Exponential Laws	Logarithm Laws
$x^a \cdot x^b = x^{a+b}$	$\log(ab) = \log(a) + \log(b)$
$\frac{x^a}{x^b} = x^{a-b}$	$\log\left(\frac{a}{b}\right) = \log(a) - \log(b)$
$(x^a)^b = x^{ab}$	$\log(a^b) = b \cdot \log(a)$
$x^{-a} = \frac{1}{x^a}$	$\log_x\left(\frac{1}{x^a}\right) = -a$
$x^0 = 1$	$\log_x 1 = 0$

Jan 12-8:15 AM

$\log ab = \log a + \log b$	$\ln ab = \ln a + \ln b$
$\log \frac{a}{b} = \log a - \log b$	$\ln \frac{a}{b} = \ln a - \ln b$
$\log \frac{1}{x} = -\log x$	$\ln \frac{1}{x} = -\ln x$
$\log y^x = x \log y$	$\ln y^x = x \ln y$
$\log 10^x = x$	$\ln e^x = x$
$10^{\log x} = x$	$e^{\log x} = x$

Jan 12-8:19 AM

Algebra 2 Name_____ ID: 1

Log & Exp - Notes Day 1

Date_____ Period____

Solve each equation.

1) $\log(9 - m) = \log 6$

2) $\log 4n = \log n$

3) $\log_{13}(3a - 7) = \log_{13} -2a$

4) $\log(4x + 6) = \log(-2x + 3)$

5) $\log_4 7 + \log_4 -4x = 2$

6) $\log_6(x + 4) + \log_6 9 = 2$

7) $\log_8 3x + \log_8 6 = \log_8 23$

8) $\log_3 x - \log_3(x + 4) = 4$

9) $4^{2n} = 4^{-2n}$

10) $3^{-n} = 81$

One-to-one property

1) $\log(9-m)=\log 6$

$9-m=6$

$-m=-3$

$m=3$

$4n=n$

$-n\ -n$

$3n=0$

$\frac{3n}{3}=\frac{0}{3}$

$n=0$ ✓

2) $\log 4n=\log n$

$?\ \frac{4n}{n}=\frac{n}{n}$

$4=1$

$?\ \frac{4n}{4}=\frac{n}{4}$

$n=\frac{n}{4}$

3) $\log_{13}(3a-7)=\log_{13}-2a$

$3a-7=-2a$

$5a-7=0$

$5a=7$

$a=7/5$

4) $\log(4x+6)=\log(-2x+3)$

$4x+6=-2x+3$

$4x+3=-2x$

$3=-6x$

$3/-6=x$

$-1/2=x$

Log Property to Expand.

$$\log(ab) = \log(a) + \log(b)$$

log ab = log a + log b

① $\log 5x = \log 5 + \log x$

② $\log xy = \log x + \log y$

③ $\log 5xy = \log 5 + \log x + \log y$

④ $\log 3(x+2) = \log 3 + \log (x+2)$

* What if...

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

≠ must stay this way

Property of Log to Condense | $\log(ab) = \log(a) + \log(b)$

① $\log 8 + \log x = \log 8x$

② $\log x + \log 6 + \log 4 = \log(x \cdot 6 \cdot 4)$

$= \log 24x$

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

Expand $\log\left(\frac{a}{b}\right) = \log(a) - \log(b)$

$\log\frac{3}{x} = \log 3 - \log x$

$\log\frac{2}{5} = \log 2 - \log 5$

$\log\frac{2x}{5y} = \frac{\log 2 + \log x}{\log 5 + \log y} = \log 2 + \log x - \log 5 + \log y$

$\log(ab) = \log(a) + \log(b)$

$\log\left(\frac{a}{b}\right) = \log(a) - \log(b)$

Condense each expression to a single logarithm.

11) $5\log_4 3 + \dfrac{\log_4 2}{2}$

12) $4\log_9 5 - 16\log_9 12$

13) $\dfrac{\log_5 7}{3} + \dfrac{\log_5 2}{3} + \dfrac{\log_5 3}{3}$

14) $5\log_8 u - 3\log_8 v$

Expand each logarithm.

15) $\log_8 \left(z\sqrt{x \cdot y}\right)$

16) $\log_7 \left(\dfrac{x}{y^6}\right)^4$

17) $\log_6 \left(\dfrac{u}{v^4}\right)^2$

18) $\log_5 \left(\dfrac{8}{11^2}\right)^3$

Condense each expression to a single logarithm.

11) $5\log_4 3 + \dfrac{\log_4 2}{2}$

$\log_4 \left(3^5\sqrt{2}\right)$

12) $4\log_9 5 - 16\log_9 12$

$\log_9 \dfrac{5^4}{12^{16}}$

13) $\dfrac{\log_5 7}{3} + \dfrac{\log_5 2}{3} + \dfrac{\log_5 3}{3}$

$\log_5 \sqrt[3]{42}$

14) $5\log_8 u - 3\log_8 v$

$\log_8 \dfrac{u^5}{v^3}$

Expand each logarithm.

15) $\log_8 \left(z\sqrt{x \cdot y}\right)$

$\log_8 z + \dfrac{\log_8 x}{2} + \dfrac{\log_8 y}{2}$

16) $\log_7 \left(\dfrac{x}{y^6}\right)^4$

$4\log_7 x - 24\log_7 y$

17) $\log_6 \left(\dfrac{u}{v^4}\right)^2$

$2\log_6 u - 8\log_6 v$

18) $\log_5 \left(\dfrac{8}{11^2}\right)^3$

$3\log_5 8 - 6\log_5 11$

Algebra 2 Name_____ ID: 1

Log & Exp - Notes Day 1

Date_____ Period____

Solve each equation.

1) $\log(9-m) = \log 6$

$\{3\}$

2) $\log 4n = \log n$

No solution.

3) $\log_{13}(3a-7) = \log_{13} -2a$

No solution.

4) $\log(4x+6) = \log(-2x+3)$

$\left\{-\frac{1}{2}\right\}$

5) $\log_4 7 + \log_4 -4x = 2$

$\left\{-\frac{4}{7}\right\}$

6) $\log_6(x+4) + \log_6 9 = 2$

$\{0\}$

7) $\log_8 3x + \log_8 6 = \log_8 23$

$\left\{\frac{23}{18}\right\}$

8) $\log_3 x - \log_3(x+4) = 4$

No solution.

9) $4^{2n} = 4^{-2n}$

$\{0\}$

10) $3^{-n} = 81$

$\{-4\}$

1) $\log(9-m) = \log 6$

2) $\log 4n = \log n$

3) $\log_{13}(3a-7) = \log_{13} -2a$

4) $\log(4x+6) = \log(-2x+3)$

Jan 12-8:37 AM

Log Property to Expand.

$$\log(ab) = \log(a) + \log(b)$$

log ab : log a + log b

① log 5x = log 5 + log x

② log xy = log x + log y

③ log 5xy = log 5 + log x + log y

④ log 3(x+2) = log(3x+6)

log 3·(x+2) = log 3 + log (x+2)

log a·b =

⑤ log (x+1)(x+3) =

Property of Log to Condense | $\log(ab) = \log(a) + \log(b)$

① $\log 8 + \log x = \log 8 \cdot x = \log 8x$

② $\log x + \log 6 + \log 4 = \log x \cdot 6 \cdot 4 = \log 24x$

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

$\log(x^2 + x - 6)$

Expand

$$\log\left(\frac{a}{b}\right)=\log(a)-\log(b)$$

$\log\frac{3}{x}$ = $\log 3-\log x$

$\log\frac{2}{5}$ = $\log 2-\log 5$

$\log\frac{2x}{5y}$ = $\log 2x-\log 5y$

$\log(ab)=\log(a)+\log(b)$

$\log 2+\log x-\log 5y$

$\log\left(\frac{a}{b}\right)=\log(a)-\log(b)$

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

$\log 2+\log x-\log 5-\log y$

Condense

$$\log\left(\frac{a}{b}\right) = \log(a) - \log(b)$$

① $\log 5 - \log 2 = \log\left(\frac{5}{2}\right)$

② $\log 3x - \log 4 = \log\left(\frac{3x}{4}\right)$

③ $\log 2 + \log 3 + \log x - \log 5 + \log y$

$\log 2 \cdot 3 \cdot x \div 5 \cdot y$

$\log \frac{2(3)(x)}{5} \cdot y$

$\log \frac{6xy}{5}$

$\log 2 \cdot 3 \cdot \frac{x}{5} \cdot y$

Jan 12-9:11 AM

Condense the log

$$\log(a^b) = b \cdot \log(a)$$

① $4 \log x = \log x^4$

② $x \log 5 = \log 5^x$

③ $(x+2) \log 3 = \log 3^{(x+2)}$

Expand the log

$$\log(a^b) = b \cdot \log(a)$$

① $\log 5^{(x-2)} = (x-2)\log 5$

② $\log 4^{(x+1)} = (x+1)\log 4$

③ $\log 4x^{(n-5)} = \log 4 + \log x^{(n-5)}$

$= \log 4 + (n-5)\log x$

Why?

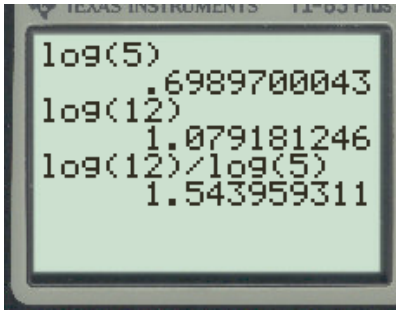
$5^x = 12$

$\log 5^x = \log 12$

$x \log 5 = \log 12$

$\frac{x(\log 5)}{(\log 5)} = \frac{(\log 12)}{(\log 5)}$

$x = \frac{\log 12}{\log 5} = 1.54$



Why???

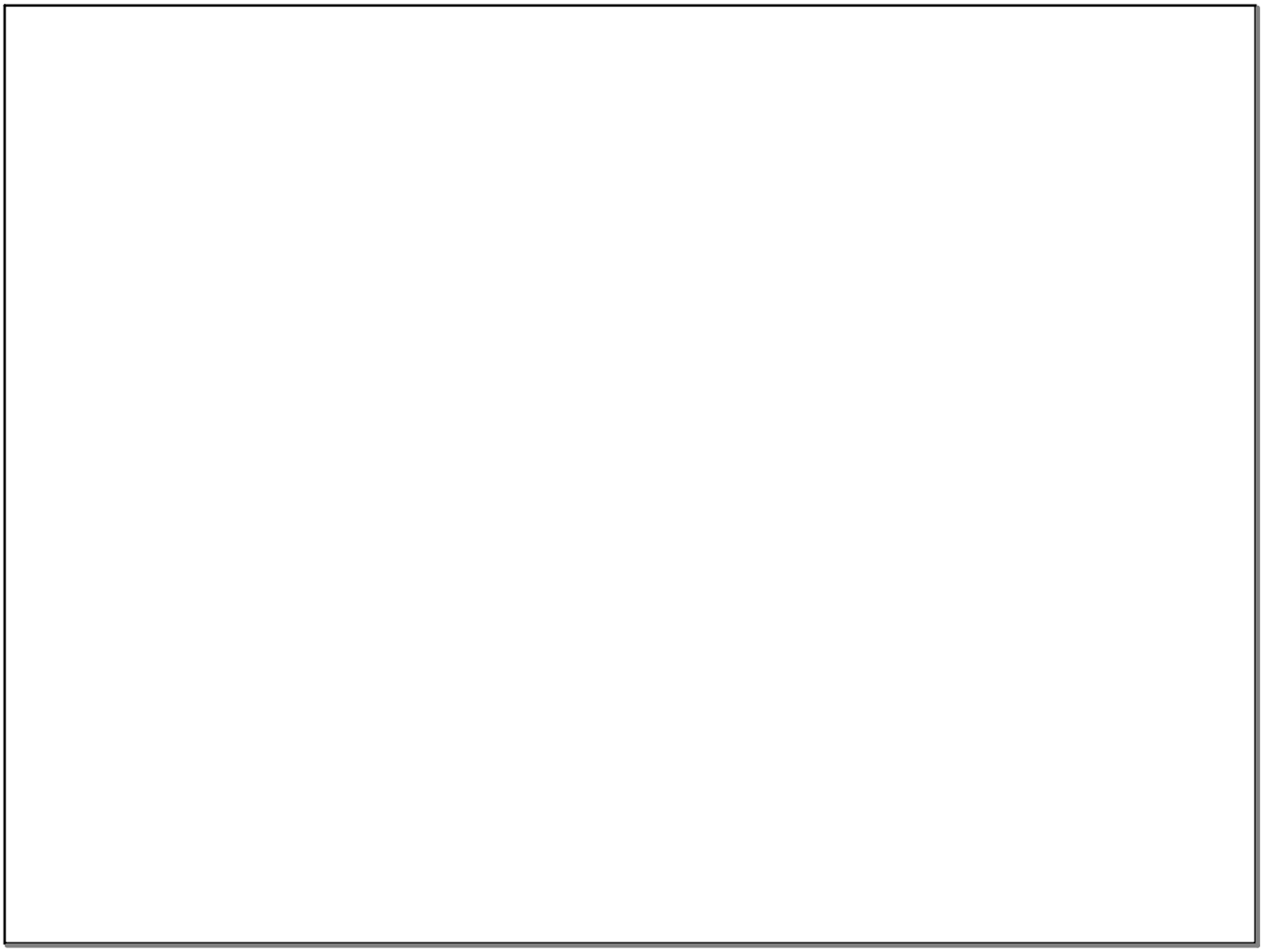
$$\log_x\left(\frac{1}{x^a}\right) = -a$$

$$\log_x 1 = 0$$

Jan 12-9:14 AM

Using the properties of Log to solve

Jan 12-9:15 AM



Jan 12-10:00 AM