Math 207C
Homework 2
Due Friday, April 15th

1. Compute the swimming speed of an undulating sheet moving at zero Reynolds number between two walls on which the velocity is zero (in lab frame) located at $y = \pm L$ in the limit of low amplitude. In the reference frame moving with the swimmer, the shape of the swimmer is $y = A \sin(kx - \omega t)$.

2. Suppose the position of a mass on a damped linear spring obeys the following equation

$$m\ddot{x} + b\dot{x} + kx = 0,$$

where m, b, and k are constants representing the mass, damping coefficient, and spring constant, respectively.

   (a) Each term in the above equation has dimensions of force. Identify the dimensions of b and k in terms of mass, length, and time.

   (b) Identify the three time scales in the problem and discuss their physical meaning.

   (c) Present two different nondimensionalizations: one appropriate for the limit of vanishing friction and the other appropriate for the limit of vanishing mass. Identify the small nondimensional parameter in each case.