Logarithm Rules

- Remember: **logarithms** work just like **exponents**. In fact, the logarithmic function is the **inverse** of the exponential function.
- Taking the **logarithm** of **two numbers multiplied together** is the same as taking the **logarithm** of **each number** and **<u>adding</u>**.
  - Example: log 6*4 = log 6 + log 4
- Taking the **logarithm** of **one number divided by another** is the same as taking the **logarithm** of **each number** and **<u>subtracting</u>**.
  - Example: $\log \frac{25}{16} = \log 25 - \log 16$
- Taking the **logarithm** of **one number raised to a power** is the same as **<u>multiplying</u>** the **power** by the **logarithm** of **the number**
  - Example: $\log 5^3 = 3\log 5$
- Because **logarithms** are the **inverse** of **exponentials**, you can convert back and forth.
  - Example: $\log_{10} x = 3 \rightarrow 10^3 = x$. In this case the base is 10. 3 is equal to the logarithm, and therefore is just an exponent. The expression $\log_{10} x = 3$ says that if you raise the base (10) to the exponent (3) you get the number (x).
  - Example: $2^x = 8 \rightarrow \log_2 2^x = \log_2 8 \rightarrow x \log_2 2 = \log_2 8 \rightarrow x = 3$. In this case we solved the exponential equation by taking the logarithm of each side of the equal sign. The base was picked as 2 because the number 8 is a power of 2: 2^3.
- Tips:
  - Generally, **if you see a logarithm of a number raised to a power**, use the rule above to multiply the power by the logarithm of the number.
  - Likewise, **if you see two logarithms added or subtracted**, use the rules above to convert to the logarithm of a product or the logarithm of a quotient. **If you see the logarithm of a product or quotient**, use the rules above to add or subtract individual logarithms.
  - If you are taking the **logarithm of two numbers added together**, the only rule you have is to **add the numbers and <u>then</u> take the logarithm**. Do not get tricked into splitting into the sum of two logarithms!
    - Example: log (6 + 4) = log 10 = 1, **not** log 6 + log 4!!