EXAM 1

February 10 and 11, 2004

Directions

- This exam is open notes, open book.

- You may not collaborate on this exam; do not work with others.

- When you are done with the exam, give it to me or put it in my office. Don't put it in my mailbox.

- Unless other arrangements are made, you should get this exam back to me by 10 pm on Wednesday February 11.

- Remember to include units.

- To receive full credit on these problems you must show your work clearly.

1. Consider two velocity vectors, $\vec{v_1}$ and $\vec{v_2}$. Let $\vec{v_1}$ have a magnitude of 10m/s and a direction of 53 degrees north of west. Let $\vec{v_2}$ have a magnitude of 20m/s and point due south.

   (a) Find the components of $\vec{v_3}$ where $\vec{v_3} = 2\vec{v_1} - \frac{1}{2}\vec{v_2}$.

   (b) Find the magnitude and direction of $\vec{v_3}$.

2. A disgruntled COA student drops a TAB mug off a 40 meter building. What is the speed of the mug right before it hits the ground?

3. A 60 kg goalie stands on a sheet of ice. He catches a 1 kg puck that was shot at him at 100 miles per hour. After he catches the puck, what is the speed of the goalie?

4. A student wants to throw a ball so that it reaches a height 20 meters off the ground. What is the minimum velocity with which the student must throw the ball in order to do so?
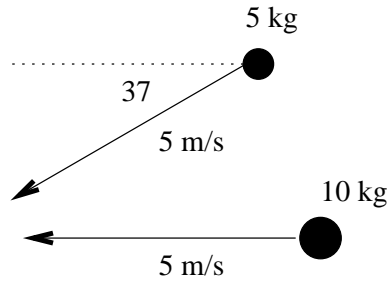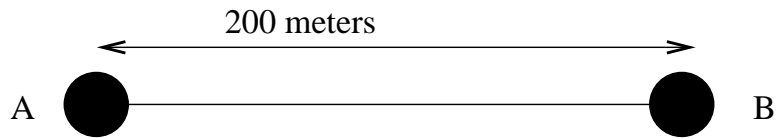
Figure 1:

Figure 2:

5. Two pucks collide on a frictionless surface. One puck has a mass of 10 kg and is moving due east at 5 m/s. The second puck has a mass of 5 kg and is moving 5 m/s, 37 degrees south of east. The two pucks collide and stick together. What is the velocity (magnitude and direction) of the two pucks immediately after the collision?

6. Two objects are arranged as shown in Fig.2. Object A has a mass of 25 kg. The center of mass of the system is 20 meters from object A. What is the mass of object B?