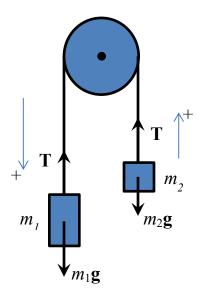PHY 166, Fall 2021, TEST 2, Practice
(3 points maximum for each problem, 15 points maximum for the whole)

Look into my Problem solving manual for the solution of these and similar problems.
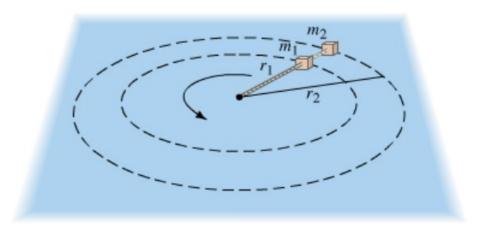
1) (Dynamics) A massless cord goes over a massless block, and the masses m_1 and m_2 are suspended at the ends of the cord. Find the acceleration of the masses and the tension of the cord.

2) (Linear momentum) An object of mass $m_1 = 30$ kg moving with the velocity $v_1 = 2$ m/s in the North-West direction is inelastically colliding with another object of mass $m_2 = 50$ kg moving with the velocity $v_2 = 2$ m/s in the North direction. What is the velocity of the system after the collision? What is the energy lost in the collision and the fraction of the energy lost in the collision?

3) (Circular motion)

23. (III) Two blocks, of masses m_1 and m_2, are connected to each other and to a central post by cords as shown in Fig. 5–37. They rotate about the post at a frequency f (revolutions per second) on a frictionless horizontal surface at distances r_1 and r_2 from the post. Derive an algebraic expression for the tension in each segment of the cord.

4) (Moment of inertia)

31. (II) Calculate the moment of inertia of the array of point objects shown in Fig. 8–43 about (a) the vertical axis, and (b) the horizontal axis. Assume $m = 1.8$ kg, $M = 3.1$ kg, and the objects are wired together by very light, rigid pieces of wire. The array is rectangular and is split through the middle by the horizontal axis. (c) About which axis would it be harder to accelerate this array?
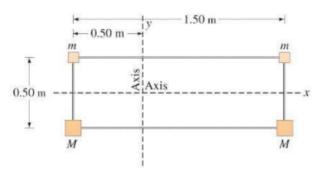

FIGURE 8–43   Problem 31.

5) (Rotational dynamics, energy conservation) A solid sphere rolls down a slope of height h without slipping. What will be the speed of its CM at the end of the slope?