

Motion in one a plane Assignment 2

Question 1

A particle moves 4 km North East and reach position A and then moves 3 Km South East to reach the position B. Let assume the initial point has co-ordinates (0, 0). And Co-ordinates of the position A and B are

A \rightarrow (x_a, y_a)

B \rightarrow (x_b, y_b)

Also \mathbf{i} and \mathbf{j} are the unit vector across the x and y direction

Find out the following

- Find out the co-ordinates of Position A and B
- Find out the distance of point B from the Origin
- Find out the position vector of point A and B

Question 2

An object is fired upward at an angle 40° to the horizontal .The object is fired with an initial speed of 20m/s.

Find out the following

- How high up will it strike a wall which is 8 m away
- How much time it will take to strike the wall
- What are the horizontal and vertical components of velocity when it strike the wall

Question: 3

The position of a particle is given by the below equation

$$\mathbf{R} = (2\sin 2\pi t)\mathbf{i} + (3\cos 2\pi t)\mathbf{j}$$

- Find out the trajectory of the particle
- Find out the velocity and acceleration vector and the relation between the acceleration and position vector.
- Find out the times when velocity becomes maximum and minimum.
- Find out the time dependence of the angle α between velocity and acceleration vector
- Find the angle α at $t=0$ and $t=1/4$

Question: 4

A ball is thrown upward from a point O on the side of a hill which slopes upward uniformly at an angle 30° . Initial Velocity of the ball is v_0 and it is thrown at an angle 60° with respect to horizontal.

- Find out the range along the slope of the hill
- Find out the Time period of the Projectile
- What height above the point O ,ball strike the incline plane
- What velocity does the ball strike the plane

Question 5

A particle moves in the plane xy with velocity given by $\vec{v} = a\hat{i} + bx\hat{j}$, where \hat{i} and \hat{j} are the unit vectors of the x and y axis and a and b are constants. At the initial moment of time the particle was located at point $x=y=0$. Find

- (a) The equation of particle's trajectory $y(x)$
- (b) The curvature radius of trajectory as a function of x .