11-5

Study Guide

Common Logarithms

Logarithms with base 10 are called **common logarithms.** The change of base formula, $\log_a n = \frac{\log_b n}{\log_b a}$, where a, b, and n are positive numbers and neither a nor b is 1, allows you to evaluate logarithms in other bases with a calculator. Logarithms can be used to solve **exponential equations.**

Example 1 **Evaluate each expression.**

a. $\log 8(3)^2$

$\log 8(3)^2 = \log 8 + 2 \log 3$ *$\log ab = \log a + \log b$, $\log b^n = n \log b$*

$\approx 0.9031 + 2(0.4771)$ *Use a calculator.*

$\approx 0.9031 + 0.9542$

≈ 1.8573

b. $\log \frac{15^3}{7}$

$\log \frac{15^3}{7} = 3 \log 15 - \log 7$ *$\log \frac{a}{b} = \log a - \log b$, $\log a^m = m \log a$*

$\approx 3(1.1761) - 0.8451$ *Use a calculator.*

$\approx 3.5283 - 0.8451$

≈ 2.6832

Example 2 **Find the value of $\log_8 2037$ using the change of base formula.**

$\log_8 2037 = \frac{\log_{10} 2037}{\log_{10} 8}$ *$\log_a n = \frac{\log_b n}{\log_b a}$*

$\approx \frac{3.3090}{0.9031}$ *Use a calculator.*

≈ 3.6641

Example 3 **Solve $7^{2x} = 93$.**

$7^{2x} = 93$

$\log 7^{2x} = \log 93$ *Take the logarithm of each side.*

$2x \log 7 = \log 93$ *$\log_b m^p = p \cdot \log_b m$*

$2x = \frac{\log 93}{\log 7}$ *Divide each side by log 7.*

$2x \approx 2.3293$ *Use a calculator.*

$x \approx 1.1646$