# **Lesson Objectives**

* 1. Use logarithm properties to solve equations

# Expanding/Condensing Logarithm Properties – Reminder for your reference:

* **Product Rule:**

EXPANDING (Product to Sum)

or CONDENSING (Sum to Product)

* **Quotient Rule:**

EXPANDING (Quotient to Difference)

or CONDENSING (Difference to Quotient)

* **Power Rule:**

EXPANDING (Exponent to Coefficient)

or CONDENSING (Coefficient to Exponent)

* **EXAMPLE:** Solve the equation. [\*Martin-Gay 9.8.13]

|  |  |
| --- | --- |
| Use **Product Rule** (sum to product) to CONDENSE to single logarithm.  This will also **isolate** the logarithm. |  |
| Do **NOT** divide by the 2 yet! It is trapped inside the logarithm. |  |
| To undo the logarithm, convert to the exponential form. | **A logarithm is an exponent** |
| Simplify. Remember property: |  |
| Solve the equation. (Divide both sides by 2) |  |
| Simplify. |  |
| **Answer:** |  |

* **EXAMPLE:** Solve the following logarithmic equation.

[\*Angel 13.6.47]

|  |  |
| --- | --- |
| Use **Product Rule** (sum to product) to CONDENSE to single logarithm.  This will also **isolate** the logarithm. |  |
| Do **NOT** divide by the 7 yet! It is trapped inside the logarithm. |  |
| To undo the logarithm, convert to the exponential form. | **A logarithm is an exponent** |
| Simplify. |  |
| Solve the equation. (Divide both sides by 7) |  |
| Simplify. |  |
| **Answer:** |  |

* **EXAMPLE:** Solve the logarithmic equation. [5.6.59]

(Round to the nearest thousandth as needed.)

|  |  |  |
| --- | --- | --- |
| Use **Product Rule** (sum to product) to CONDENSE to single logarithm.  This will also **isolate** the logarithm. |  | |
| Simplify. (add exponents) |  | |
| Equation will be EASIER with just than with .  Use **Power Rule** (exponent to coefficient) |  | |
| Divide both sides by 3. |  | |
| Simplify. Remember that **ln** is same as **loge** |  | |
| To undo the logarithm, convert to the exponential form. | **A logarithm** is **an exponent** | |
| This is the **exact answer:** |  | |
| Use calculator to get the rounded answer:  This a picture of the calculator button sequence 2ND, LN, 4, Divide, e, ENTER | This is a screenshot from a Texas Instruments TI-84 Plus CE calculator. e^(4/3) returns a value of 3.793667895 | **Rounded Answer:** |

(**RESET** – Here’s another way to do the previous problem):

* **EXAMPLE:** Solve the logarithmic equation. [5.6.59]

(Round to the nearest thousandth as needed.)

|  |  |  |
| --- | --- | --- |
| Rather than use the Product Rule like before, use the **Power Rule** (exponent to coefficient) on the second term. |  | |
| The first term has an understood coefficient **1**. |  | |
| Combine like terms:  **1** of them + **2** of them = **3** of them |  | |
| (From here, the steps are the same as before.)  Divide both sides by 3. |  | |
| Simplify. Remember that **ln** is same as **loge** |  | |
| To undo the logarithm, convert to the exponential form. | **A logarithm** is **an exponent** | |
| This is the **exact answer:** |  | |
| Use calculator to get the rounded answer:  This a picture of the calculator button sequence 2ND, LN, 4, Divide, e, ENTER | This is a screenshot from a Texas Instruments TI-84 Plus CE calculator. e^(4/3) returns a value of 3.793667895 | **Rounded Answer:** |

You can use EITHER method when you solve a problem like the previous examples (for Question 7 in the Homework). Be ready to do either the **exact** answer (like ) or the rounded answer.

Sources Used:

1. MyLab Math for *Elementary & Intermediate Algebra for College Students*, 5th Edition, Angel, Pearson Education Inc.
2. MyLab Math for *Intermediate Algebra: A Graphing Approach*, 5th Edition, Martin-Gay, Pearson Education Inc.
3. MyLab Math for *College Algebra with Modeling and Visualization*, 6th Edition, Rockswold, Pearson Education Inc.
4. Texas Instruments TI Connect® CE software, <https://education.ti.com/en/products/computer-software/ti-connect-ce-sw>