Answer on Question #49812-Physics-Other

Sound from speakers registered an intensity level of $\beta_1 = 126dB$ when measured at a distance of $r_1 = 32m$ from the speakers. How far away would you have to be to hear a sound intensity level of $\beta_2 = 60dB$.

Solution

The ratio of intensities is

$$\frac{I_1}{I_2} = \left(\frac{r_2}{r_1}\right)^2.$$

The sound intensity level is given by equation

$$\beta = (10\ dB) \log_{10}\left(\frac{I}{I_0}\right),$$

where $I_0 = 10^{-12}\frac{W}{m^2}$.

Thus

$$\frac{\beta_1}{\beta_2} = \log_{10}\left(\frac{I_1}{I_2}\right).$$

So

$$\frac{I_1}{I_2} = 10^{\frac{\beta_1}{\beta_2}}.$$

Then

$$r_2 = r_1\sqrt{\frac{I_1}{I_2}} = r_1\sqrt{10^{\frac{\beta_1}{\beta_2}}} = 32\sqrt{10^{\frac{126}{60}}} = 359\ m.$$

Answer: $359\ m$.