Expand.

$$\log_4 5x^2 y^3 = \log_4 5 + \log_4 x + \log_4 y$$
$$\log_4 5 + 2\log_4 x + 3$$

$$\ln\left(\frac{\sqrt{x}}{yz}\right) = \ln \sqrt{x} - \ln yz$$
$$\ln x^{1/2} - (\ln y + \ln z)$$
$$\tfrac{1}{2}\ln x - \ln y - \ln z$$

Condense.

$$\log_3 7 + 2\log_3 y - \log_3 x =$$
$$\log_3 \frac{7y^2}{x}$$

$$\tfrac{1}{2}\log(x+3) - \log 5 - \log x =$$
$$\log(x+3)^{1/2}$$

$$\log \sqrt{x+3} - \log 5 - \log x$$

$$\log \frac{\sqrt{x+3}}{5x}$$

$$\frac{3}{2} \log_4 5t^6 - \frac{3}{4} \log_4 t^4$$

$$\log_4 \left(5t^6\right)^{\frac{3}{2}} - \log_4 \left(t^4\right)^{\frac{3}{4}}$$

$$\log_4 5t^9 - \log_4 t^3$$

$$\log_4 \left(\frac{5t^9}{t^3}\right)$$

$$\boxed{\log_4 5t^6}$$

$$5^1 5^{1/2}$$
$$5\sqrt{5}$$

$$\ln x - 2 \left(\ln(x+2) + \ln(x-2) \right)$$

$$\ln x - \left(\ln(x+2) + \ln(x-2) \right)^2$$

$$\ln x - \ln \left(x^2 - 4 \right)^2$$

$$\ln \frac{x}{(x^2-4)^2}$$

Solving Exponential Equations using the One-to-One Property (No Calc)

Hint: Rewrite non-exponential side using the same base

Example 1: $16 = 4^{x+1}$

$$4^2 = 4^{x+1}$$
$$2 = x + 1$$
$$\boxed{x = 1}$$

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

$$\left(2^{-1}\right)^x$$
$$2^{-x} = 2^3$$
$$-x = 3$$
$$\boxed{x = -3}$$

Example 3: $3^{x+1} = 27$

$$3^{x+1} = 3^3$$
$$x + 1 = 3$$
$$\boxed{x = 2}$$

Example 4: $2^{x-2} = \dfrac{1}{32}$

$$2^{x-2} = 2^{-5}$$
$$x - 2 = -5$$
$$\boxed{x = -3}$$

Solving Logarithmic & Exponential Equations

Calc

Ex5.

$$3^x = 30$$

$$\log_3 30 = x$$

$$\frac{\log_{10} 30}{\log_{10} 3} = \boxed{3.1}$$

Ex6.

$$\left(\tfrac{1}{4}\right)^x = 60$$

$$\log_{\frac{1}{4}} 60 = x$$

$$\boxed{-2.95}$$

Ex.7

$3(2^x) = 42$

$\dfrac{}{3} \quad \dfrac{}{3}$

$2^x = 14$

$\log_2 14 = x$

$\boxed{x = 3.81}$

Ex.8

$e^x = 7$

$\log_e 7 = x$

$\ln 7 = x$

$x = 1.95$

$\ln e^x = \ln 7$

$x = \ln 7$

$x = 1.95$

Ex.9

$$5 - 3e^x = 2$$

$$\underline{-5} \qquad\qquad \underline{-5}$$

$$\frac{-3e^x}{-3} = \frac{-3}{-3}$$

$$e^x = 1$$

$$x = 0$$

Ex.10

$$2(3^{2t-5}) - 4 = 11$$

$$2(3^{2t-5}) = 15$$

$$3^{2t-5} = 7.5$$

$$\log_3 7.5 = 2t - 5$$

$$1.83 = 2t - 5$$

$$3.42$$

Ex.11

$$e^{2x} - 7e^x = -12$$

$$e^{2x} - 7e^x + 12 = 0$$

$$(e^x - 4)(e^x - 3) = 0$$

$$e^x - 4 = 0 \quad e^x - 3 = 0$$
$$e^x = 4 \quad e^x = 3$$
$$\log_e 4 = x \quad \log_e 3 = x$$
$$\ln 4 = x \quad \ln 3 = x$$
$$x = 1.39 \quad x = 1.1$$

Ex.12

$$e^{2x} - 4e^x - 5 = 0$$

$$(e^x - 5)(e^x + 1) = 0$$

$$e^x = 5 \quad e^x = -1$$

$$\log_e 5 = x \quad \cancel{\log_e x = x}$$

$$\ln 5 = x$$

$$x = 1.61$$

No Warm-Up Books

Warm-Up will be handed out

Section 8.6
Solving Logarithmic
& Exponential
Equations

Example 1:
Solve $\log_3 x = \log_3 12$

$X = 12$

Example 2:
Solve $\log(2x - 1) = \log x$

$X = 1$

Example 3:   Solve $\log_4(x^2 - 6) = \log_4 10$

$X = \pm 4$

Ex.1 $\ln x = -3$	Ex.2 $\log x = -1$
$\log_e x = -3$ $e^{-3} = x$ $x = .05$	$10^{-1} = x$ $x = .1$

Ex.3 $\dfrac{2\log_5(3x)}{2} = \dfrac{4}{2}$	Ex.4 $\ln x - \ln 3 = 0$
$\log_5(3x) = 2$ $5^2 = 3x$ $25 = 3x$ $\boxed{x = \dfrac{25}{3}}$	$\ln x = \ln 3$ $\boxed{x = 3}$

Ex.5 $\log_3(2x + 1) + \log_3(2) = \log_3(5x)$

$\log_3(4x+2) = \log_3(5x)$

$4x+2 = 5x$

$\boxed{2 = x}$

Ex.6 $\log_6(3x + 14) - \log_6(5) = \log_6(2x)$

$\log_6\left(\dfrac{3x+14}{5}\right) = \log_6(2x)$

$\dfrac{3x+14}{5} = 2x$

$3x + 14 = 10x$

$14 = 7x$

$x = 2$

Ex.7   log(5x) + log(x – 1) = 2

$$\log(5x^2 - 5x) = 2$$

$$10^2 = 5x^2 - 5x$$

$$100 = 5x^2 - 5x$$

$$5x^2 - 5x - 100 = 0$$

$$5(x^2 - x - 20) = 0$$

$$5(x - 5)(x + 4) = 0$$

$$x = 5 \quad x = -4$$

Ex.8 $\log_4 x - \log_4(x - 1) = \frac{1}{2}$

$$\log_4\left(\frac{x}{x-1}\right) = \frac{1}{2}$$

$$4^{\frac{1}{2}} = \frac{x}{x-1}$$

$$2 = \frac{x}{x-1} \quad (x-1) \text{ Extraneous}$$

$$2x - 2 = x \qquad \boxed{x = 2}$$

Ex.9

$\log x + \log(x + 4) = 1$

$\log(x^2 + 4x) = 1$

Example 10 – If you had $2000 to invest in an account with an APR of 6% (compounded monthly), how many years would it take for the account to be worth $5000?

Example 11: You have deposited $500 in an account that pays 6.75% interest, compounded continuously. How long will it take (round the years to the nearest hundredths) for your money to double?