ECE 473
Homework Assignment #7
Due: Friday, October 26, 2018

1. For plane wave reflection from a fluid – fluid interface it is observed that at normal incidence the pressure amplitude of the reflected wave is one-half that of the incident wave (no phase information is recorded). As the angle of incidence is increased, the amplitude of the reflected wave first decreases to zero and then increases until at 40^o the reflected wave is as strong as the incident wave. Find the density and sound speed in the second medium if the first medium is water.

2. Derive Eq. 6.4.18 (the angle of intromission) from Snell's law and the conditions for the angle of intromission (show all work).

3. Problem 6.6.1 in Kinsler et al. Use air at 0˚C.

4. An acoustic sonar wave is incident from the ocean onto the steel hull of a surface ship.
   (a) Using the properties for sea water listed in Appendix A10 in the text and the properties of steel listed below determine all critical angles, i.e., for both longitudinal and transverse waves if both exist.

   Steel: $\rho = 7850$ kg/m^3
   Longitudinal propagation speed, $c_L = 6100$ m/s
   Shear propagation speed, $c_S = 3280$ m/s

   (b) What are the angles for all waves transmitted for an incident angle of 20˚?