Examples: $3^x = 81 \rightarrow 3^x = 3^4 \rightarrow x = 4$

$\log_2 x - \log_2 5 = 0 \rightarrow \log_2 x = \log_2 5 \rightarrow x = 5$

1. $3^{x+4} = 243$

$3^{x+4} = 3^5$

$x + 4 = 5$

$\boxed{x = 1}$

2. $\left(\frac{1}{2}\right)^x = 8$

$\frac{1}{2}^x = \frac{1}{2}^{-3}$

$\boxed{x = -3}$

3. $\left(\frac{3}{4}\right)^x = \frac{27}{64}$

$\boxed{x = 3}$

4. $\log_2 x - \log_2 13 = 0$

$\log_2 x = \log_2 13$

$\boxed{x = 13}$

5. $\log_2(2x - 4) - \log_2 8 = 0$

$\log_2(2x-4) = \log_2 8$

$2x - 4 = 8$

$2x = 12$

$\boxed{x = 6}$

6. $\log_2(x + 2) - \log_2 9x = 0$

$\log_2(x+2) = \log_2 9x$

$x + 2 = 9x$

$2 = 8x$

$\boxed{x = \frac{1}{4}}$

7. $\frac{\log 2x}{\log 14} = 1$

$\log 2x = \log 14$

$2x = 14$

$\boxed{x = 7}$

8. $\frac{\log(5x-1)}{\log 29} = 1$

$\log(5x-1) = \log 29$

$5x - 1 = 29$

$5x = 30$

$\boxed{x = 6}$

9. $\frac{\log 5^{(x-2)}}{\log 625} = 1$

$\log 5^{x-2} = \log 625$

$5^{x-2} = 5^4$

$x - 2 = 4$

$\boxed{x = 6}$

Write the three log properties that we learned last class.

$\log_b mn = \log_b m + \log_b n$

$\log_b \frac{m}{n} = \log_b m - \log_b n$

$\log_b m^n = n \log_b m$

Investigation – Using log properties to find values

Rewrite each value as a product of 2 or more values.

6 → $2 \cdot 3$ 15 → $3 \cdot 5$ 20 → $2 \cdot 2 \cdot 5$

Given: $\log_2 3 \approx 1.585$
$\log_2 5 \approx 2.322$
$\log_2 7 \approx 2.807$

a. $\log_2 9 \approx$ 3.17

$\log_2 3^2$

$2 \cdot \log_2 3$

$2(1.585)$

b. $\log_2 10 \approx$ 3.322

$\log_2 (2 \cdot 5)$

$\log_2 2 + \log_2 5$

$1 + 2.322$

c. $\log_2 12 \approx$ 3.585

$\log_2 (2^2 \cdot 3)$

$2 \cdot \log_2 2 + \log_2 3$

$2(1) + 1.585$

d. $\log_2 \left(\frac{7}{3}\right) \approx$ 1.222

$\log_2 7 - \log_2 3$

$2.807 - 1.585$

e. $\log_2 \left(\frac{30}{7}\right) \approx$ 2.1

$\log_2 30 - \log_2 7$

$\log_2 (2 \cdot 3 \cdot 5) - \log_2 7$

$\log_2 2 + \log_2 3 + \log_2 5 - \log_2 7$

$1 + 1.585 + 2.322 - 2.807$

f. $\log_2 486 \approx$ 8.925

$\log_2 (2 \cdot 3^5)$

$\log_2 2 + 5 \cdot \log_2 3$

$1 + 5(1.585)$

Are there any other values needed 2 to calculate any value of log base 2?

$\log_2$ (any prime #)

Use rewriting with log properties to determine if the two expressions are equivalent.

g. $\log_4 5 - \log_4 x = \log_4\left(\frac{5}{x}\right)$

$= \log_4 5 - \log_4 x$

h. $\log 3 - \log x - \log x = \log\left(\frac{3}{x^2}\right)$

$= \log 3 - 2 \cdot \log x$

$= \log 3 - \log x - \log x$

i. $\log x - \log 5 = \frac{\log x}{\log 5}$

not equivalent

j. $5 \log x = \log x^5$

$= 5 \log x$

k. $2 \log x + \log 5 = \log(x^2 + 5)$

not equivalent

l. $\frac{1}{2} \log x = \log \sqrt{x}$

$= \log x^{\frac{1}{2}}$

$= \frac{1}{2} \log x$

m. $\log(x - 5) = \frac{\log x}{\log 5}$

not equivalent

Check if you are correct by graphing using Desmos.com. Graph each expression and if they make the same line, then they are equivalent.