# Practice Problems (DYNAMICS)

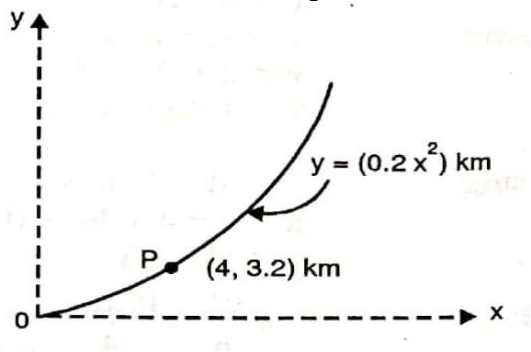
**1) The position vector of a particle which moves in the X-Y plane is given by $\bar{r}=(3t^3-4t^2)i+(0.5t4)j$ m. Calculate velocity and acceleration at t=1 sec.**

**2)** A particle travels on a circular path, whose distance travelled is defined by

$S=(0.5t^3+3t)$m. If the total acceleration is 10 m/s$^2$, at t=2 sec, find its radius of curvature.

**3) A point moves along a path $y=x^2/3$ with a constant speed 8 m/s. What are the x and y components of its velocity when x=3m ? What is the acceleration at this point ?**

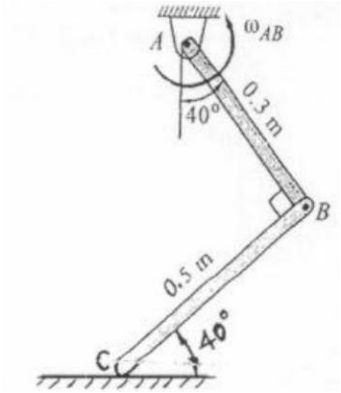
**4)An airplane travels on a curved path. At P it has speed of 360 kmph which is increasing at the rate of 0.5 m/s$^2$. Determine at P**
**a)The magnitude of total acceleration**
**b) angle made by acceleration vector with the positive X – axis.**



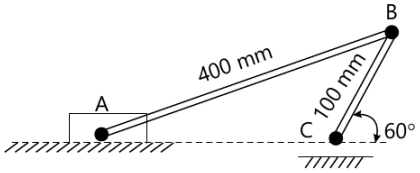

5)A rod AB ha an angular velocity of 2 rad/sec, counter clockwise as shown. End C of rod

BC is free to move on a horizontal surface. Determine
i)Angular velocity of BC and

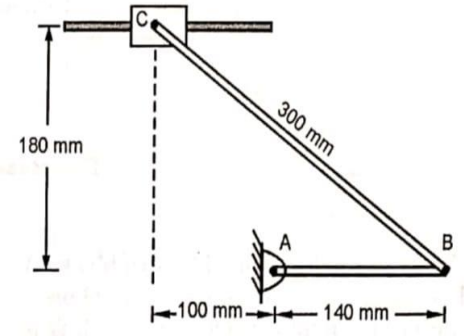
ii) Velocity of C.



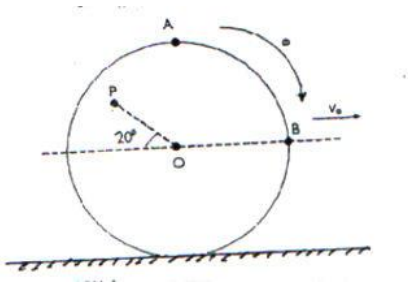

6)The crank BC of a slider crank mechanism is rotating at constant speed of 30 rpm clockwise. Determine the velocity of the piston A at the given instant



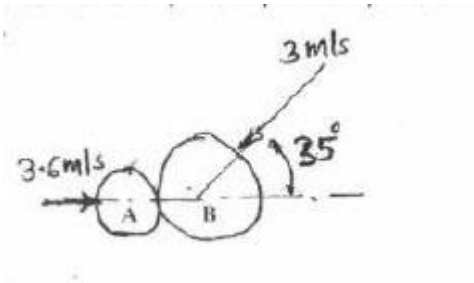

**7)In figure collar C slides on a horizontal rod. In the position shown rod AB is horizontal and has angular velocity of 0.6 rad/sec clockwise. Determine angular velocity of BC and velocity of collar C.**



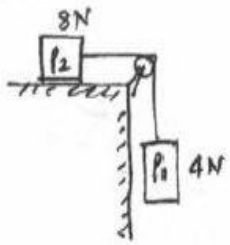

8)A wheel is rolling along a straight path without slipping. Determine velocity of points A, B and p. OP = 600mm, ω=4 rad/sec, Vo=4m/s. Refer Figure above.



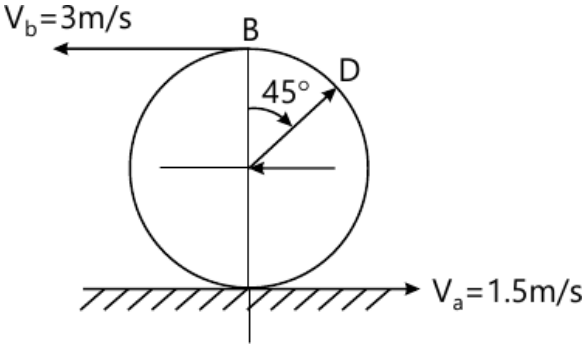
9)Just before any collide, two disk on a horizontal surface have velocities shown in fig. knowing that 90N disk 'A' rebound to the left with a velocity of 1.8 m/s. Determine the rebound velocity of the 135N. disk 'B'. Assume the impact is perfectly elastic.



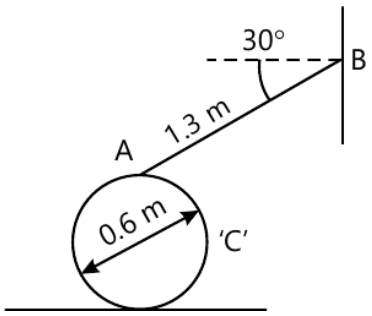

10) Blocks $P_1$ and $P_2$ are connected by inextensible string. Find velocity of block $P_1$, if it falls by 0.6m starting from rest. The coefficient of friction is 0.2, pulley is friction less.



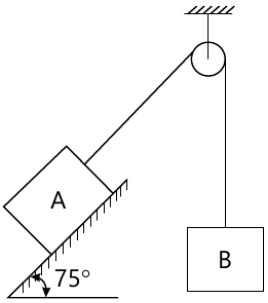

**11)** Due to slipping, points A and B on the rim of the disk have the velocity $V_a$=1.5 m/s to the right and $V_b$=3m/s to the left as shown in figure. Determine the velocities of the centre point C and point D on the rim at this instant. Take radius of disk 0.24 m.



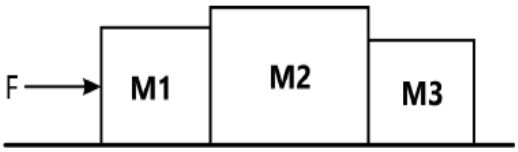

**12)** C' is a uniform cylinder to which a rod 'AB' pinned at 'A' and the other end of the rod 'B' is moving along a vertical wall as shown in figure. If the end 'B' of the rod is moving upward along the wall at a speed of 3.3 m/s find the angular velocity of the cylinder assuming that it is rolling without slipping.




**13)** Block A and B of mass 6kg and 12kg respectively are connected by a string passing over a smooth pulley. Neglect mass of pulley. If coefficient of kinetic friction between the block A and the inclined surface is 0.2, determine the acceleration of block A and block B.




**14)** Three m1, m2 and m3 of masses 1.5kg, 2kg & 1kg respectively are placed on a rough surface with ?=0.2 as shown. If a force F is applied to accelerate the blocks at 3 $m/s^2$, what will be the force that 1.5 kg block exerts on 2 kg block?




**15) State the laws of robotics**

**16) Explain briefly about Degrees of freedom with neat sketch**