PHYS 101

Homework # 3
DUE DATE: October 6, 2009

You have to use problem solving methods (analysis, solution and checks). Please do not submit copycat answers from the solutions book, internet or some other solution you have in hand. You should at least show your understanding of the problem. Otherwise, this will be considered as cheating.

1) An airplane has a speed of 280 km/h in still air. the pilot knows that prevailing winds tend to be roughly easterly, and ground control informs him that the actual wind speed is 90. km/h relative to the ground. The pilot notices, however, that he is flying north with a speed of 280 km/h relative to the ground, i.e. with the same speed as if there were no wind.
(a) What is the direction of the wind velocity, specified by its angle relative to the north direction?
b) What is the heading of the plane, specified by the angle between the axis of the plane and the north direction?

2) Discussion Questions 3.4, 3.9, 3.18   in the text. Chapter 3. (page 97-98)

3) This is a computer based problem.
Using a computer program or spreadsheet (like Excel) create a table which tabulates the values of the variables describing the motion of a particle specified below, and answer the questions:

A particle moves in the xy plane subject to the acceleration $a_x = -1.7$ and $a_y = -0.45$ (in units of cm and s). At $t = 0$, the particle passes through the point $x = 1$, $y = 10$ moving with velocity $v_x = 10$ and $v_y = 2$. Tabulate the following variables for small time steps while the particle is in the first (upper-right) quadrant only:

$t, x, y, r, \theta (= \tan^{-1} y / x), v_x, v_y, \phi (= \tan^{-1} v_y / v_x)$

Give all answers to three significant figures. Some questions may have more than one answer.
   (a) At what time and what location does the particle leave the first quadrant?
   (b) What is the maximum distance of the particle from the origin, and what is its speed at that time?
   (c) In what direction is the particle moving when its speed is 1.50?
   (d) Where does the particle cross the $45°$ line that bisects the quadrant?
Please do NOT submit the print out of the entire table, but rather for each question you may display the relevant portions of the table (just a few lines).

4) Problem 3-67   in the text. Chapter 3.,

5) Problem 3-70   in the text. Chapter 3.

6) Internet Treasure Hunt: Using a net browser, find the following information and tell which WWW site you have located this info. Please also explain (in step by step) how you have reached to this information
a) The current distance between earth and the sun, and between moon and the earth.

b) Physical constants, list only five of them, indicate the number of physical constant (with measurement errors) in your list you have found in internet.

c) The name of the founder of Oz Optics (a company which sells fiber optic products).

d) The physics nobel prize winners (with their research topics) in the past 20 years.

e) The textbook used in Freshman Physics Courses in Stanford University

7) A football kicker can give the ball an initial speed of v. Within what two elevation angles must he kick the ball to score a field goal from a point at a distance L to the front of goalposts whose horizontal bars is at a height h above the ground?

(Hint use $\cos^2 \theta + \sin^2 \theta = 1$ to get a relation between $\tan^2 \theta$ and $\dfrac{1}{\cos^2 \theta}$, substitute, and then solve the quadratic equation)