Physics 216 HW 3: Ch 17 To hand in due beginning of class 2/3/2017.

To receive full credit:

- **clearly show your reasoning** (including any necessary calculations),
- **indicate your final answer in an unambiguous way** (such as by circling or underlining it).
- **Round your answers appropriately**

Use a separate sheet to answer problems/work solutions.

1. Exercises and Problems #4 in Ch 17
2. Exercises and Problems #28 in Ch 17
3. Since we have 2 ears, we could use interference effects to help us track where sounds come from as follows: The sound waves from a single source would arrive at each ear with a different phase due to traveling different distances to each ear. If the sound displacement at each ear is converted in to a corresponding nerve signal and the two signals are superposed in the audio cortex of the brain, the signal would be large if the phases are the same, smaller when not. Rotating the head or waiting for the object to move could tell us about absolute location. Consider a source of 440Hz sound 10 m away from you as it moves around a circle keeping a constant distance from you.
   a) Carefully sketch the setup (graph paper may help—see next page).
   b) Use the sketch to help you find a relationship for the phase difference between the signals from each ear as a function of angle around the circle. Be explicit about any assumptions you make and any data sources you use.
   c) Under everyday conditions (state them), find an expression for the combined signals—that is, find the function $A(\theta)$ that describes the amplitude of the combined signal as the source moves to various angles, θ.
   d) I) Plot (include the plot in what you hand in) the function you found in c) and
      ii) comment on how well you think such a method would be at helping you localize where a sound comes from.
      iii) Could you tell if a source is in front of you or 180 degrees from there if all you had to go on was this sort of detection scheme?