

Section 1: Exponential functions and logarithms

Solutions to Exercise level 3

1. (i) $A_k = L(10^{k-4})$

(ii) $A_k = L(10^{k-4})$

$$\Rightarrow k - 4 = \log_{10} \frac{A_k}{L}$$

$$\Rightarrow k = 4 + \log_{10} A_k - \log_{10} L$$

(iii) $A_6 = (0.01)(10^2) = 1$

so waves of approximately 1 metre would be expected.

(iv) $k = 4 + \log_{10} 2 - \log_{10}(0.01) \approx 6.3$ (1 d.p.)

so the quake was approximately 6.3 on the Richter Scale.

(v) Energy released $\propto (A_k)^{\frac{3}{2}}$

so in an increase from magnitude 4 to magnitude 6.3,

$$\text{relative increase in release} \approx \left(\frac{A_{6.3}}{A_4} \right)^{\frac{3}{2}}$$

$$\approx (10^{2.3})^{\frac{3}{2}} \approx 2818$$

so the energy released increases by a factor of approximately 2800