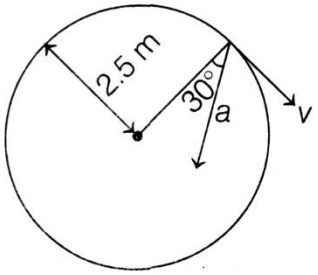
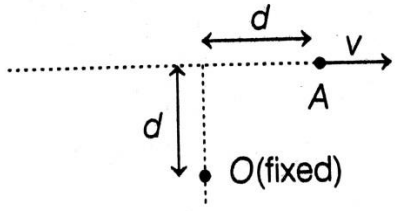
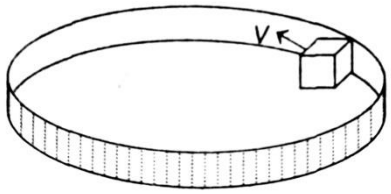
1. A particle is moving with a constant angular acceleration of 4 rad/s^2 in a circular path. At time t = 0. particle was at rest. Find the time at which the magnitudes of centripetal acceleration and tangential acceleration are equal.
2. A particle begins to move with a tangential acceleration of constant magnitude 0.6 m/s^2 in a circular path. If it slips when its total acceleration becomes 1 m/s^2, find the angle through which it would have turned before it starts to slip.
3. A particle moves clockwise in a circle of radius 1 m with centre at (x, y) = (1, 0). It starts from rest at the origin at time t = 0. Its speed increases at the constant rate of $\left(\frac{\pi}{2}\right)$m/s^2.
   (a) How long does it take to travel halfway around the circle?
4. Figure shows the direction of total acceleration and velocity of a particle moving clockwise in a circle of radius 2.5 m at a given instant of time. At this instant if magnitude of net acceleration is 25 m/s ^{2}, find



   (a) the radial acceleration,
   (b) the speed of the particle and
   (c) its tangential acceleration.
5. Find angular velocity of A with respect to O at the instant shown in the figure.

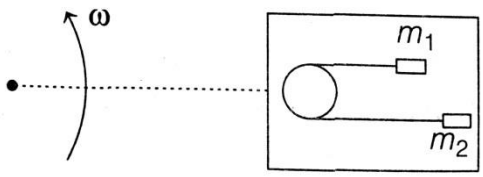


6. A block of mass *m* moves with speed *v* against a smooth, fixed vertical circular groove of radius *r* kept on smooth horizontal surface. Find
   (a) normal reaction of the floor on the block.
   (b) normal reaction of the vertical wall on the block.



7. A hemispherical bowl of radius R is rotating about its axis of symmetry which is kept vertical. A small ball kept in the bowl rotates with the bowl without slipping on its smooth surface and the angle made by the radius through the ball with the vertical is α. Find the angular speed at which the bowl is rotating.

8. A table with smooth horizontal surface is placed in a cabin which moves in a circle of a large radius R. A smooth pulley of small radius is fastened to the table. Two masses m_1 = m and m_2 = 2m are placed on the table connected through a string going over the pulley. Initially the masses were at rest. Find the magnitude of the initial acceleration of the masses as seen from the cabin and the tension in the string.



9. A body weighs 98N on a spring balance at the north pole. What will be the reading on the same scale if it is shifted to the equator? Use, g = GM / R^2 = 9.8 m/s^2 and R_{earth} = 6400 km.

10. A solid body rotates about a stationary axis so that its angular velocity depends on rotation angle ∅ as ω= ω_0- k ∅, find the dependence of the rotation angle.

(a) $k\omega_0 e^{-kt}$ (b) $\frac{\omega 0}{k} e^{-kt}$ (c) $\frac{\omega 0}{k}(1-e^{-kt})$ (d) $\frac{k}{\omega 0}(e^{-kt}-1)$

11. A particle is moving along the circumference is giving by s = $\frac{t^2}{2} + \frac{t^3}{3}$
The acceleration of particle when t = 2 s is

(a) 1.3 m/s^2 (b) 13 m/s^2 (c) 3 m/s^2 (d) 10 m/s^2

12. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration ac is varying with time t as $\alpha_C = k^2 r^2$, where k is a constant. The power delivered to the particle by the force acting on it is

(a) $2\pi mk^2r^2$ (b) mk^2r^2t (c) $\left(\frac{mk^4r^2t^5}{3}\right)$ (d) zero