# Problem set 1

1. You make a couple observations of a harmonic wave traveling to the right on a string. A photograph of the string at t=0 shows that there is a crest at x=0 and that the crests are separated by 2m. Watching the motion of the string bit at x=0m, you see that it takes it 0.1s to go from its lowest to its highest point and that distance is 0.2m. Write an explicit expression f(x,t) that describes this wave.
2. Q1 B.1 (Although this is from a chapter not yet discussed, we have discussed the part needed to do this problem.
3. The *intensity* I of a sound wave is the power per unit area. Because the range of intensities is so large and because of the physiology of the ear, it is more convenient to use the *intensity level* instead. The intensity level β is proportional to the log of the intensity. The usual units are decibels (dB).
   $\beta = 10 \log_{10}(I/I_0)$ dB with $I_0 = 10^{-12}$ W/m$^2$, which is near the threshold of hearing.
   Ordinary conversation is around 60 dB, and loud music is around 120 dB. What is the ratio of the amplitude of the louder sound wave to that of the quieter one?
4. Make up a function that describes a wave *pulse* traveling to the left (-x) in 1-dimension on a string with wave speed 10m/s. The choice of shape is yours. Show that it is a solution to the wave equation. Write the expression for the total energy in your wave pulse. If it is simple enough, carry out the integration to get a final expression for the energy.
5. Observe surface waves on water. Do they seem to be dispersionless? Do they obey the superposition principe? How does the answer to the previous question depend on the amplitude of the waves?