## Algebra 2 Unit: Exponential and Logarithmic Functions Section: Solving Exponential and Logarithmic Equations

Extra example problems:

1. 
$$4^x = 5$$
 2.  $7^x = 12$ 
 $log(4^x) = log(5)$ 
 $log(7^x) = log(12)$ 
 $xlog4 = log5$ 
 $xlog7 = log12$ 
 $x = \frac{log5}{log4} \approx 1.1610$ 
 $x = \frac{log12}{log7} \approx 1.2770$ 

3. 
$$13^{x-1} = 2$$
4.  $8^{x-2} = 14$  $log(13^{x-1}) = log(2)$  $log(8^{x-2}) = log(14)$  $(x - 1)log13 = log2$  $(x - 2)log8 = log14$  $xlog13 - log 13 = log2$  $xlog8 - 2log8 = log14$  $xlog13 = log2 + log13$  $xlog8 = log14 + 2 log8$  $x = \frac{log2 + log13}{log13}$  $x = \frac{log14 + 2log8}{log8}$  $x \approx 1.2702$  $x \approx 3.2691$ 

5. 
$$5^{x+1} = 3$$
6.  $2^{x+1} = 7$  $log(5^{x+1}) = log(3)$  $log(2^{x+1}) = log(7)$  $(x + 1)log5 = log3$  $(x + 1)log2 = log7$  $xlog5 + log 5 = log3$  $xlog2 + log 2 = log7$  $xlog5 = log3 - log5$  $xlog2 = log7 - log2$  $x = \frac{log3 - log5}{log5}$  $x = \frac{log7 - log2}{log2}$  $x \approx -0.3174$  $x \approx 1.8074$ 

7. $\log_7 x = 4$	8. log <sub>2</sub> x = 8
$7^4 = x$	2 <sup>8</sup> = x
2401 = x	256 = x

9. 
$$\log_2(3x - 8) = 6$$
  
 $2^6 = 3x - 8$   
 $64 = 3x - 8$   
 $72 = 3x$   
 $24 = x$   
10.  $\log_x 121 = 2$   
 $x^2 = 121$   
 $\sqrt{x^2} = \pm \sqrt{121}$   
 $x = 11$   
Only the positive answer is valid.

11.  $4 \log_6(2y + 8) = 8$ Divide both sides by 4 first.  $\log_6 (2y + 8) = 2$  $6^2 = 2y + 8$ 36 = 2y + 828 = 2y14 = y

13. 
$$\log_{6} (8x) - 7 = -3$$
  
Add 7 to both sides first.  
 $\log_{6} (8x) = 4$   
 $6^{4} = 8x$   
 $1296 = 8x$   
 $162 = x$ 

15. 2(5)<sup>w+3</sup> = 34  
Divide both sides by 2 first.  

$$5^{w+3} = 17$$
  
 $log(5)^{w+3} = log17$   
(w + 3)log5 = log17  
wlog5 + 3log5 = log17  
wlog5 = log17 - 3log5  
w =  $\frac{log17 - 3log5}{log5}$   
w ≈ -1.2396

12.  $3 \log_5(x^2 + 9) - 6 = 0$ Add 6 to both sides and divide by 3.  $\log_5 (x^2 + 9) = 2$  $5^2 = x^2 + 9$  $25 = x^2 + 9$  $0 = x^2 - 16$ 0 = (x + 4)(x - 4)x = -4, 4

> 14.  $\log_4 (10x) - 3 = 0$ Add 3 to both sides first.  $\log_4 (10x) = 3$  $4^3 = 10x$ 64 = 10x6.4 = x

16.  $4(2)^{x-5} = 12$ Divide both sides by 4 first.  $2^{x-5} = 3$  $log(2)^{x-5} = log3$ (x-5)log2 = log3xlog2 - 5log2 = log3xlog2 = log3 + 5log2 $x = \frac{log3 + 5log2}{log2}$  $x \approx 6.5850$ 

17. 
$$9^{2x-1} + 4 = 20$$
  
Subtract 4 from both sides first.  
 $9^{2x-1} = 16$   
 $log(9)^{2x-1} = log16$   
 $(2x - 1)log9 = log16$   
 $2xlog9 - log9 = log16$   
 $2xlog9 = log16 + log9$   
 $x = \frac{log16 + log9}{2log9}$   
 $x \approx 1.1309$ 

18.  $5^{x^2-3}+2 = 74$ Subtract 2 from both sides first.  $5^{x^2-3} = 72$  $\log 5^{x^2-3} = \log 72$  $(x^2 - 3)\log 5 = \log 72$  $x^2\log 5 - 3\log 5 = \log 72$  $x^2\log 5 = \log 72 + 3\log 5$  $x^2 = \frac{\log 72 + 3\log 5}{\log 5}$ 

19.  $\log_2 4 + \log_2 x = 5$ Combine the logs using the product property:  $\log a + \log b = \log (ab)$ 

$$log_{2} (4x) = 5$$
  
 $2^{5} = 4x$   
 $32 = 4x$   
 $8 = x$ 

 $20. \quad \log_8 2 + \log_8 (2x) = 2$ Combine the logs using the product property:  $\log a + \log b = \log (ab)$ 

$$log_8 (4x) = 2$$
  
 $8^2 = 4x$   
 $64 = 4x$   
 $16 = x$ 

Use this area to take any notes or work out any of the problems: