Section 5.3 Properties of Logarithms

Review of Evaluating Logarithmic Expressions
Recall from section 5.2 that the expression $\log_b x$ is the exponent to which *b* must be raised to in order to get *x*.

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 $\log_b u^r = r \log_b u$.

$\log_b(u+v)$ 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

When expanding and condensing logarithmic expressions be sure to look for resulting logarithms that can be evaluated or simplified.

Review of Solving Rational Equations
See Section 1.1b.

Review of Solving Quadratic Equations by Factoring and by Using the Square Root Property
See Section 1.4.

Review of Solving Radical Equations of the Form $\sqrt[n]{x} = c$
To solve a radical equation of the form $\sqrt[n]{x} = c$ raise each side of the equation to the appropriate power to eliminate the radical. When the index of the radical is even, be sure to check for extraneous solutions.

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 $\log_b u = \dfrac{\log_a u}{\log_a b}$ where a is any positive number such that $a \neq 1$.