If the distance of the observer/listener from both of the two sound sources is ***large*** compared to the sound source separation distance, *i.e.* $L >> d$, {the so-called "far-field" limit} then $\tan\theta \approx \sin\theta$ and hence $\Delta L \approx d \sin\theta$. The relative phase difference between the two amplitudes at the observer/listener location is: $\delta = k\,\Delta L = 2\pi\Delta L/\lambda \approx 2\pi d \sin\theta/\lambda$ (in radians).

At the observer/listener location, suppose the individual over-pressure amplitudes at a given instant in time are given by:

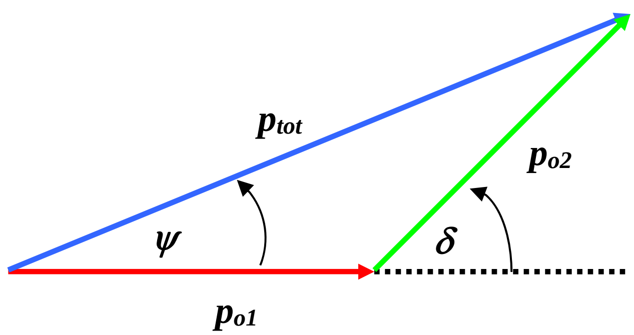
$$p_1(L,t) = p_{o_1}\cos(\omega t - kL)$$

$$p_2(L,t) = p_{o_2}\cos[\omega t - k(L+\Delta L)] = p_{o_2}\cos(\omega t - kL - \delta)$$

$$p_{tot}(L,t) = p_1(L,t) + p_2(L,t) = p_{o_1}\cos(\omega t - kL) + p_{o_2}\cos(\omega t - kL - \delta)$$

The phase-sensitive interference relation between the two individual over-pressure amplitudes and the resultant/total over-pressure amplitude heard by the observer/listener can be represented graphically using a so-called ***phasor diagram***, as shown in the figure below. The phasor diagram adds the two vector amplitudes together to form the resultant/overall/net vector amplitude.

The phasor diagram, by convention, orients the over-pressure amplitude associated with the first sound source $p_1(z,t)$ on the horizontal axis. The base of the over-pressure amplitude associated with the second sound source, $p_2(z,t)$ is placed at the tip of the first, and angled away from the $x$-axis by the relative phase difference angle, $\delta$. The resultant/total/net displacement amplitude, $y_{tot}(t)$ is the vector drawn from the base of the first displacement amplitude to the tip of the second displacement amplitude, as shown in the figure below:




Note that the phasor triangle obeys the trigonometrical *law of cosines* relation:

$$c^2 = a^2 + b^2 - 2ab\cos(\pi - \delta) = a^2 + b^2 + 2ab\cos\delta$$

{the latter relation on the RHS of this equation was obtained using the trigonometric identity: $\cos(A - B) = \cos A\cos B + \sin A\sin B$).

The *magnitude* (*i.e.* length) of the resultant/total/net over-pressure amplitude, $p_{tot}$ is given by:

$$p_{tot}^2 = p_{o_1}^2 + p_{o_2}^2 + 2p_{o_1}p_{o_2}\cos\delta \quad \text{or:} \quad p_{tot} = \sqrt{p_{o_1}^2 + p_{o_2}^2 + 2p_{o_1}p_{o_2}\cos\delta}$$