Algebra 2 **Exponential and Logarithmic Equation** DATE:

Change of Base Formula

$$\log_b M = \frac{\log M}{\log b}$$

Examples:

$\log_5 22 = \frac{\log 22}{\log 5} \approx 1.92$ (or you can also use the **Change of Base key** on your calculator)

Find each:

$\log_7 332$ $\log_2 \frac{1}{6}$ $\log_{\frac{1}{2}} 32$

Exponential Equation – an equation with a variable in the exponent.

Solving Exponential Equations

Solve: $5^{2x} = 16$ change to logarithmic form

$2x = \log_5 16$ solve for *x*

$x = \frac{\log_5 16}{2}$ Use your calculator

$x \approx 0.861$

Solve: $6 + 7^{2n-1} = 59$

$7^{2n-1} = 53$ Isolate the power

$2n - 1 = \log_7 53$ Change to log form

$2n = \log_7 53 + 1$ Solve for n

$n = \frac{\log_7 53+1}{2}$ Use your calculator

$n \approx 1.52$

Solve: $3^x - 7 = 100$

Solve: $5^{x+2} = 120$

Logarithmic Equation – an equation with a logarithm.

We will be changing the logarithmic equation to an exponential equation:

$\log_b y = x$ becomes $b^x = y$

Example:

$\log_5(2x + 1) = 3$ becomes $5^3 = 2x + 1$

Solving Logarithmic Equations

Solve: $\log_5(2x + 1) = 3$

$5^3 = 2x + 1$ Change to exponential form

$125 = 2x + 1$ Solve for *x*

$124 = 2x$

$\frac{124}{2} = x$

$x = 62$

Solve: $3\log x - \log 2 = 5$ condense to a single logarithm

$\log x^3 - \log 2 = 5$

$\log \frac{x^3}{2} = 5$ common logarithm means base 10

$\log_{10} \frac{x^3}{2} = 5$ change to exponential form

$10^5 = \frac{x^3}{2}$ solve for *x*

$100000 = \frac{x^3}{2}$

$200000 = x^3$

$x = \sqrt[3]{200000}$

$x \approx 58.48$

Solve: $\log_3 x + 5 = 4$ Isolate the logarithm

$\log_3 x = -1$ change to exponential form

$3^{-1} = x$ solve for *x*

$x \approx 0.3333$

Solve: $\log_3(x - 5) = 4$

Solve: $2\log x - \log 4 = 3$