Example 3

Sound from a near by airport has an intensity of 3.5×10^{-3} W/m^2 as heard from your home. What is the decibel rating for this noise?

$I = 3.5 \times 10^{-3}$ w/m^2

$$dB = 10 \cdot \log_{10}\left(\frac{3.50 \times 10^{-3}}{1.0 \times 10^{-12}}\right)$$

$$dB = 10 \cdot \log_{10}(3.5 \times 10^{9})$$

$$dB = 10 \cdot \frac{\ln(3.5 \times 10^{9})}{\ln(10)}$$

$$dB = 10 \cdot 9.54$$

$$\boxed{dB = 95.4}$$

Example 4

Each of four people talking, when speaking individually produce an unknown sound with an unknown intensity I_1. When all four talk together, the sound level is 70.0 dB.

A. What is the sound intensity for each individual voice?
B. How many decibels does each voice have?

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

$$70 = 10 \cdot \log_{10}\left(\frac{4 \cdot I}{1.0 \times 10^{-12}}\right)$$

$$7 = \log_{10}\left(\frac{4 \cdot I}{1.0 \times 10^{-12}}\right)$$

$$10^{7} = \frac{4 \cdot I}{1.0 \times 10^{-12}}$$

$$1 \times 10^{7} = \frac{4 \cdot I}{1.0 \times 10^{-12}}$$

$$1.0 \times 10^{-5} = 4 \cdot I$$

$$\boxed{I = 2.50 \times 10^{-6}\ w/m^2}$$

Doppler Effect

Example 5

The siren of a police car at rest emits a frequency of 1600.0 Hz. What frequency will you hear if you are at rest and the police car moves at 25.0 m/s...

A. Toward you
B. Away from you

$f_s = 1600$ Hz

$v_s = 25.0$ m/s

$v = 343$ m/s

A)

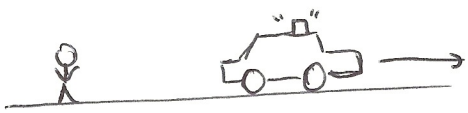
$$f_o = f_s\left(\frac{v +/- v_o}{v +/- v_s}\right)$$

$$f_o = 1600\left(\frac{343 +/- 0}{343 - 25}\right)$$

$$f_o = 1600\,(1.08)$$

$$\boxed{f_o = 1728\ Hz}$$

B)



$$f_o = f_s\left(\frac{v +/- v_o}{v +/- v_s}\right)$$

$$f_o = 1600\left(\frac{343 +/- 0}{343 + 25}\right)$$

$$f_o = 1600\,(0.932)$$

$$\boxed{f_o = 1491\ Hz}$$