# Physics 312 – Classical Mechanics – Homework 6

1. The frequency of a damped harmonic oscillator is 100 Hz, and the ratio of the amplitude of two successive maxima is one half.
a. What is the natural (undamped) frequency of this oscillator, in Hertz?
b. If the oscillator is launched at time $t = 0$ from the origin with speed 2 m/s, what is its speed at time $t = 0.0140$ sec?

2. The amplitude of a damped harmonic oscillator drops to $1/e$ of its initial value after $n$ complete cycles. Show that the ratio of the period of oscillator to the period of the same oscillator with no damping is given by

$$\frac{T_d}{T_0} \cong 1 + \frac{1}{8\pi^2 n^2}$$

when $n$ is large.

3. Find the angular frequency of the mass-spring configurations shown above, assuming small oscillations about equilibrium. Each spring as elastic constant $k$. In parts (b) and (c), the junction between springs is massless.

*Hint*: In parts (b) and (c), it is helpful to write the condition for force balance at the massless junction. Denote its displacement by $x'$, and note that $x'$ is not equal to the displacement $x$ of the mass.