Section 5.3 Properties of Logarithms

Objective 1: Using the Product Rule, Quotient Rule and Power Rule for Logarithms

Let $b > 0$, $b \neq 1$, $u$ and $v$ represent positive numbers, and $r$ be any real number.

1. The Product Rule for Logarithms is $\log_b(uv) = \log_b u + \log_b v$.

2. The Quotient Rule for Logarithms is $\log_b \frac{u}{v} = \log_b u - \log_b v$.

3. The Power Rule for Logarithms is $\log_b u^r = r \log_b u$.

**Caution**

$\log_b(u + v)$ is NOT equivalent to $\log_b u + \log_b v$

$\log_b(u - v)$ is NOT equivalent to $\log_b u - \log_b v$

$\frac{\log_b u}{\log_b v}$ is NOT equivalent to $\log_b u - \log_b v$

$(\log_b u)^r$ is NOT equivalent to $r \log_b u$

Objective 2: Expanding and Condensing Logarithmic Expressions
Objective 3: Solving Logarithmic Equations Using the Logarithm Property of Equality

The Logarithm Property of Equality: If a logarithmic equation can be written in the form \( \log_b u = \log_b v \), then \( u = v \). Furthermore, if \( u = v \), then \( \log_b u = \log_b v \).
**Objective 4: Using the Change of Base Formula**

**Change of Base Formula:** For any positive base $b \neq 1$ and for any positive real number $u$, then

$$\log_b u = \frac{\log_a u}{\log_a b}$$

where $a$ is any positive number such that $a \neq 1$. 