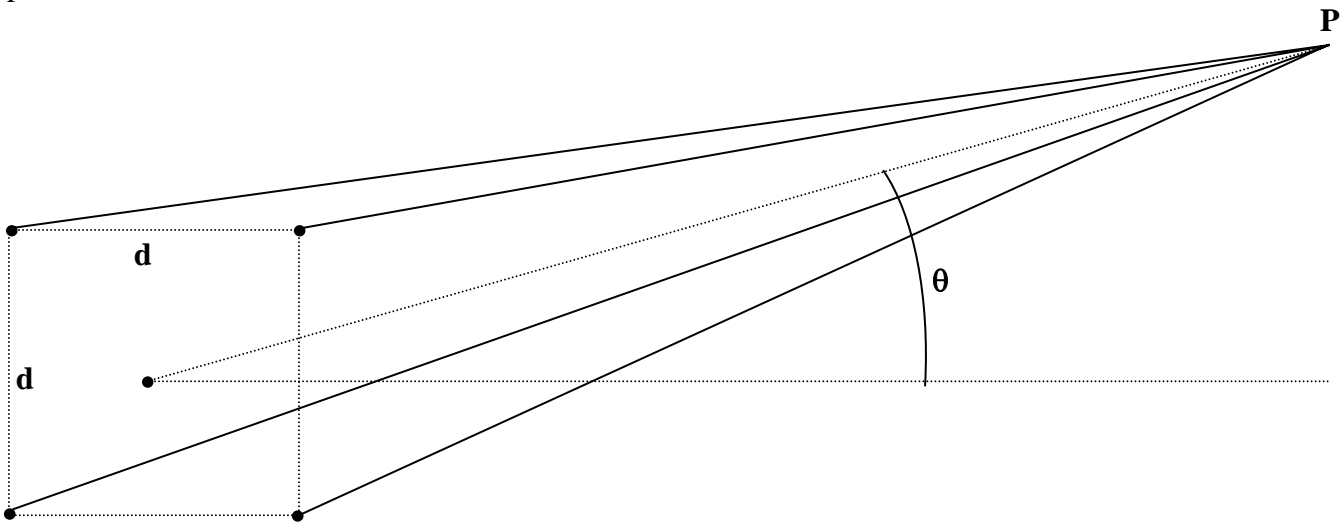


Square Antenna Array

- Purpose:
1. To investigate the intensity of light at distant points due to the interference of four point sources positioned on the corners of a square.
 2. To gain practice working adding sinusoidal waves using phasors

Introduction:

The intensity, $I(\theta)$, due to a number of point sources can be determined by taking into account the phase differences and amplitudes of the waves arriving at some point, P. If the waves leave their sources with equal intensities and if P is a distant point, we can often ignore any differences in amplitude of the arriving waves. In this case the resultant wave depends only on the differences in phase between the waves. In this exercise we will find $I(\theta)$ for an array of four point sources located on the corners of a square as shown in the figure. The resultant amplitude at P can be found by combining equal length phasors that represent the phase of each individual wave.



Procedure:

1. Make a careful phasor diagram showing the phasor for each of the four waves arriving at P. Find the resultant phasor, E_R , in terms of d , λ , and θ . **Hint:** Take advantage of the symmetry in your phasor diagram.
2. Find $I(\theta) = k E_R^2$ (k = a proportionality constant). Put your answer in terms of the equal intensities, I_0 , the intensity of waves originating from each point source.
3. Assume that $d = \lambda$ and use graphical analysis (or Excel) to create a polar graph of $I(\theta)$ vs θ ($0 \leq \theta \leq 2\pi$) to show how the intensity varies for different angles. Set $I_0 = 1$ to establish a relative scale for the intensity function.
4. Determine the location of all of the minima and maxima of $I(\theta)$ between 0 and 90 degrees.
5. Repeat for $d = 2\lambda$ and $d = \lambda/3$.