This is a practice test for test #1. Although the problems on your test may be similar to these, you are responsible for all the material we have covered.

Instructions: Solve each of the following problems. For full credit, you must supply complete details.

(1) Suppose $\vec{A} = 5\hat{i} + 4\hat{j}$. $\vec{B} = -3\hat{i} + 8\hat{j}$, and $\vec{C} = 3\hat{i} - 9\hat{j}$. Find the following:

(a) $\vec{A} \bullet \vec{B}$

(b) $\vec{A} + 2\vec{B} + 3\vec{C}$

(c) $\vec{B} - \vec{C}$

(d) $|\vec{A} - \vec{B}|$

(e) the angle between $\vec{A}$ and $\vec{C}$.

(2) A helicopter takes off straight up from the Earth. During the first 15 seconds after lift-off, the acceleration is given by $\vec{a} = 0\hat{i} + bt^2\hat{j}$ with t in seconds. At t=0, both the velocity and position are zero. At the end of this time,

(a) what is the velocity of the helicopter?

(b) what is the altitude of the helicopter?

(c) if b=0.03 m/s^4, provide numerical answers to (a) and (b) together with correct SI units

(3) A ball is projected upward from ground level with an initial speed of 20 m/s. If the initial velocity makes an angle of 25^0 with respect to the x-axis (i.e., the ground), answer the following:
(a) How far does the ball travel in the x-direction when it returns to the ground?
(b) How high did the ball go at its maximum altitude?

(4) You are the pilot and commander of an aerial Antarctic rescue mission. As your plane approaches the south pole, you note that you are flying at an altitude of 5000 m with a speed of 70 m/s. You must release a package of medicine so that it lands exactly at the south pole. Let y represent altitude and let x represent your distance from the south pole (the south pole has the coordinates (0,0) here). Assume that the initial velocity in the y-direction is zero.
(a) How long will it take (in seconds) for a package released from the airplane to hit the ground? You may ignore the curvature of the Earth and wind resistance.
(b) What is the x coordinate of the plane at the moment the package must be released in order to hit the south pole exactly?
(c) What is the velocity **vector** of the package at the moment it impacts the south pole?

(5) Two masses m_1 and m_2 are connected by a string and are resting on a frictionless table. Mass m_2 is pulled with a force F. Answer the following:
(a) **Draw free body diagrams**.
(b) Find the acceleration of the system (symbolically)
(c) Find the tension in the string (symbolically)
(d) If m_1=1 kg, m_2=3 kg and F=2N, provide numerical answer to (b) and (c) together with correct units.

(6) A mass m_1 is on a frictionless table and is connected to a mass m_2 by a string which is hanging over the side of the table. Find the tension and the acceleration in terms of m_1, m_2, and g. **You must provide free body diagrams here.**