PHYSICS 2A/SAMPLE EXAM 1

SHOW ALL WORK IN COMPLETE DETAIL. NO CREDIT WILL BE GIVEN IF NO WORK IS SHOWN!

1. A cross-country skier skis 2.80 km in the direction 45.0^o west of south for 25 minutes, then 7.40 km in the direction 30.0^o north of east for 40 minutes, and finally 3.30 km in the direction 22.0^o south of west for 30 minutes. Use a coordinate system where east corresponds to the positive x-axis and north corresponds to the positive y-axis. (10 pts)
   a) On a vector diagram show the displacement vectors, the resultant displacement vector, and the average velocity vector. The vectors do not have to be drawn to scale but approximate their magnitude and direction.
   b) Use the component method to calculate the magnitude and direction of the resultant displacement vector.
   c) Calculate the magnitude and direction of the average velocity vector.
   d) Calculate the average speed.

2. A boy stands at the edge of a bridge 20.0 m above a river and throws a stone straight down with a speed of 12.0 m/s. He throws another pebble straight upward with the same speed so that it misses the edge of the bridge on the way back down and falls in the river. For each stone find: (15 pts)
   a) the velocity as it reaches the water
   b) the average velocity while it is in flight.

3. A car is parked on a steep incline overlooking the ocean. The incline makes an angle of 37.0^o below the horizontal. The car rolls from rest down the incline with a constant acceleration of 4.00 m/s^2, traveling 50.0 m to the edge of a vertical cliff. The cliff is 30.0 m above the ocean. (15 pts)
   a) Find the speed of the car when it reaches the edge of the cliff and the time it takes to get there.
   b) Find the speed of the car when it lands in the ocean.
   c) Find the total time the car is in motion.
   d) Find the position of the car when it lands on the ocean, relative to the base of the car.

4. At $t_1 = 2.0s$, the acceleration of a particle in counterclockwise circular motion is $6\ m/s^2\ \mathbf{i} + 4.0\ m/s^2\ \mathbf{j}$. It moves at a constant speed. At At $t_2 = 5.0s$, its acceleration is $4\ m/s^2\ \mathbf{i} - 6.0\ m/s^2\ \mathbf{j}$.
   a) Draw a vector diagram indicating the acceleration vector, position vector, and velocity vector at both times indicated above. Take the origin of the coordinate system at center of circular path with the positive x-axis to the right and positive y-axis upward.
   b) Calculate the radius of motion of the particle.
   b) Calculate the displacement vector of the particle from $t_1 = 2.0s$ to $t_2 = 5.0s$.