**Physics 1145 Homework for Week 3: Vectors, Motion in 2-d**

1. Vectors $\vec{A}$ and $\vec{B}$ are given in components: $A_x=4$, $A_y=6$, $B_x=5$, $B_y=-2$.
a) Sketch the vectors in a diagram and find magnitude and direction of each vector.
b) The vector $\vec{C} = \vec{B} + \vec{A}$. Sketch the vector $\vec{C}$ and find its components, magnitude and direction.
c) The vector $\vec{D} = \vec{B} - \vec{A}$. Sketch the vector $\vec{D}$ and find its components, magnitude and direction.

2. In the figure, the magnitudes of the vectors are A= 5 and B=2. The angle θ equals 30°.

a) Calculate the vector components A_x, A_y, B_x, B_y.
b) The vector $\vec{C} = \vec{B} + \vec{A}$. Sketch vector $\vec{C}$ in the diagram and calculate its components, magnitude, and direction.
c) The vector $\vec{D} = \vec{B} - \vec{A}$. Sketch vector $\vec{D}$ in the diagram and calculate its components, magnitude, and direction.
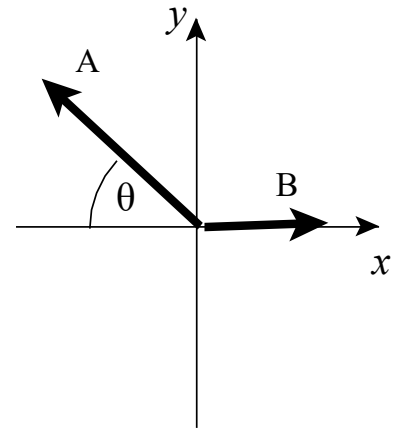
For problems 3-5, draw complete diagrams. Every symbol you use in your calculation must be defined in the diagram. Beginning from the kinematics starting equations, derive symbolic expressions and calculate numerical answers. Assume air resistance is negligible.

3. A skier with an initial speed of 2m/s is starting down a straight frictionless slope that is inclined by 10° with the horizontal. His speed at the bottom is 10 m/s. How long was the slope? How long did it take him to reach the bottom?

4. You roll a small ball on a horizontal table that is 1.2m above the floor. It rolls off the edge with a speed of 0.5m/s.
a) How long does it take the ball to hit the floor?
b) At what horizontal distance from the table does it land on the floor?
c) What is the ball's speed as it hits the ground? (Hint: velocity has x- and y- components!)
d) Sketch, qualitatively, the horizontal and vertical components of velocity as functions of time.

5. A stuntman is running towards a cliff and wants to jump off horizontally. The cliff is $H = 10$m above the water, but he must clear rocky outcrops at water level that extend into the water by a distance $D = 2$m from the base of the cliff.
a) How long is the stuntman in the air?
b) What is his minimum pushoff speed necessary to clear the rocks?