Name: 1B Discussion - Week 2

1. **Tsunami** *(YF 13th ed. 15.3).* On December 26, 2004, a great earthquake occurred off the coast of Sumatra and triggered immense waves (tsunami) that killed some $200,000$ people. Satellites observing these waves from space measured 800km from one wave crest to the next and a period between waves of 1.0 hour. What was the speed of these waves in km/h and in m/s. Does your answer help you understand why the waves caused such devastation?

2. **Speed of Propagation vs. Particle Speed** *(YF 13th ed. 15.12).*
(a) Show that the equality holds

$$y(x,t) = Acos\left[2\pi f\left(\frac{x}{v} - t\right)\right] = Acos\left[\frac{2\pi}{\lambda}(x - vt)\right] \quad (1)$$

(b) Use y(x,t) to find an expression for the transverse velocity v_y of a particle in the string on which the wave travels. (c) Find the maximum speed of a particle of the string. Under what circumstances is this equal to the propagation speed v? Less than v? Greater than v?

3. **Standing Waves** *(YF 13th ed. 15.50).* A flexible stick 2.0 m long is not fixed in any way and is free to vibrate. Make clear drawings of this stick vibrating in its first three harmonics, and then use your drawings to find the wavelengths of each of these harmonics. (Hint: Should the ends be nodes or antinodes?)

4. **Energy of Sound** *(YF 13th ed. 15.25).* A jet plane at takeoff can produce sound of intensity $10.0 W/m^2$ at 30.0 m away. But you prefer the tranquil sound of normal conversation, which is $1.0 \mu W/m^2$. Assume that the plane behaves like a point source of sound. (a) What is the closest distance you should live from the airport runway to preserve your peace of mind? (b) What intensity from the jet does your friend experience if she lives twice as far from the runway as you do? (c) What power of sound does the jet produce at takeoff?