# D.5 - Log/Expo Applications and Modeling

## Day 3

The formula $\log \frac{I_1}{I_2} = M_1 - M_2$ compares the intensity levels of earthquakes where $I$ is the intensity level determined by a seismograph, and $M$ is the magnitude on a Richter scale.

**Ex.**

In 1995, an earthquake in Mexico registered 8.0 on the Richter scale. In 2001, an earthquake of magnitude 6.8 shook Washington state. How many times more intense was the 1995 earthquake than the 2001 earthquake?

$M_1$

$M_2$

$\log_{10} \frac{I_1}{I_2} = 1.2$

$10^{1.2} = \frac{I_1}{I_2}$

15.8

Mar 15-9:26 AM

**Sound Application:** The loudness in decibels (dB) of a sound is defined as $10 \log \frac{I}{I_0}$, where $I$ is the intensity of the sound in watts per square meter $(W/m^2)$. $I_0$, the intensity of a barely audible sound, is equal to $10^{-12}$ $W/m^2$. Town regulations require the loudness of construction work not to exceed 100 dB.

a.) Suppose a construction team is using a jackhammer that can produce a sound of intensity of $1.75 \times 10^{-3}$ $W/m^2$. Does this sound violate town regulations?

$L = 10 \cdot \log \frac{1.75 \times 10^{-3}}{10^{-12}} \rightsquigarrow 92.43 \text{ dB}$ No

b.) What is the intensity (I) in $W/m^2$ of a sound of loudness 75 decibels?

$7.5 = \log_{10} \frac{I}{10^{-12}}$

$10^{7.5} = \frac{I}{10^{-12}}$

mult.

$3.16 \times 10^{-5}$ $W/m^2 = I$

Mar 15-10:01 AM

## Amortization Calculation

Usually, whether you can **afford** a loan depends on whether you can afford the periodic **payment** (commonly a monthly payment period). So, the most important amortization formula is probably the calculation of the *payment amount per period*.

**Calculating the Payment Amount per Period**

The formula for calculating the payment amount is shown below.

$$A = P\frac{r(1+r)^n}{(1+r)^n - 1}$$

where

- $A$ = payment Amount per period
- $P$ = initial Principal (loan amount)
- $r$ = interest rate per period
- $n$ = total number of payments or periods

Mar 15-10:09 AM

**Example:** What would the ***monthly*** payment be on a 5-year, $20,000 car loan with a *nominal* 7.5% ***annual*** interest rate? We'll assume that the original price was $21,000 and that you've made a $1,000 down payment.

$P = 20000$

$r = 7.5\% \div 12 \rightarrow 0.625\%$ ⟿ decimal $0.00625$

$n = 5\text{yrs} \times 12\ \text{months} \rightarrow 60$

$$A = 20000 \cdot \frac{.00625(1+.00625)^{60}}{(1+.00625)^{60}-1}$$

$A = \$$

Mar 15-10:15 AM

7-4 : p.466 : 45, 46, 73, 74

7-5 : p.474 : 62, 63

7-3 p.456 : 32 → 35 all

Mar 15-1:46 PM