4.4 Evaluating Logarithms and the Change-of-Base Theorem

Common Logarithms

CLASSROOM EXAMPLE 1 Evaluating Common Logarithms with a Calculator

$\log 10{,}000$ $\log 341$ $\log 0.06894$

Applications and Models with Common Logarithms

In chemistry the **pH** of a solution is defined as

$$\mathbf{pH = -\log\left[H_3O^+\right]},$$

where $\left[H_3O^+\right]$ is the hydronium ion concentration in moles per liter. The pH value is a measure of the acidity or alkalinity of a solution. Pure water has a pH 7.0, substances with pH values greater than 7.0 are alkaline, and substances with pH values less than 7.0 are acidic. It is customary to round pH values to the nearest tenth.

CLASSROOM EXAMPLE 2 Finding pH

(a) Find the pH of a solution with $\left[H_3O^+\right] = 6.8 \times 10^{-8}$.

(b) Find the hydronium ion concentration of a solution with pH = 4.3.

Natural Logarithms

CLASSROOM EXAMPLE 5 Evaluating Natural Logarithms with a Calculator

Use a calculator to find the values of

$\ln e^4$ $\ln 341$ $\ln 0.06894$

Logarithms with Other Bases

CLASSROOM EXAMPLE 8 Using the Change-of-Base Theorem

Use the change-of-base theorem to find an approximation to four decimal places for each logarithm.

$\log_4 20$ $\log_2 0.7$ $\log_9 794$