Physics 262 Written HW #4

1. Use phasors to find A and B in the expressions:

a) $A\cos(\omega t + B) = 2\cos(\omega t) + 3\cos(\omega t + \pi/4)$

b) $A\cos(\omega t + B) = 6\cos(\omega t) + 4\cos(\omega t + 11\pi/6)$

2. Consider 3 equal-width slits. The bottom two are 5 microns apart, while the top one is 10 microns above the middle one.

a) Use phasors to show that the intensity in the interference pattern is nowhere zero.

b) Draw a phasor diagram for the E field $1/80^{th}$ of a radian above the central maximum, and $1/80^{th}$ of a radian below the central maximum. The wavelength is 0.5 microns.

c) What are the intensities at these angles, compared with the central maximum?

3.a) Use phasors to sketch the intensity vs. angle for a 4-slit interference pattern (identical width and separation d=5 microns, wavelength =0.5 microns.)

b) On the same angular scale, draw the intensity pattern if the top two slits are covered.

c) The intensity pattern if the bottom 2 slits are covered is the same as (b), of course. So you can consider the top and bottom pairs of slits as *two sources* that have an angularly dependent radiation pattern. These two sources interfere with each other, and they are separated by 2d (center to center.) Draw, on the same angular scale, the intensity pattern for interference of two uniform slit sources separated by 2d. If you multiply this by your pattern in (b), you should get your pattern in (a).

d) Now consider the interference pattern from just the top and bottom slits, which have a separation of 3d. (Cover the two middle slits.) Sketch, on the same angular scale, this pattern. Are the zeros of intensity at the same angles as in (a)? Discuss why or why not.

4. Phasors can also be used to describe thin film interference. Assume the reflections off the top and bottom surfaces of a thin soap bubble film are the same amplitude. If the film is 2 microns thick, and the index of refraction of water/soap is 1.33, what is the phasor diagram and relative reflected intensity (compared with the maximum) for red light (700 nm) and blue light (400 nm)?