

## Section 4.4: Exponential and Logarithmic Equations and Inequalities

**Key Topics:** solving exponential equations using logarithms, solving logarithmic equations, solving inequalities

The one-to-one property of exponential and logarithmic functions states that

if  $a^u = a^v$ , then \_\_\_\_\_.

if  $\log_a u = \log_a v$ , then \_\_\_\_\_.

### Solving Exponential Equations Using Logarithms

#### OBJECTIVE

*Solve exponential equations when both sides are not expressed with the same base.*

**Step 1** \_\_\_\_\_ the exponential expression on \_\_\_\_\_ of the equation.

**Step 2** \_\_\_\_\_.

**Step 3** Use the power rule,  $\log_a M^r =$  \_\_\_\_\_.

**Step 4** Solve for the \_\_\_\_\_.

Solve the equation  $2^x - \frac{40}{2^x} = 3$ .

Solve the equation  $5 \log_3 x + 12 = 2$ .

Solve the equation  $\log_5 x + \log_5 (x+1) = \log_5 2 + \log_5 (x+6)$ .

**Section 4.5: Logarithmic Scales; Modeling****Key Topics:** various applications**pH SCALE FORMULA**

We define the pH scale of a solution by the formula

$$\text{pH} = \text{_____},$$

where  $[\text{H}^+]$  is the \_\_\_\_\_ of  $\text{H}^+$  ions in moles per liter. (A mole is a unit of measurement, equal to  $6.023 \times 10^{23}$  atoms.)**RICHTER SCALE**The magnitude  $M$  of an earthquake is a function of its intensity  $I$  and is defined by

$$M = \text{_____}$$

where  $I_0$  is the intensity of the zero-level earthquake.**ENERGY OF AN EARTHQUAKE**The energy  $E$  (in joules) released by an earthquake of magnitude  $M$  (Richter scale) is given by

$$\log E = \text{_____}$$

or

$$E \approx (2.5 \times 10^4) \times 10^{1.5M}.$$

**LOUDNESS OF SOUND AND DECIBELS**

The *loudness* (or relative intensity)  $L$  of a sound measured in decibels is related to its intensity  $I$  by the formula

$$L = \text{_____},$$

or

$$I = \text{_____}$$

where  $I_0 = 10^{-12} \text{ W/m}^2$  is the intensity of TOH.

**CHANGE IN PITCH**

If  $f$  is a frequency measured in Hertz (Hz) and  $f_0$  is a reference frequency, then the change in pitch  $P(f)$  in cents from  $f_0$  to  $f$  is given by:

$$P(f) = \text{_____}.$$

**APPARENT MAGNITUDE**

If two stars of magnitudes  $m_1$  and  $m_2$  have apparent brightness  $b_1$  and  $b_2$ , respectively, then

$$m_2 - m_1 = \text{_____}.$$