



# ***Solving Equations and Modeling***

*Section 7.6*

*Algebra 2*

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# ***Earthquake Intensity***

- ✧ Earthquake intensity, using the Richter scale, is a perfect real-world application of logarithms.
- ✧ The video clip at [http://www.youtube.com/watch?v=4Y-62Ti5\\_6s](http://www.youtube.com/watch?v=4Y-62Ti5_6s) shows clips of several earthquakes in California and Taiwan and the damage they cause.
- ✧ Check it out.

# ***Earthquake Intensity***

- ✧ On the Richter scale, the magnitude,  $M$ , of an earthquake depends on the amount of energy,  $E$ , released by the earthquake by the formula:

$$M = \frac{2}{3} \log \frac{E}{10^{11.8}}$$

- ✧ The amount of energy, measured in ergs, is based on the amount of ground motion recorded by a seismograph at a known distance from the epicenter of the earthquake

# ***Earthquake Intensity***

$$M = \frac{2}{3} \log \frac{E}{10^{11.8}}$$

- ✧ The logarithmic function for the Richter scale assigns very large numbers for the amount of energy,  $E$ , to numbers that range from 1 to 9.
- ✧ A rating of 2 on the Richter scale indicates the smallest tremor that can be detected.
- ✧ Destructive earthquakes are those rated greater than 6 on the Richter scale.

# ***Earthquake Intensity***

<b><i>RICHTER SCALE RATINGS</i></b>		
<b>Magnitude</b>	<b>Results near epicenter</b>	<b>Occurrences per year</b>
8-9	Near total damage	0.2
7-7.9	Serious damage to buildings	14
6-6.9	Moderate damage to buildings	185
5-5.9	Slight damage to buildings	1000
4-4.9	Felt by most people	2800
3-3.9	Felt by some people	26,000
2-2.9	Not felt but recorded	800,000

# ***Example 1***

✧ Suppose that the magnitude of an earthquake measures 7.5 on the Richter scale. Find the amount of energy,  $E$ , released by this earthquake.

$$M = \frac{2}{3} \log \frac{E}{10^{11.8}}$$

$$\text{✧} \approx 1.12 \times 10^{23} \text{ ergs}$$



# ***Logarithmic and Exponential Properties***

- ✧ ***Exponential equations*** are equations where the variable occurs in an exponent.
- ✧ Logarithmic equations are those where a logarithm expression (or natural logarithm expression) is involved.
- ✧ To solve logarithmic or exponential equations, we can use many different properties that we have developed in this chapter.
- ✧ The following examples will use those properties to help solve the equations.

# ***Example 2***

✧ Solve each equation for  $x$ :

$$\text{✧ } 9^{2x} = 27^{x-1}$$

$$\text{✧ } 81^{3-x} = \left(\frac{1}{3}\right)^{5x-6}$$



# ***Example 3***

✧ Solve the logarithmic equation for  $x$ :

$$4^x = 11$$

$$\text{✧ } x \approx 1.73$$

# ***Example 4***

✧ Solve for  $x$ :

$$8e^{2x-5} = 56$$

$$\text{✧ } x \approx 3.47$$

# ***Example 5***

✧ Solve each equation. Check for extraneous solutions (remember we cannot take the log of a negative number).

$$\text{✧ } \ln(7x - 4) = \ln(2x + 11)$$

$$\text{✧ } \log_2(h - 6) = 5$$



# ***Example 6***

✧ Solve the equation and check for extraneous solutions.

✧  $\log_4(x+12) + \log_4x = 3$



# ***Assessment***

*Pgs. 519-520:  
#’s 3-42, multiples of 3*