

### PHGN 462 Recitation 3

As always, make sure you interpret your results and discuss them amongst your group.

Start with a parallel plate waveguide with plates that are some distance  $b$  apart. We're going to find the TM modes that this waveguide can support. Let  $z$  be the direction of propagation, and let  $y = 0$  and  $y = b$  be the locations of the plates.

- a) Write a trial magnetic field that might be appropriate. Check that trial field against all four of the Maxwell equations (but not the wave equation – we're doing it a bit differently this time). Identify any conditions that need to be satisfied for the Maxwell equations to be true. For example, you should get at the very least the beginnings of a dispersion relation and a rough form for  $E$ .
  
- b) Use our fundamental boundary conditions to fix any unidentified constants that you have floating around, and to find any induced surface charges and currents. By the time you're done, you should have a complete dispersion relation, and fields that are indexed by some integer  $n$ .
  
- c) Find the group and phase velocities for these TM modes. Also find the cutoff frequency for any particular mode. Compare these to the corresponding quantities for TE modes.