Tutorial 3

Monsoon 2024 PHY-101

Q1: A bead moves along the spoke of a wheel at constant speed 'u' m/s. The wheel rotates with uniform angular velocity $\dot{\theta}$ = ꞷ radians per second about an axis fixed in space. At t = 0 the spoke is along the x axis and the bead is at the origin. Find the velocity of the bead at time t in both polar and cartesian coordinates.

Q2. Consider a particle which feels the angular acceleration of the form $a_\theta = 3\dot{r}\dot{\theta}$. Show that

$\dot{r} = \sqrt{Ar^4 + B}$ where A and B are constants.

Q3 A particle moves so that its position vector is given by $\mathbf{r} = Cos\omega t\hat{\imath} + Sin\omega t\hat{\jmath}$ where ω is a constant. Show that (a) the velocity **v** of the particle is perpendicular to **r.** (b)the acceleration **a** is directed towards the origin and has a magnitude proportional to the origin , **(c) r** X **v =** Constant vector.

Q4 In planar polar co-ordinates, an object's position at time t is given as (r, θ)
$= \left(e^t \, meter, \sqrt{8} \, t \, radian\right)$

(a) Find radial velocity, tangential velocity and speed of particle at t=0

(b) Find radial acceleration, tangential acceleration and magnitude of acceleration at t=0