

## Application of Logarithmic Functions:

Logarithmic functions are very important in science and other areas. Here is an excellent application of the logarithmic function.

**Example:** The magnitude,  $R$ , of the Richter scale of an earthquake of intensity  $I$  is given by:

$$R = \log \frac{I}{I_0} .$$

Mercalli Scale	Richter Scale
<b>I.</b> Felt by almost no one.	<b>2.5</b> Generally not felt, but recorded on seismometers.
<b>II.</b> Felt by very few people.	<b>3.5</b> Felt by many people.
<b>III.</b> Tremor noticed by many, but they often do not realize it is an earthquake.	
<b>IV.</b> Felt indoors by many. Feels like a truck has struck the building.	
<b>V.</b> Felt by nearly everyone; many people awakened. Swaying trees and poles may be observed.	
<b>VI.</b> Felt by all; many people run outdoors. Furniture moved, slight damage occurs.	<b>4.5</b> Some local damage may occur.
<b>VII.</b> Everyone runs outdoors. Poorly built structures considerably damaged; slight damage elsewhere.	
<b>VIII.</b> Specially designed structures damaged slightly, others collapse.	<b>6.0</b> A destructive earthquake.
<b>IX.</b> All buildings considerably damaged, many shift off foundations. Noticeable cracks in ground.	
<b>X.</b> Many structures destroyed. Ground is badly cracked.	<b>7.0</b> A major earthquake.
<b>XI.</b> Almost all structures fall. Bridges wrecked. Very wide cracks in ground.	<b>8.0</b> Great earthquakes.
<b>XII.</b> Total destruction. Waves seen on ground.	<b>and up</b>

Here,  $I_0$  is the intensity of a barely felt zero-level earthquake. The earthquake that destroyed San Francisco in 1906 was  $10^{8.3}$  times as intense as a zero-level earthquake. What was its magnitude on the Richter scale?

We will come back and solve this problem after we have discussed the logarithmic function.

