Physics Problem Set #3

Show your work if you want partial credit.

1. A plane flies northwest out of O'Hare Airport in Chicago at a speed of 400 km/hr in a direction of 150 degrees (i.e., 30 degrees north of west). The Canadian border is located a distance of 1500 km due north of Chicago. The plane will cross into Canada after approximately _____ hours.

2. A motor boat traveling 6 m/s, East encounters a current traveling 3.7 m/s, South.
   a. What is the resultant velocity of the motor boat?
   b. If the width of the river is 128 meters wide, then how much time does it take the boat to travel shore to shore?
   c. What distance downstream does the boat reach the opposite shore?

3. A cannonball is launched horizontally from the top of an 98.4-meter high cliff. How much time will it take for the ball to reach the ground and at what height will the ball be after each second of travel?

4. A pool ball leaves a 0.70-meter high table with an initial horizontal velocity of 2.6 m/s. Predict the time required for the pool ball to fall to the ground and the horizontal distance between the table's edge and the ball's landing location.

5. A soccer ball is kicked horizontally off a 25.0-meter high hill and lands a distance of 37.0 meters from the edge of the hill. Determine the initial horizontal velocity of the soccer ball.

6. A soccer ball is kicked at an angle of 32 degrees from the ground with a velocity of 21 m/s. How far away will the ball land? What is the maximum altitude of the ball?

7. A soldier would like to hit a target one half of a mile away. His cannon is set at an angle of 45 degrees from the ground. Can he determine the initial velocity that he needs for the cannonball? If so, what is it? If not, why not?

8. A quarterback wants to complete a pass to a receiver 28 yards downfield. He must throw it over a defender who is standing 14 yards downfield - the ball must be at a height of 10 feet to clear the defender. Assume the ball is released 6 feet off the ground and also caught 6 feet off the ground. At what angle and velocity should the quarterback throw the ball?

Bonus: Use the same scenario as problem #7 with the exception that the defender is standing 7 yards downfield. At what angle and velocity should the quarterback throw the ball?