# PHYS 111
# HOMEWORK #4

Due : 24 Sept. 2015

1.  A man leaves his front door and walks 1000 m east, 2000 m north, then takes a cent from his pocket and drops it from a cliff 100 m high.  Set up a coordinate system and write an expression, using unit vectors, for the displacement of the coin.  What is the magnitude of this displacement? The man then returns home, what is the net displacement for his trip?

2.  A room has dimensions 8 m x 10 m x 12 m.  A fly starting at one corner flies along the diagonal to the diametrically opposite corner. What is the magnitude of the displacment (the fly go from a corner of the floor to the opposite corner of the ceiling).

3.  A car is driven north for 30 km, then east for 50 km, then in a direction 30 degrees east of north for 40 km.  Find the magnitude and direction of the displacment vector.

4. Differntiate the following functions :

a) $f(t) = t + \dfrac{1}{t}$

b) $f(x) = x^2 - 2x^{-3} + \dfrac{4}{x^4}$

c) $f(s) = a s^2 + c s + d$ (where a, c, d are constants)

d) $f(x) = \left(2x^2 + 3x + 1\right)^3$ (you may use the chain rule if you know it,

      otherwise expand the polynomial and differentiate term by term)

e) $f(t) = \dfrac{1}{1+t}$

5.   An object is dropped from rest from a cliff a height H.  It is observed that the object completes the last half of the trip in 1 second.  Determine the time (in seconds) it takes the object to reach the ground and also find the height of the cliff (in meters).

6.  An object is launched with initial velocity $v_o$ and launch angle $\theta$ with respect to a horizontal plane and lands a distance R from the launch point.  If the initial velocity is doubled, how far (in terms of R) will it land?  If the launch angle is changed to $(90 - \theta)$, how far downrange will the object land (also in terms of R).

7.   An object slides off the edge of a horizontal table that is 2 m above a level floor.  If the object leaves the table with a horizontal velocity of 5 m/s, how far from the edge of the table will the object land?

8.  Consider the same situation as in problem 7 except now we use only symbols and not numbers. Call the height of the table H and the velocity as it slides off the table v.  Derive an expression for a)

the time of flight, and b) the distance from the edge of the table where the object lands.

9. An object is launched from the edge of a cliff that is 100 m above the ground. The object has an intial velocity of 30 m/s that is directed upward at an angle of 40 degrees with respect to the edge of the cliff. Determine :

a) The time of flight

b) The maximum height the object achieves above the ground

c) The horizontal distance the object lands from the baes of the cliff.

d) The x and y components of the velocity just at the instant of impact.

e) The magnitude and angle of the velocity vector at the moment of impact with respect to the ground .

Five points for each part.