

Question 6

The intensity I of an earthquake is measured on the Richter scale using the formula:

$$R = \log_{10} \left(\frac{I}{I_0} \right)$$

where R is the Richter magnitude and $I_0 = 10^{-4}$ is the reference intensity.

- (a) If an earthquake has intensity $I = 10^{-1.5}$, what is its magnitude R ?
- (b) If an earthquake has a Richter magnitude of $R = 6.2$, what is its intensity I ?
- (c) How many times more intense is an earthquake of magnitude 7.2 compared to one of magnitude 5.2?

Question 6 - Solution

(a) Compute the magnitude R :

$$R = \log_{10} \left(\frac{10^{-1.5}}{10^{-4}} \right) = \log_{10}(10^{2.5}) = \boxed{2.5}$$

(b) Find the intensity for $R = 6.2$:

$$R = \log_{10} \left(\frac{I}{10^{-4}} \right) \Rightarrow 10^R = \frac{I}{10^{-4}} \Rightarrow I = 10^R \cdot 10^{-4}$$

$$I = 10^{6.2-4} = 10^{2.2} \approx \boxed{158.49}$$

(c) Compare intensities of magnitudes **7.2** and **5.2**:

Let I_1 and I_2 be the intensities corresponding to magnitudes 7.2 and 5.2, respectively.

$$\log_{10} \left(\frac{I_1}{I_0} \right) = 7.2 \Rightarrow I_1 = 10^{7.2} \cdot I_0, \quad \log_{10} \left(\frac{I_2}{I_0} \right) = 5.2 \Rightarrow I_2 = 10^{5.2} \cdot I_0$$

$$\frac{I_1}{I_2} = \frac{10^{7.2} \cdot I_0}{10^{5.2} \cdot I_0} = 10^{7.2-5.2} = 10^2 = \boxed{100}$$

So the magnitude 7.2 earthquake is **100 times more intense** than the 5.2 earthquake.