

**Lesson 61 Objective: SWBAT solve log equations.**

Kickoff- Solve each of the following.  
Round your answers to the nearest thousandth if necessary.

1)  $64 \cdot 16^{-3x} = 16^{3x-2}$   
 $(4)^3 (4^2)^{-3x} = (4)^{3x-2}$   
 $3 - 6x = 6x - 4$   
 $16x = 12x - 4$   
 $4 = 12x - 4$   
 $8 = 12x$   
 $7/12 = x$

2)  $-6e^{8n+8} - 3 = -23$   
 $-6e^{8n+8} = -20$   
 $e^{8n+8} = \frac{10}{3}$   
 $(8n+8) \ln e = \ln \frac{10}{3}$   
 $8n+8 = \frac{\ln 10}{\ln 3}$   
 $8n = \frac{\ln 10}{\ln 3} - 8$   
 $n = \frac{\frac{\ln 10}{\ln 3} - 8}{8}$   
 $n = -0.850$

**Situation #1- One Log**  
Use Loop di Loop and solve using the calculator, common bases, raising both sides to the reciprocal, or just using algebra to solve.  
**\*Check for undefined values!**

Using the Calculator	Using Common Bases	Using Reciprocals
$\log_3 x = 4$ $3^4 = x$ $81 = x$	$\log_2 \frac{1}{4} = -2$ $10 \log_2 \frac{1}{4} = x$ $2^x = \frac{1}{4}$ $2^x = 2^{-2}$ $x = -2$	$\log_{5x-1} 4 = \frac{1}{3}$ $((5x-1)^{\frac{1}{3}})^3 = (4)^3$ $5x-1 = 64$ $5x = 65$ $x = 13$

**Using Algebra**  
Round to the nearest tenth.  $\ln e \rightarrow \frac{1}{e}$

$\log_{(x+4)} (17x-4) = 2$   
 $(x+4)^2 = 17x-4$   
 $x^2 + 8x + 16 = 17x - 4$   
 $x^2 - 9x + 20 = 0$   
 $(x-4)(x-5) = 0$   
 $x = 4 \quad x = 5$

$\log_e (4x-3) = 2$   
 $e^2 = 4x-3$   
 $7.389056... = 4x-3$   
 $10.389056... = 4x$   
 $2.6 = x$

\*  $\log_b [x] \rightarrow$  cannot be -  
 \* denom cannot be 0!

**Situation #2- Logs on one side**  
Condense and then use Loop di loop and then solve using any method above. **\*Check for undefined values!**

$\log_{(x+3)} (2x+3) + \log_{(x+3)} (x+5) = 2$   
 $\log_{(x+3)} (2x+3)(x+5) = 2$   
 $(x+3)^2 = (2x+3)(x+5)$   
 $x^2 + 6x + 9 = 2x^2 + 13x + 15$   
 $0 = x^2 + 7x + 6$   
 $0 = (x+1)(x+6)$   
 $-1 = x \quad -6 = x$

$\log_3 (x^2-4) - \log_3 (x+2) = 2$   
 $\log_3 \frac{x^2-4}{x+2} = 2$   
 $3^2 = \frac{x^2-4}{x+2}$   
 $9 = \frac{x^2-4}{x+2}$   
 $9(x+2) = x^2-4$   
 $0 = x^2 - 9x - 22$   
 $0 = (x-11)(x+2)$   
 $11 = x \quad -2 = x$

**Situation #3- Logs on both sides**  
\*Condense, if necessary, and then cross off logs on both sides. **\*Check for undefined values!**

$\log_7 (7x+3) = \log_7 (5x+9)$   
 $7x+3 = 5x+9$   
 $-3x = 5x-9$   
 $2x = 6$   
 $x = 3$

$\log_7 (x-2)(x+3) = \log_7 14$   
 $(x-2)(x+3) = 14$   
 $x^2 + x - 6 = 14$   
 $x^2 + x - 20 = 0$   
 $(x+5)(x-4) = 0$   
 $x = -5 \quad x = 4$