Day 7: 3.5 – Applications of Rational Functions

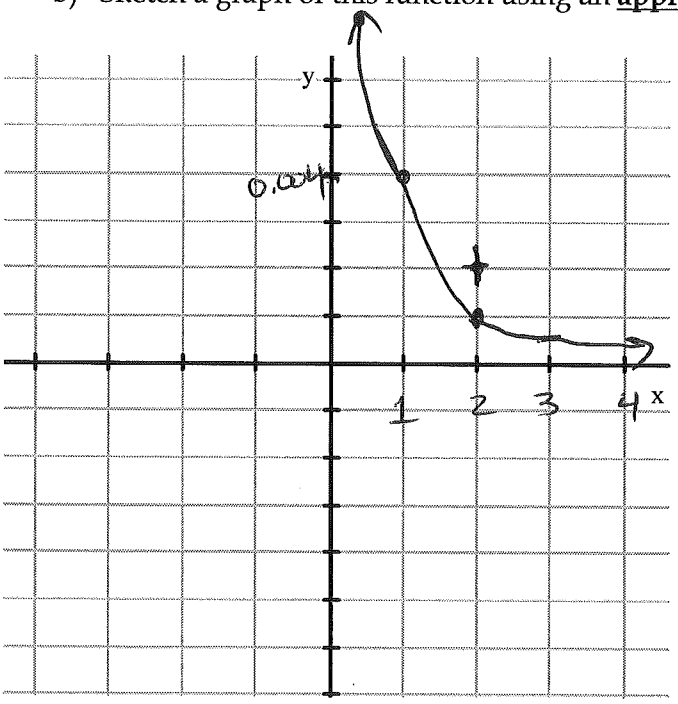
EX 1 - The intensity of sound, in watts per square meter, varies inversely as the square of the distance, in meters, from the source of the sound. The intensity of the sound from a loudspeaker at a distance of 2 m is 0.001 W/m²

a) Determine a function to represent this relationship. Note: $I = \frac{k}{d^2}$

$0.001 = \frac{k}{2^2}$

$k = 0.004 \Rightarrow I = \frac{0.004}{d^2}$

b) Sketch a graph of this function using an **appropriate** domain and range.



Domain: $d > 0$

range: $I > 0$

c) What is the effect of **halving** the distance from the source of the sound?

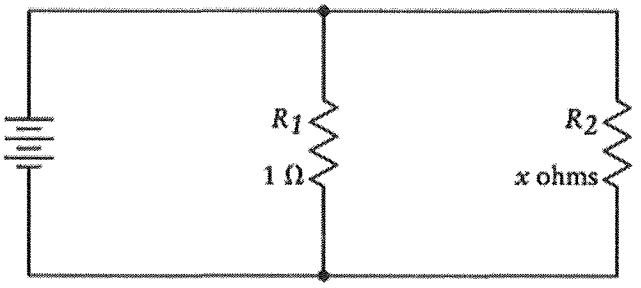
$I = \frac{0.004}{(\frac{1}{2}d)^2} = \frac{0.004}{\frac{1}{4}d} = (0.004)(4)/d$

∴ Intensity would be 4 times higher.

EX 2 - When connected in parallel, a resistor of x ohms and a resistor of 1 Ω will have a total resistance is defined by the function $R(x) = \frac{x}{1+x}$

a) For the total resistance to be 0.5 Ω, what does the resistance x need to be?

b) For the total resistance to be less than 0.25Ω, what does the resistance x need to be?



a) $0.5 = \frac{x}{x+1}$

$0.5x + 0.5 = x$

$0.5x = 0.5$

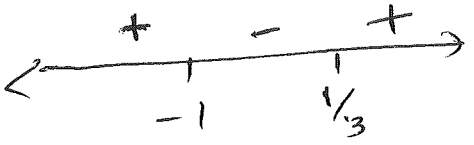
$\boxed{x = 1}$

b) $\frac{x}{x+1} < 0.25$

$\frac{x}{x+1} - \frac{1}{4} < 0$

$\frac{4x - (x+1)}{x+1} < 0$

$\frac{3x - 1}{x+1} < 0$



$x \in (-1, 1/3)$

NOTE: Resistance can be < 0.