Homework 10
Physics 1000
Preparatory Physics
Due: Friday April 11, 1997

Reading Assignment

Basic Technical Physics, by Tippens. Chapter 4.1, 4.2, 4.3, 4.8, Ch. 7.

1. A 10 kg object hangs from a vertical rope. Ignore the mass of the rope.

   a. What is the tension in the rope if the object is stationary?

   b. What is the tension in the rope if the object is moving upward with a constant velocity of 1 m/s?

   c. What is the tension in the rope if the object is moving downward with a constant velocity of 1 m/s?

   c. What is the tension in the rope if the object is moving upward with a constant acceleration of 1 m/s^2?

   c. What is the tension in the rope if the object is moving downward with a constant acceleration of 1 m/s^2?

2. Two boxes are suspended by a single rope over a frictionless pulley. Box 1 weighs 10 kg and Box 2 weighs 12 kg. The only force operating on the boxes are friction and the tension in the rope. Ignore the mass of the pulley and the mass of the rope.

   a. What is the accleration of Box 1?

   b. What is the accleration of Box 2?

   c. What is the tension in the rope?

3. Tow boxes are connected by a rope running over a pulley on the edge of a table. Box 1 is 5 kg and sits on a table. Box 2 is 2 kg and dangles from the rope attached to Box 1 which runs over the pulley. Ignore the mass of the rope and the pulley. The coefficient of friction between box 1 and the table is 0.2.

   a. What is the acceleration of Box 1?

   b. What is the acceleration of Box 2?

4. Consider a ball dropped from the mast of a moving boat. The boat is moving along the water at 5 m/s and the mast is 10 m over the surface of the water. Ignore air resistance.

   a. What is the x-component (horizontal) of the velocity of the ball when it hits the water?

   b. What is the y-component (vertical) of the velocity of the ball when it hits the water?

   c. How will the ball be in the air before it hits the water?

   d. How far will the ball travel horizontally while it is in the air?

   e. What is the final speed of the ball while it's in the air? (Hint: To answer this question use the definition that speed is the magnitude of the velocity vector. You need to use the Pythagorean theorem and both the x- and y-components of velocity to find speed.)