Math 3 **3.4 Solving Exponential Equations** Unit 3

*EQ: How do you solve equations without logarithms by using either similar bases or the properties of logs?*

**Solving equations with NO logs!**

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| **Method 1:** SWOOSH!(Note: Does not work for every problem) |
| **Step 1:** Make sure the piece with the unknown exponent is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on one side.**Step 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into logarithmic form.**Step 3:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ using your calculator and then solve for x! |

**Example 1:** Solve for x: $5^{3x}=\frac{1}{125}$

**You Try!** Solve for x:$ 2^{5x+1}=32$

**Example 2:** Solve for x:$ 3^{x}+5=40$

**You Try!** Solve for x:$ 2(6^{2x})=20$

Why would you need to use a log? Because the variables are in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and logs bring them down!

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| **Method 2:** Properties of Logs(Note: This works for every problem) |
| **Step 1:** Make sure the piece with the unknown exponent is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on one side.**Step 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the logarithm to each side of the equation.**Step 3:** Use the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to bring down the exponent and solve! |

**Example 3:** Solve for x: 23x = 12x

**You Try!** Solve for x: 62x = 254x

**Example 4:** 3x - 7 = 2 x + 4

**You Try!** 73x + 2 = 11x - 1

The Many Ways to Solve a Logarithmic Equation

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| One Log | **SWOOSH!**Use when a variable is attached to the logarithm. | Solve for x: log4(4x – 2) = 3 |
| **Evaluate in your Calculator**Use when the variable is not attached to the logarithm. | Solve for x: log245 = x |
| Two Logs | **Cancel the logs!**Do this if and only if there is one log per side. | Solve for x: log6 x = log6 2x – 2 |
| **Condense the logs** So that only one log appears per side. Then, decide whether to cancel, swoosh, or use change of base. | Solve for x: $3log\_{2}x+log\_{2}5=7$ |
| No Logs | **SWOOSH!**Use this if there is only one variable located in the exponent. | Solve for x: $7^{x-3}+5=30$ |
| **Add logs!**Add a log to each side of the equation if there are variables located in both exponents! | Solve for x: $25^{2x}=125^{x+1}$ |

**Practice:** Complete the following problems for extra practice using the above rules for solving logarithms.

1. 2log4x = 12
2. Log 5x – log 7 = 2
3. log515 = 3x
4. $4^{3x}∙4^{2x}=1048576$