Commonly used properties of Logarithms.

**Bases MUST be the same for the properties below to hold true.**

- **Equality Property of Logarithms**
  \[ \log_b x = \log_b y \iff x = y \]
  If everything is a Log, you may cancel across equal signs

- **Product Property of Logarithms**
  \[ \log_b x + \log_b y = \log_b (xy) \]
  Arguments in logs that are added, are multiplied.

- **Quotient Property of Logarithms**
  \[ \log_b x - \log_b y = \log_b \left(\frac{x}{y}\right) \]
  Arguments in logs that are subtracted, are divided.

- **Power Property of Logarithms**
  \[ \log_b x^y = y \log_b x \]
  Coefficients can be placed as an exponent of the argument.

**Try the problems below and check your work on the second page.**

**Example One:**
Rewrite as a single log. \[ 4 \log_3 x + \log_3 5 \]

**Example Two:**
Rewrite as a single log. \[ \log_4 1 + \log_4 a \]

**Example Three:**
Solve \[ \log_2 x + \log_2 m = \log_2 6 \]

**Example Four:**
Solve \[ \left(\frac{1}{2}\right)\log_3 91 + \left(\frac{1}{3}\right)\log_3 8 = \log_3 x \]

**Answers**

**Example One:** \[ 4 \log_3 x + \log_3 5 \ldots \log_3 x^4 + \log_3 5 \ldots \log_3 5x^4 \]

**Example Two:** A log with a base of 4 and another with a base of 3 cannot be combined.

**Example Three:** \[ \log_2 x + \log_2 m = \log_2 6 \ldots \log_2 2m = \log_2 6 \ldots 2m = 6 \ldots m = 3 \]

**Example Four:** \[ \left(\frac{1}{2}\right)\log_3 91 + \left(\frac{1}{3}\right)\log_3 8 = \log_3 x \ldots \log_3 81^{\left(\frac{1}{2}\right)} + \log_3 8^{\left(\frac{1}{3}\right)} = \log_3 x \ldots \log_3 9 + \log_3 2 = \log_3 x \ldots \log_3 18 = \log_3 x \ldots 18 = x \]

**The End**