Notes for 4.5 Exponential and Logarithmic Equations
(pp. 443 – 448)

Name:
Date:
Instructor:

Topics: Exponential Equations, Logarithmic Equations, Applications

1. Exponential Equations (pp. 443 – 445)
We use the Identity Property that if $x > 0$, $y > 0$, $a > 0$, and $a \neq 1$, then

$x = y$ if and only if $\log_a x = \log_a y$ or $\ln x = \ln y$ or $\log x = \log y$
(*whichever is needed as the inverse)

*This means that we can put in logs or lns on both sides that will activate the properties of logs that bring down exponents within reach to become coefficients.

Ex. $5^x = 13$ (can also be worked with logs on both sides)

Ex. $2^{x-5} = 3^{2x+4}$

* Use the calculator to go directly to the decimal answer, remembering to put ( ) around the numerator and the denominator, and to close the) after the ln or log button has opened one for you.

Ex. $e^{x^2-4} = 300$ *Always use *ln* on both sides to undo *e* and bring down the exponent.

II. Logarithmic Equations (pp. 445 – 447) (*Always check these… there are many possible solutions that don't work because they make the argument a negative number… they aren't in the domain.)

We will use the Identity Property again, but in reverse for this type of log equation with logs (lns) in **all** terms.

Ex. Solve: $\log_a(x+4)-\log_a(x-2)=\log_a x$ (Notice that ***every*** term has a log)
(Condense logs on each side)
(Take the logs off)

Ex. Solve: $\log(k+4)+\log(k+3)=\log(14k)$

Ex. Solve: $\log_3(s+5)=1+\log_3(s+1)$ (Notice that ***some*** terms have a log… these must be condensed, then rearranged into the exponential form using the definition.)

Summary of Solving Exponential or Log Equations: (p. 447)

1. $a^{f(x)} = b$ (when *b cannot* be written as a power of *a*): Take the logs on both sides and use the power rule to bring down *f(x)*. (Ex. 1, 2, 3 pp. 443 – 445)

$1\frac{1}{2}$. $a^{f(x)} = b$ (when *b can* be written as a power of *a*): Rewrite with the same base, bring down the exponents and solve.

2. $\log_a f(x) = b$ (logs in *some* or *only one* of the terms): Change to the exponential form $a^b = f(x)$.

3. $\log_a f(x) = \log_a g(x)$ (logs in *all* of the terms): Condense if needed, then solve $f(x) = g(x)$.

4. It may be necessary to solve for (isolate) $e^{f(x)}$ or log $a^{f(x)}$ first, then solve.

III. Application

Ex. Find *t* to the nearest hundredth if $10,000 grows to $13,007.61 at 9.6% interest compounded monthly.

*Use the compound interest formula $A = P\left(1 + \frac{r}{m}\right)^{tm}$ and solve for *t*.

*When you get the answer for *t* with the lns/logs, use the calculator to find the answer directly.

Assignment:

Text: pp. 448 – 452 #5 – 17 odd, 21 – 37 odd, 65, 67, 71, 72