Name: _____ Date: _____

SOLVING EQUATIONS INVOLVING LOGARITHMS
ALGEBRA 2 WITH TRIGONOMETRY

Equations involving logarithms arise in a variety of contexts. Most of the time, these equations are solved by isolating the logarithm and then writing an **equivalent exponential equation**.

***Exercise* #1:** Solve each of the following logarithmic equations by first isolating the logarithm (if necessary) and then writing an equivalent exponential equation.

(a) $\log_6 x = 2$ (b) $\log_2 (x+5) = 3$ (c) $3\log_5 (4x+1) - 2 = 4$

Since each of the above equations has only a single logarithm, it was relatively easy to isolate this logarithm and then write its equivalent exponential equation. When two or more logarithms are involved it is necessary to first combine these logarithms using the logarithm laws from the previous lesson.

***Exercise* #2:** Solve each of the following equations for all value(s) of *x* by first combing logarithms.

(a) $\log_2 (3x+23) - \log_2 (x+1) = 3$ (b) $\log x + \log (x-3) = 1$

***Exercise* #3:** *Algebraically* determine the intersection point of the two logarithmic functions shown below.

$$y = \log_3 (x+25) + 3 \text{ and } y = \log_3 (x+1) + 5$$

Using techniques like the above, we can now find inverses for more complicated logarithmic functions.

***Exercise* #4:** Find the inverse functions for each of the following.

(a) $y = \log_5(x+6) - 2$

(b) $y = \log(2x-1) + 5$

***Exercise* #5:** *Algebraically* determine the *x*-intercept of the function $y = \log_2(x-7) - 4$.

There are also instances when equations involve only logarithms. In these cases, the solution method is similar to before, but there is no need to write an equivalent exponential expression.

***Exercise* #6:** Solve the following for the value of *x*.

(a) $\log_2 x + \log_2 9 = \log_2 45$

(b) $\log(2x+1) - \log 3 = \log 5$

***Exercise* #7:** Solve the equation below for all value(s) of *x*. Be sure to check your answers.

$$2\log_4 x - \log_4 2 = \log_4 18$$

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SOLVING EQUATIONS INVOLVING LOGARITHMS
ALGEBRA 2 WITH TRIGONOMETRY - HOMEWORK

SKILLS

1. Solve each of the following equations involving logarithms. Express your answers in simplest form.

(a) $\log_5 x = 3$ (b) $\log_2 x = -1$ (c) $\log_9 x = 1/2$

(d) $\log_4 (x+10) = 3$ (e) $\log_2 (3x-1) = 5$ (f) $\log_5 (4x+3) = 2$

(g) $5\log_3 x - 2 = 8$ (h) $\frac{1}{2}\log_2 (x+8) = 3$ (i) $3\log_8 (x+6) + 5 = 6$

2. Which of the following values of x is the solution to $4\log_5 (8x+5) = 12$?

(1) 25 (3) 7

(2) 165 (4) 15

_____

3. Which of the following represents the x-intercept of $y = \log_2 (x+5) - 2$?

(1) 1 (3) -1

(2) -2 (4) 8

_____

4. Solve each of the following equations for the value of *x*.

(a) $\log_3(5x+20)-\log_3 x=2$

(b) $\log_2(x-3)-\log_2(x+9)=-2$

5. Solve the following equations for all value(s) of *x*.

$$\log_4(x-7)+\log_4(x+5)=3$$

6. Given the function $y=3\log_2(x+8)-12$, *algebraically* determine both the *x* and *y* intercepts. Show work to justify your answers.

7. Find the inverse function for each of the following:

(a) $y=\log_5(x+8)-2$

(b) $y=2\log_3(x-1)$

8. Solve the equation $\log(3x+1)-\log 2=\log 11$ for the value of *x*.