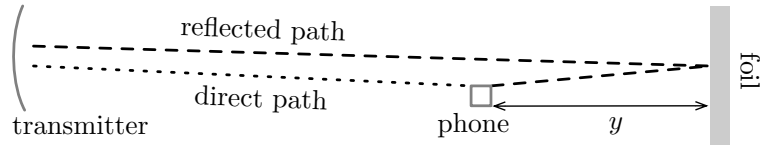
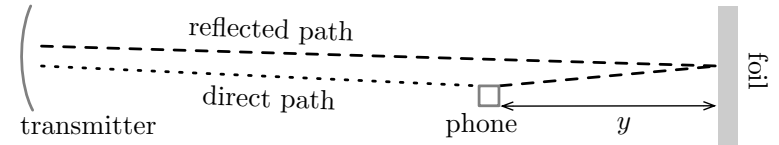


You are trying to increase the signal to your phone and flatten a piece of aluminum foil to act as a mirror so that you can reflect the signal to your phone. In this way the phone receives the signal twice. You are holding the aluminum foil $y = 5\text{cm}$ from the phone as shown. Suppose that the reflected signal has an amplitude of $3.0\frac{\text{N}}{\text{C}}$ and the direct signal has an amplitude of $4.0\frac{\text{N}}{\text{C}}$. What is the amplitude of the combined signal? The wavelength of the signal is 30cm .



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Solution:

$$\Delta\phi = 2\pi \frac{\Delta x}{\lambda} = 2\pi \frac{2y}{\lambda} = 2\pi \frac{10\text{cm}}{30\text{cm}} = 2\frac{\pi}{3}$$

so

$$\begin{aligned} E^2 &= E_1^2 + E_2^2 + 2E_1E_2 \cos(\Delta\phi) \\ &= E_1^2 + E_2^2 + 2E_1E_2(-1/2) \\ &= E_1^2 + E_2^2 - E_1E_2 \\ &= (3.0\frac{\text{N}}{\text{C}})^2 + (4.0\frac{\text{N}}{\text{C}})^2 - (3.0\frac{\text{N}}{\text{C}})(4.0\frac{\text{N}}{\text{C}}) \\ &= (9 + 16 - 12)(\frac{\text{N}}{\text{C}})^2 \\ &= 13(\frac{\text{N}}{\text{C}})^2 \end{aligned}$$

So

$$E = \sqrt{13} \frac{\text{N}}{\text{C}}$$