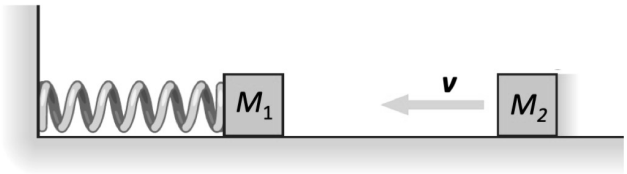
Chapter 14 Written Homework Problems
DUE: April 14th at the beginning of class
SHOW ALL WORK FOR FULL CREDIT

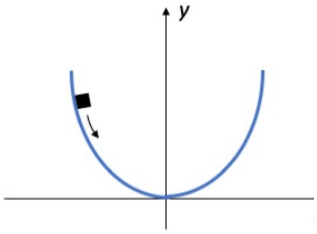
1. What is the equation describing the displacement of an object as a function of time if the object undergoes simple harmonic motion *(a)* with amplitude 1.0 cm, frequency 5.0 Hz, and maximum displacement at $t = 0$ and *(b)* with amplitude 3.5 cm, angular frequency of 2.0/s and maximum velocity at $t = 0$.

2. An object is attached to a spring and undergoes simple harmonic motion. If its mass is 100 g, its maximum acceleration is 10 m/s^2 and its maximum speed is 4.5 m/s, what is *(a)* its angular frequency, *(b)* the spring constant, and *(c)* the amplitude of the motion?

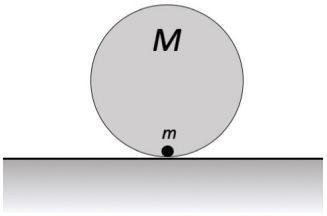
3. Mass M_1 (= 2.0 kg) is on a frictionless surface and attached to a spring with spring constant k (= 25 N/m) as shown in the Figure. The block is oscillating with a phase constant φ_1 (= $-\pi/2$) and amplitude A_1 (= 5 cm), as given by $x(t) = A_1\cos(\omega t - \pi/2)$. A block of mass M_2 (= 1.0 kg) moving with a speed v (= 2.0 m/s) hits and sticks to the first block. M_2 strikes M_1 when the spring is at is maximum extension. What is the *(a)* frequency, and *(b)* amplitude of the motion of the $M_1 + M_2$ combination?



4. The shape of a frictionless slope is given by $y = \alpha x^2$, where α is a constant with units of [m^{-1}]. A mass is placed on this slope and released. What is the period of its oscillation?



5. Consider a point of mass m attached to the outside edge of the end of a solid cylinder of mass M and radius R, as shown in the Figure. Show that the period of oscillation of this system if it is rolled slightly away from its equilibrium position and released is given by $2\pi(3MR/2mg)^{1/2}$. Assume $m << M$.



6. Now suppose that the disk in #5 above, instead of sitting on the ground, rotates about a horizontal axle oriented perpendicular to the page and through its center. Assume the axle is frictionless. What is the period of oscillation? Explain the difference between your answer in #5 and your answer here.