YAKEEN NEET 2.0

2026

Motion in a Plane

Physics Assignment Solution 04

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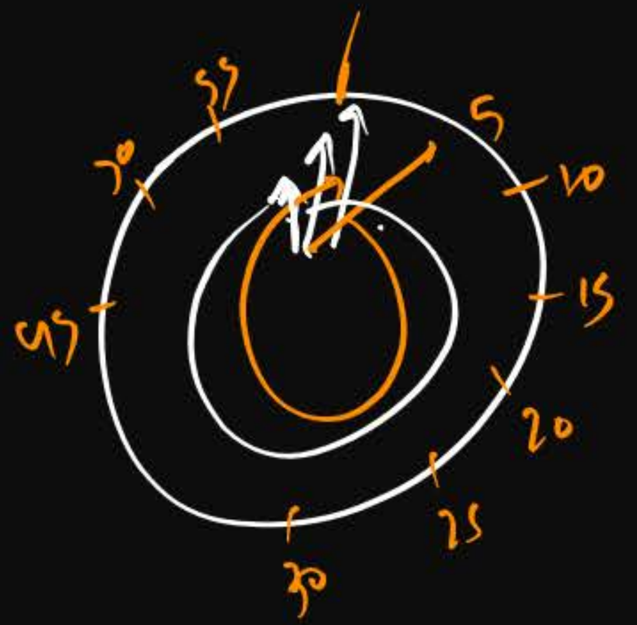
Sangharsh Assignment - 4

Motion in plane

Question

Angular velocity of minute hand of a clock is: ??

1. $\frac{2\pi}{1800}$ rad/s
2. 8π rad/s
3. $\frac{\pi}{1800}$ rad/s ✓
4. $\frac{\pi}{30}$ rad/s



mint hand = 60mint

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{60\,\text{mint}}$$

$$= \frac{\cancel{2}\pi}{60\times\cancel{60}\,30}$$

$$= \frac{\pi}{1800}$$

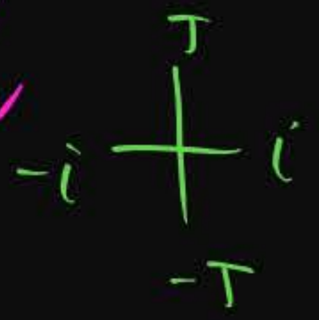
Angular speed of hr hand $= \omega = \frac{2\pi}{12\,\text{hr}}$

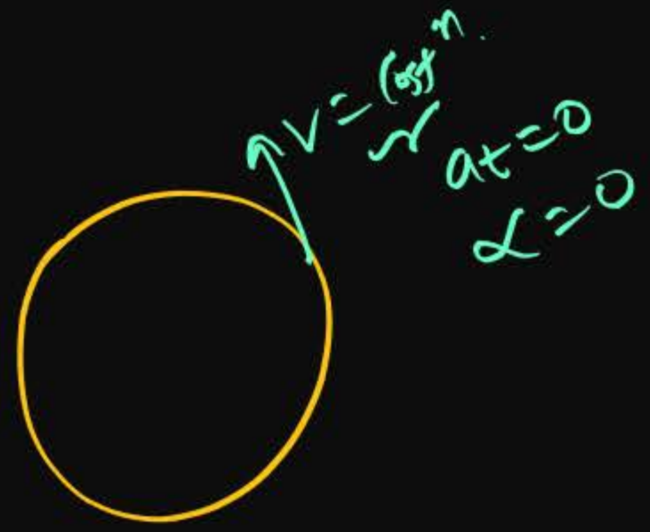
$$= \frac{2\pi}{12\times 60\times 60}\ \text{rad/s}$$

Question

An object moving in a circular path at constant speed has constant

1. Energy
2. Velocity
3. Acceleration
4. Displacement

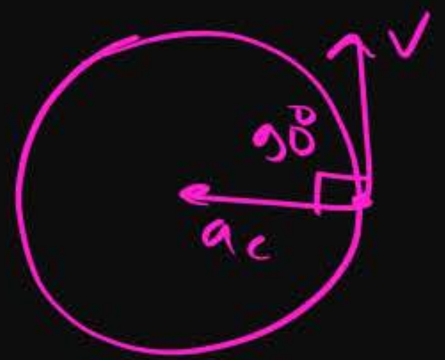




Question

The angle between velocity vector and acceleration vector in uniform circular motion is:

1. $0°$
2. $180°$
3. $90°$
4. $45°$



Question

Two cyclists cycle along circular tracks of radii R_1 and R_2 at uniform rates. If both of them take same time to complete one revolution, then their angular speeds are in the ratio

(1) $R_1 : R_2$

(2) $R_2 : R$

(3) $1 : 1$ ✓

(4) $R_1 R_2 : 1$

$$\frac{\omega_1 = \frac{\cancel{2\pi}}{\cancel{T}}}{\omega_2 = \frac{\cancel{2\pi}}{\cancel{T}}}$$

$V = R\omega$

Question

Centripetal acceleration of a cyclist [redacted] completing 7 rounds in a minute along a circular track of radius 5 m with a $\boxed{\text{constant speed}}$, is

$\rightarrow$ U.C.M.

1. $2.7\ m/s^2$
2. $4\ m/s^2$
3. $3.78\ m/s^2$
4. $6\ m/s^2$

7 round in a mint

7 rps mint = 7 round per 60 sec.

$$f = \frac{7}{60}$$

$$\omega = 2\pi f$$

$$= \frac{2 \times 22}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{60}\,30} = \frac{22}{30} = \frac{11}{15}.$$

$$a_c = \omega^2 r$$

$$= \left(\frac{11}{15}\right)^2 \times 5$$

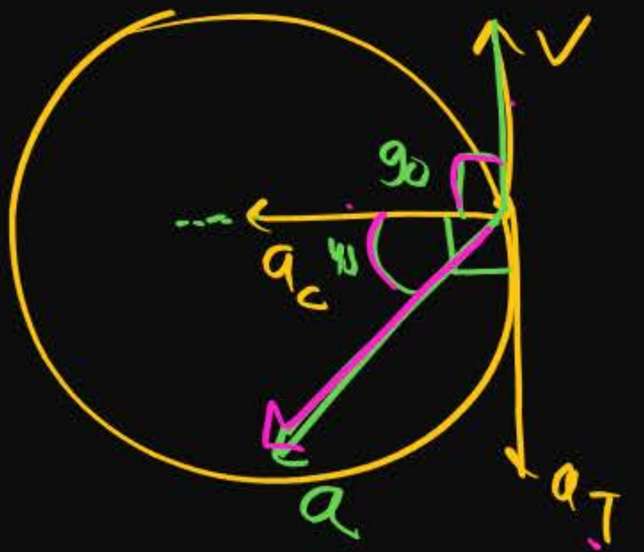
$$= \frac{11 \times 11}{15 \times \cancel{15}\,3} \times \cancel{5}$$

$$= \frac{121}{45}$$

Question

A body is moving on a circle of radius 80 m with a speed 20 m/s which is decreasing at the rate 5 m/s^2 at an instant. The angle made by its acceleration with its velocity is

1. 45°
2. 90°
3. 135° ✓
4. 0°



$R = 80\,m \quad v = 20\,m/s$

$a_t = 5\,m/s^2$

(N.U.C.M)

$a_c = v^2/R = \frac{\cancel{20}\times\cancel{20}}{\cancel{80}\,4} = 5\,m/s^2$

Question

A car is moving at a speed of 40 m/s on a circular track of radius 400 m. This speed is increasing at the rate of 3 m/s^2. The acceleration of car is

$a_t = 3 m/s^2$

NUCM

1. 4 m/s^2
2. 7 m/s^2
3. 5 m/s^2 ✓
4. 3 m/s^2

$V = 40 m/s$

$R = 400 m$

$\boxed{a_t = 3 m/s^2}$

$\boxed{a_c = \frac{V^2}{R} = \frac{40 \times 40}{400} = 4 m/s^2}$

$\vec{a} = \vec{a_t} + \vec{a_c}$

$|a| = \sqrt{a_t^2 + a_c^2}$ ✓

Question

A car is going round a circle of radius R_1 with constant speed. Another car is going round a circle of radius R_2 with constant speed. If both of them take same time to complete the circles, the ratio of their angular speeds and linear speeds will be

1. $\sqrt{\frac{R_1}{R_2}}, \frac{R_1}{R_2}$
2. $1, 1$
3. $1, \frac{R_1}{R_2}$ ✓
4. $\frac{R_1}{R_2}$

$\frac{\omega_1}{\omega_2} = \frac{1}{1}$

$v = R\omega$

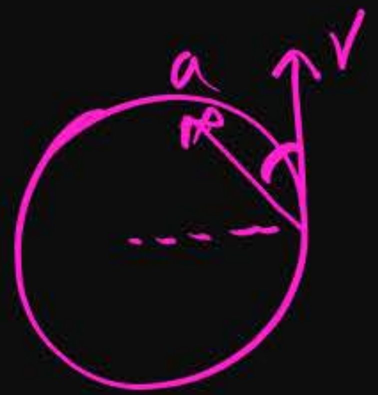
$v \propto R$

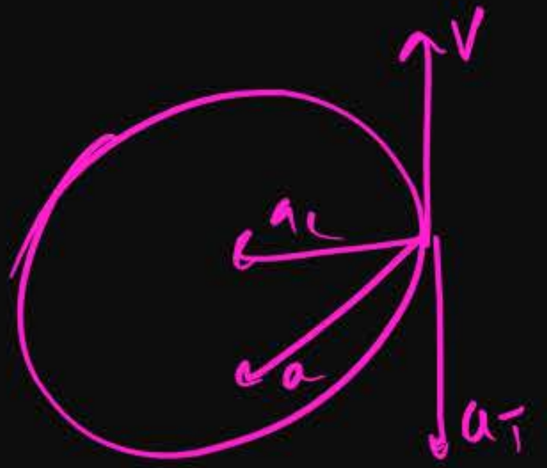
$\frac{v_1}{v_2} = \frac{R_1}{R_2}$

Question

If θ is angle between the velocity and acceleration of a particle moving on a circular path with decreasing speed, then

1. $\theta = 90°$
2. $0° < \theta < 90°$
3. $\boxed{90° < \theta < 180°}$
4. $0° \le \theta \le 180°$





Question

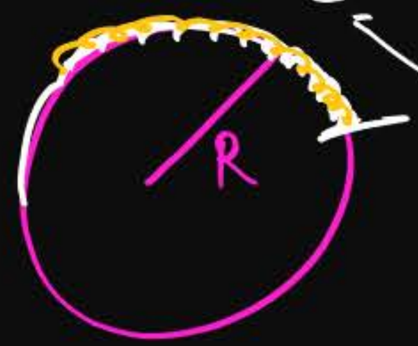
The distance of a particle moving on a circle of radius 12 m measured from a fixed point on the circle and measured along the circle is given by $s = 2t^3$ (in meters). The ratio of its tangential to centripetal acceleration at $t = 2$ sec

(1) 4 : 1

(2) 1 : 2

(3) 2 : 1

(4) 3 : 1



$s = 2t^3 \xrightarrow{\text{diff}^n}$

$\frac{ds}{dt}$ = speed $= 2(3t^2)$

speed $= 6t^2 = 6(2)^2$
$= 6 \times 4 = 24$

diff

$a_t = 6(2t)$

$\boxed{a_t = 12t = 24\ \text{m/s}^2}$

$a_c = v^2/R$

$(a_c)_{t=2} = \frac{24 \times 24}{12} = 48$

$\frac{a_t}{a_c} = \frac{24}{48} = 1:2$

Ans

Question

A motor car is travelling at 30 m/sec on a circular road of radius 500 m. It is increasing its speed at the rate of 2.0 ms^{-2}. The total acceleration is:

1. 1.8 ms^{-2}
2. 2 ms^{-2}
3. 3.8 ms^{-2}
4. 2.7 ms^{-2} ✓

$V = 30\ m/s$

$R = 500\ m$

$a_t = 2\ m/s^2 \rightarrow$ NUCM

$a_c = \frac{v^2}{R}$ ✓

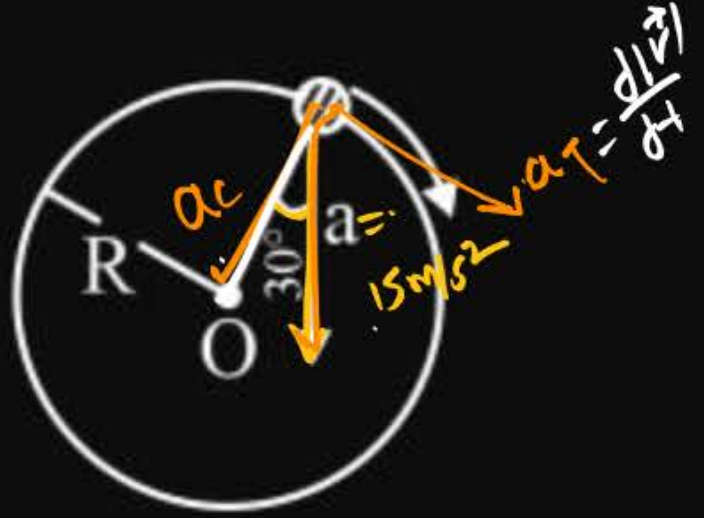
$= \frac{30 \times 30}{500} = \frac{9}{5}$

$|\vec{a}| = \sqrt{4 + \frac{81}{25}}$

$= \sqrt{\frac{181}{25}} = \sqrt{7.1}$

Question

In the given figure, $\boxed{a = 15\ \mathrm{m\ s^{-2}}}$ represents the total acceleration of a particle moving in the clockwise direction in a circle of radius $R = 2.5$ m at a given instant of time. The speed of the particle is



1. $4.5\ \mathrm{m\ s^{-1}}$
2. $5.0\ \mathrm{m\ s^{-1}}$
3. $5.7\ \mathrm{m\ s^{-1}}$
4. $6.2\ \mathrm{m\ s^{-1}}$

$v^2 = 1.71 \times \frac{75}{4}$

$a_c = \frac{v^2}{R}$

$15\cos 30^\circ = \frac{v^2}{R}$

$15 \times \frac{\sqrt{3}}{2} = \frac{v^2}{5/2}$

$v^2 = 15 \times \frac{\sqrt{3}}{2} \times \frac{5}{2}$

$= \frac{75}{4}\sqrt{3}$

Question

A car moves on a circular path such that its speed is given by $\boxed{v = Kt,}$ where K = constant and t is time. Also given: radius of the circular path is r. The net acceleration of the car at time twill be

(1) $\sqrt{K^2 + \left(\frac{K^2t^2}{r}\right)^2}$

(2) $2K$

(3) K

(4) $\sqrt{K^2 + K^2t^2}$

$v = Kt$ (speed)

$a_t = \boxed{\frac{dv}{dt} = a_t = K}$ — (1)

$a_c = \frac{v^2}{r} = \frac{(Kt)^2}{r} = \frac{K^2t^2}{r}$

$|a| = \sqrt{a_t^2 + a_c^2}$

$a = \sqrt{K^2 + \left(\frac{K^2t^2}{r}\right)^2}$

Question

If the equation for the displacement of a particle moving on a circular path is given by $(\theta) = 2t^3 + 0.5$, where θ is in radians and t in seconds, then the angular velocity of the particle after 2s from its start is:-

1. 8 rad/s
2. 12 rad/s
3. 24 rad/s
4. 36 rad/s

$\theta = 2t^3 + 0.5$

$\omega = \frac{d\theta}{dt} = 2(3t^2) + 0$

$\omega = 6t^2$

$\omega = 6(2)^2$

$\omega = 6 \times 4 = 24$

Question

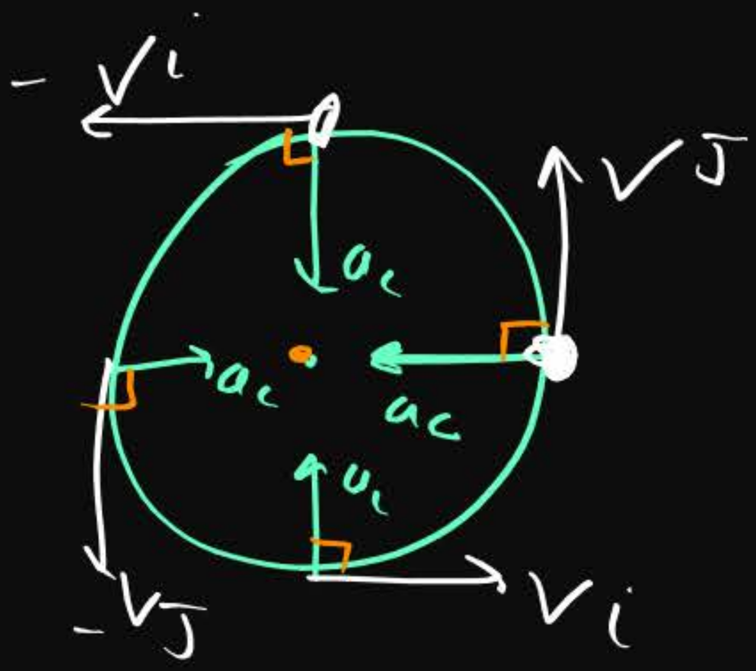
In uniform circular motion acceleration is:

1. Constant
2. Variable (due to change in dirn)

U.C.M speed = const

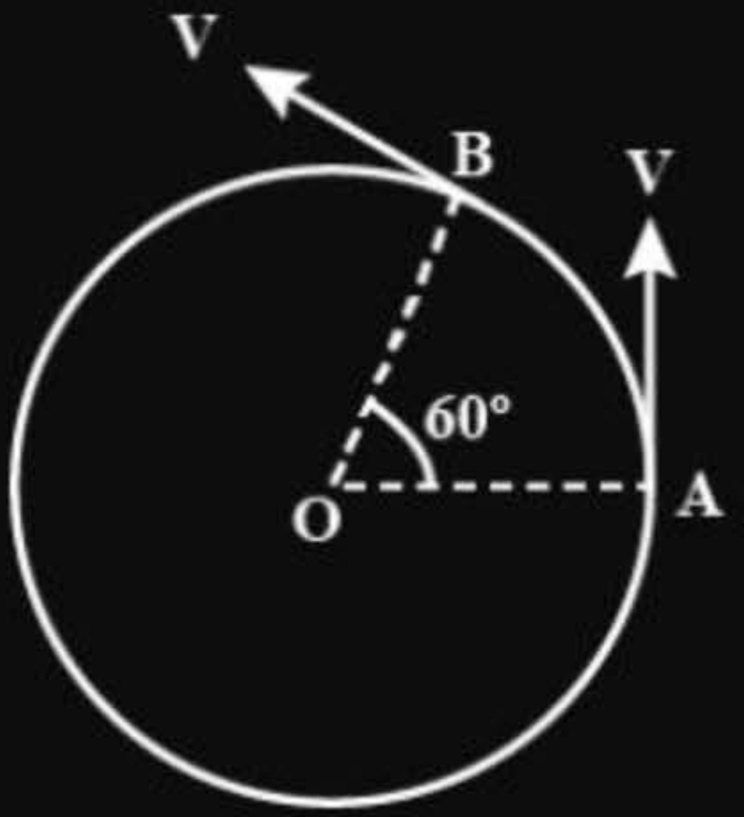
$a_t = 0$

$a_c = v^2/R$



Question

A particles is moving in a circle of radius r having centre at O, with a constant speed v. The magnitude of change in velocity in moving from A to B is



(1) $2v$

(2) 0

(3) $\sqrt{3}\,v$

(4) v

$\Delta v = 2v\sin\theta/2$

$= 2v\sin(60/2)$

$= 2v\sin 30°$

$= \cancel{2}v \times \frac{1}{\cancel{2}}$

$= v$

Question

$\rightarrow$ v.c.m

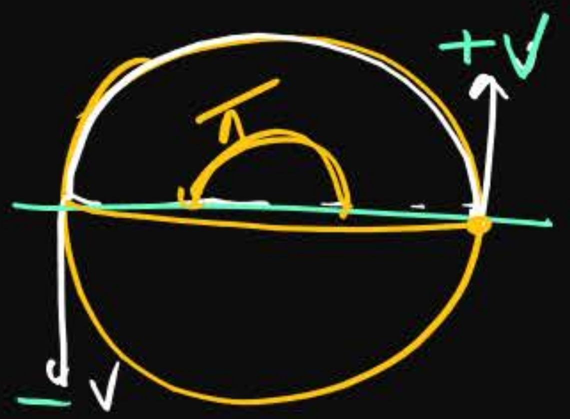
A body revolves with $\boxed{\text{constant speed } v}$ in a circular path of radius r. The magnitude of its average acceleration during motion between two points in diametrically opposite direction is

1. Zero
2. $\dfrac{v^2}{r}$
3. $\dfrac{2v^2}{\pi r}$ ✓
4. $\dfrac{v^2}{2r}$

$$\text{Avg acc}^n = \frac{\Delta v}{\Delta t}$$

$$= \frac{-v-(v)}{\Delta t}$$

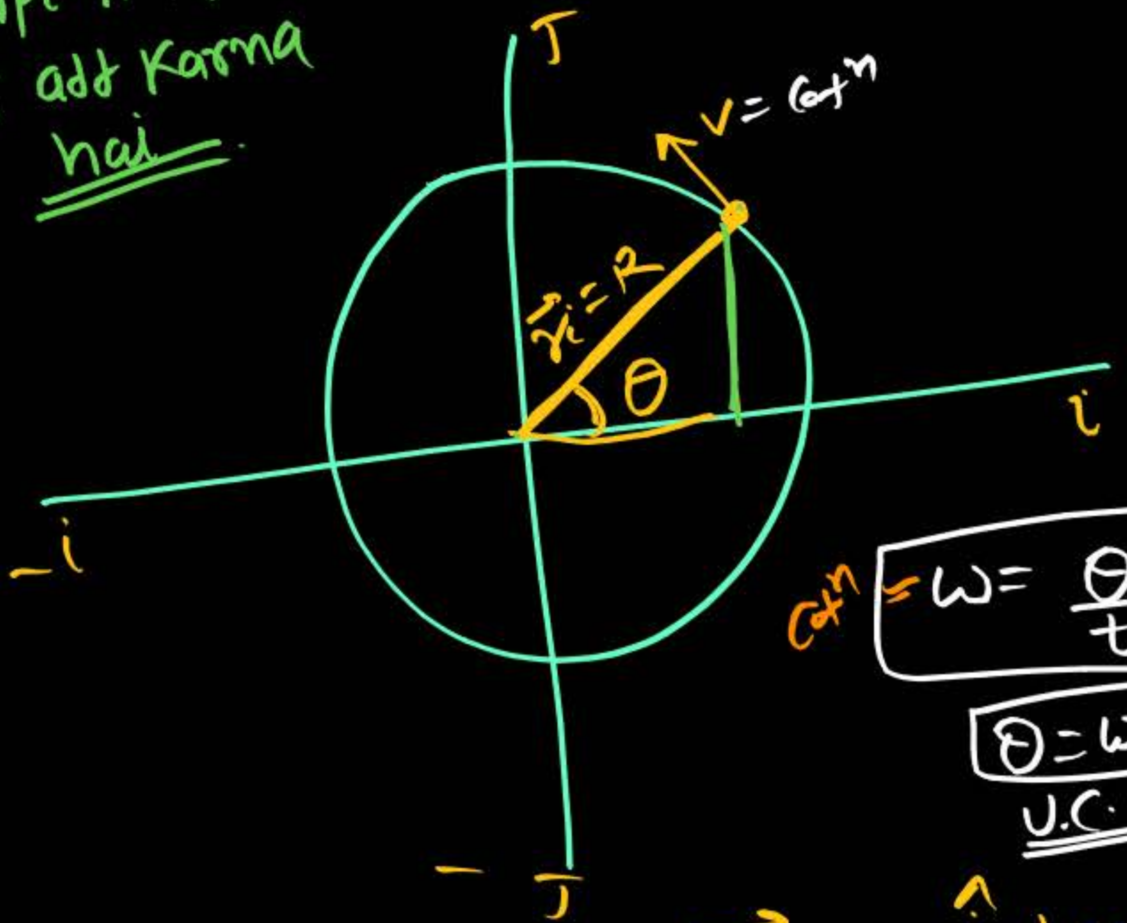
$$= \frac{-2v}{\frac{\pi R}{v}} = \frac{2v^2}{\pi R}$$ ✓



$$(a_c)_{Avg} = \frac{v^2}{R}\frac{\sin\theta/2}{\theta/2} = \frac{v^2}{R}\frac{\sin\pi/2}{\pi/2}$$

$$= \frac{v^2}{R}\frac{1}{\frac{\pi}{2}} = \frac{2v^2}{\pi R}$$ ✓

Compt Note
मे add karna hai.



$$\text{const}^n = \boxed{\omega = \frac{\theta}{t}}$$ uniform circul. Motn

$\boxed{\theta = \omega t}$

U.C.M

$$\vec{r} = x\hat{i} + y\hat{j}$$

$$\vec{r} = R\cos\theta\,\hat{i} + R\sin\theta\,\hat{j}$$

$\boxed{\vec{r} = \underbrace{R\cos(\omega t)}_{x}\hat{i} + \underbrace{R\sin(\omega t)}_{y}\hat{j}}$ eqn U.C.M

$\boxed{x^2 + y^2 = R^2}$

$$\vec{v} = \frac{d\vec{r}}{dt} = -R\sin(\omega t)\times\omega\,\hat{i} + R\cos(\omega t)\omega\,\hat{j}$$

$$\boxed{\vec{V} = -R\omega\sin(\omega t)\,\hat{i} + R\omega\cos(\omega t)\,\hat{j}}$$

$$\vec{a} = -R\omega^2\cos(\omega t)\,\hat{i} - R\omega^2\sin(\omega t)$$

$$\vec{a} = -\omega^2\left[R\cos(\omega t)\,\hat{i} + R\sin(\omega t)\,\hat{j}\right]$$

$$\boxed{\vec{a} = -\omega^2 R}$$

uniform circul motn मे $\vec{a}_c = -\omega^2 R$

proved

Question

Note कर लो

The position vector of a particle $\vec{R}$ as a function of time is given by $\vec{R} = 4\sin(2\pi t)\hat{\imath} + 4\cos(2\pi t)\hat{\jmath}$, where R is in meters, t is in seconds and $\hat{\imath}$ and $\hat{\jmath}$ denote unit vectors along x-and y-directions, respectively. Which one of the following statements is wrong for the motion of particle?

1. Path of the particle is a circle of radius 4 m
2. Acceleration vector of along $-\vec{R}$
3. Magnitude of acceleration vector is v^2/R, where v is the velocity of particle
4. Magnitude of the velocity of particle is 8 meter/second

$\vec{R} = \boxed{4}\sin(2\pi t)\,i + 4\cos(2\pi t)\,\hat{j}$

$\vec{R} = \boxed{R}\sin(\omega t)\,i + R\cos(\omega t)\,\hat{j}$

$R = 4$ $\quad \boxed{\omega = 2\pi}$

$v = R\omega = 4\times(2\pi)$

$\boxed{v = 8\pi}$

Ans (4)

Question

A particle moves so that its position vector is given by $\boxed{\vec{r} = \cos \omega t\, \hat{x} + \sin \omega t\, \hat{y},}$ where ω is a constant. Which of the following is true?

UCM

1. Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin.
2. Velocity and acceleration both the perpendicular to $\vec{r}$.
3. Velocity and acceleration both are parallel to $\vec{r}$.
4. Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin.

Question

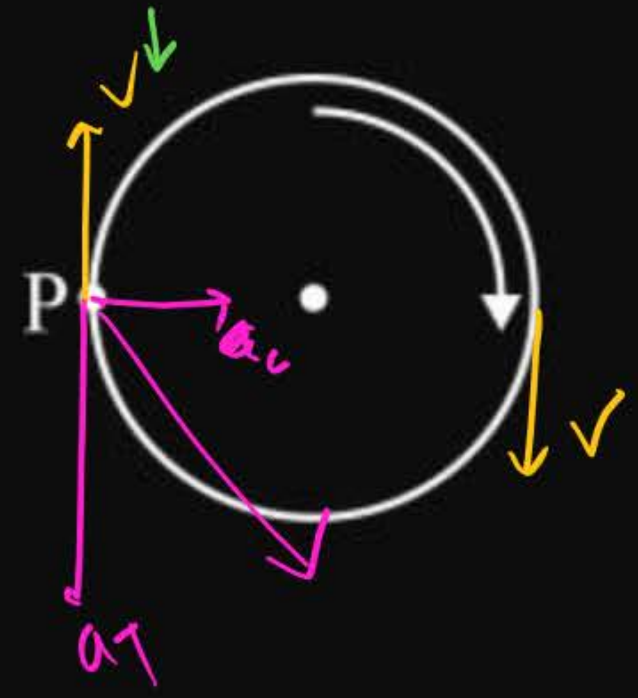
A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle, the motion of the particle takes place in a plane. It follows that:

1. Its velocity is constant
2. Its acceleration is constant
   (dir^n chang)
3. Its kinetic energy is constant
   Speed = C
4. It moves in a straight line

U.C.M

Question

A music CD of 'Bajirao Mastani' is rotating clockwise (as shown). After turning it off, the CD slows down. Assuming it has not come to a stop yet, the direction of acceleration at point P is:



(1) ↑

(2) →

(3) ↗

(4) ↘

Question

$\xrightarrow{} U.C.M$

A particle is moving around a circular path with $\boxed{\text{uniform angular speed } (\omega)}$. The radius of the circular path is r. The acceleration of the particle is:-

1. $\frac{\omega^2}{r}$ ✗

2. $\frac{\omega}{r}$ ✗

$a_c = \omega^2 R = \frac{v^2}{R}$

3. $v\omega$ ✓

$a_c = \frac{v^2}{R} = \frac{v^2}{\cancel{v}/\omega} = v\omega$

4. vr ✗

$v = R\omega$

$R = v/\omega$

Question

A particle moves in a circle of radius 5 cm with constant speed and time period 0.2π s. The acceleration of the particle is

1. $15\ \mathrm{m/s^2}$
2. $25\ \mathrm{m/s^2}$
3. $36\ \mathrm{m/s^2}$
4. $5\ \mathrm{m/s^2}$ ✓

U.C.M

$T = 0.2\pi$

$\omega = \frac{2\pi}{T} = \frac{2\cancel{\pi}}{0.2\cancel{\pi}} = \frac{\cancel{2}}{\frac{\cancel{2}}{10}}$

$\boxed{\omega = 10}$

$a_c = \omega^2 R$

$= (10)^2 \times \frac{5}{100}$

$= \cancel{100} \times \frac{5}{\cancel{100}}$

Question

A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 seconds, what is the magnitude and direction of acceleration of the stone?

44 secc = 22 rev.
1 sec = $\frac{1}{2}$ rev

1. π^2 m s^{-2} and direction along the radius towards the centre
2. π^2 m s^{-2} and direction along the radius away from the centre
3. π^2 m s^{-2} and direction along the tangent to the circle
4. $\pi^2/4$ m s^{-2} and direction along the radius towards the centre.

UCM

$f = \text{rev/s} = \frac{1}{2}$

$\omega = 2\pi f = \cancel{2}\pi \times \frac{1}{\cancel{2}}$

$\omega = \pi$

$a_c = \omega^2 R$

$\boxed{a_c = \pi^2 R}$

Question

The angular speed of a flywheel making 120 revolutions/minute is

(1) ✓ 4π rad/s

(2) $4\pi^2$ rad/s

(3) π rad/s

(4) 2π rad/s

$f = 120\ \text{rev/mint}$

$= \dfrac{\cancel{120}^{2}\ \text{rev}}{\cancel{60}\ \text{sec}}$

$f = 2\ \text{rev/s}$

$\omega = 2\pi f$

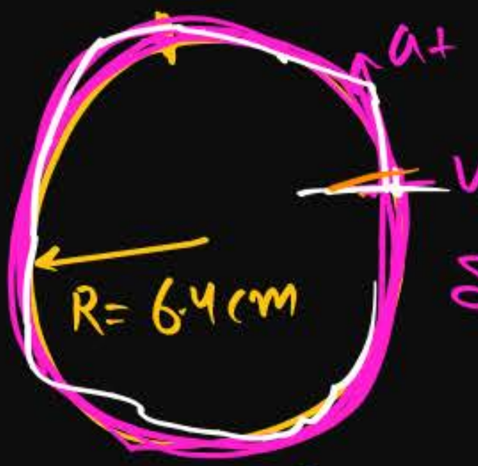
$= 2\pi \times 2$

$= 4\pi$

Question

A particle of mass 10g moves along a circle of radius 6.4 cm with a constant tangential acceleration. What is the magnitude of this acceleration, if the kinetic energy of the particle becomes equal to 8×10^{-4} J by the end of the second revolution after the beginning of the motion?

1. $0.15\ \text{m/s}^2$
2. $0.18\ \text{m/s}^2$
3. $0.2\ \text{m/s}^2$
4. $0.1\ \text{m/s}^2$



$u_i = 0 \quad t = 0$

$S = 4\pi R \quad a_t = ?$

$V_f = ?$

$R = 6.4 \times 10^{-2}\ m$

$V_f^2 - \cancel{u_i^2}^{\,0} = 2 \times a_t S$

$u_i = 0 \quad \xrightarrow{a_t} \quad S = 4\pi R \quad V_f$

$V_f^2 = 2 \times a_t (4\pi R)$

$\boxed{V_f^2 = 8\pi a_t (6.4 \times 10^{-2})}$

$K.E = 8 \times 10^{-4} = \frac{1}{2} m v^2$

$8 \times 10^{-4} = \frac{1}{2} 10^{-2} v^2$

$\boxed{16 \times 10^{-2} = v_f^2 \quad \text{—(ii)}}$

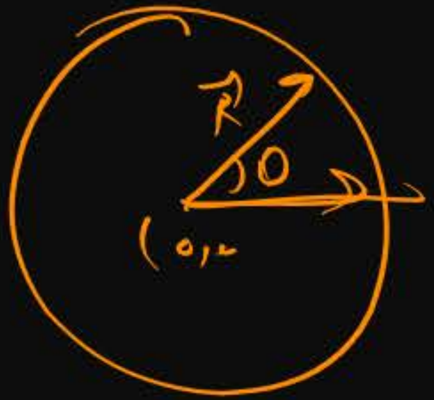
$16 \times 10^{-2} = 8\pi a_t \times 64 \times 10^{-3}$

$a_t = \frac{70}{32 \times 22} = \frac{11}{110}$

Question

The Position vector of a particle moving on a circle is given by $\vec{r} = A\cos Bt\,\hat{\imath} + A\sin Bt\,\hat{\jmath}$ (A and B are constants). The radius of the circle and speed of the particle, respectively, are

1. A, AB
2. A, A^2/B
3. B, AB
4. B, A^2/B



$$\vec{r} = A\cos(Bt)\,\hat{i} + A\sin(Bt)\,\hat{j}$$

$R = A$

$\omega \cancel{t} = B\cancel{t}$

$\boxed{\omega = B}$

$\boxed{v = R\omega = AB}$

Notes me likna hai

MR* Box

1. for U.C.M

$\omega = const^n$

$\alpha = 0$

$\boxed{speed = const^n \quad a_t = 0}$

$\vec{a} = \vec{a}_c = v^2/R = \omega^2 R$

$\boxed{\theta = \omega t}$ — (I)

MR* Box

for NUCM

ω = varible $\to \alpha \neq 0$

speed = varib. $\to a_t \neq 0$

$a_c = v^2/R$

$\vec{a} = \vec{a}_t + \vec{a}_c$

$|\vec{a}| = \sqrt{a_t^2 + a_c^2}$

for const^n Angul acc^n

$\alpha = const^n$

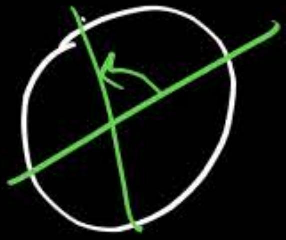
$\vec{\omega}_f = \vec{\omega}_i + \vec{\alpha} t$ — (I)

$\theta = \omega_i t + \frac{1}{2}\alpha t^2$ — (II)

$\omega_f^2 - \omega_i^2 = 2\alpha\theta$ — (III)

$\theta_{n^{th}} = \omega_i + \frac{\alpha}{2}(2n-1)$ — (IV)

*



acc^n = a = const

$S = ut + \frac{1}{2}at^2$

$v_f = u_i + at$

$v^2 - u^2 = 2as$

acc^n = const^n

$\vec{v}_f = \vec{u}_i + \vec{a}t$

$S = ut + \frac{1}{2}at^2$

$v^2 - u^2 = 2aS$

Question

Likho (H/W)

$\boxed{\omega_f = \omega_0 + \alpha t}$ — (i)

$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$ — (ii)

A particle starting from rest, moves in a circle of radius ‘r’. It attains a velocity of V_0 m/s in the n^{th} round. Its angular acceleration will be

$\alpha = ??$

N.U.C.M

1. $\frac{V_0}{n}$ rad/s^2
2. $\frac{V_0}{2\pi n r^2}$ rad/s^2
3. $\frac{V_0^2}{4\pi n r^2}$ rad/s^2
4. $\frac{V_0^2}{4\pi n r}$ rad/s^2

$\theta = n2\pi$ — (1)

$\omega_i = 0$

$\omega_f = \frac{v}{r} = \frac{V_0}{r}$

$\omega_f^2 - \cancel{\omega_i^2}^{0} = 2\alpha\theta$

$\left(\frac{V_0}{r}\right)^2 = 2\alpha(n2\pi)$

$\alpha = \frac{V_0^2}{r^2(n4\pi)}$

acc^n = a

u

$\boxed{v_f = u + at}$

angul acc^n = co^n

equation of mo^n

$$\omega_f = \omega_i + \alpha t \quad -(i)$$

$$\theta = \omega t + \frac{1}{2}\alpha t^2 \quad -(ii)$$

$$\omega_f^2 - \omega_i^2 = 2\alpha\theta \quad -(iii)$$

$\boxed{\alpha = \text{varible}}$

use नहीं concept

Note मे लिख लेना

Question

Likho (H/W)

A particle moves along a circle of radius $(20/\pi)$ m with constant tangential acceleration. If the velocity of the particle is 80 m/s at the end of the second revolution after motion has begun, the tangential acceleration is

a_t

1. $40\ m/s^2$
2. $640\pi\ m/s^2$
3. $160\pi\ m/s^2$
4. $40\pi\ m/s^2$

$R = \frac{20}{\pi}$ m

a_t = const.

$n = 2$ (revol)

$V_f = 80$ m/s

$\omega_f = \frac{V}{R} = \frac{80}{20/\pi} = 4\pi$

$\omega_i = 0$

$\theta = (2\pi) \times 2 = 4\pi$

$\omega_f^2 - \omega_i^2 = 2\alpha\theta$

$16\pi^2 = 2\alpha 4\pi$

$\boxed{\alpha = 2\pi}$

$a_t = R\alpha$

$= \frac{20}{\pi} \times 2\pi$

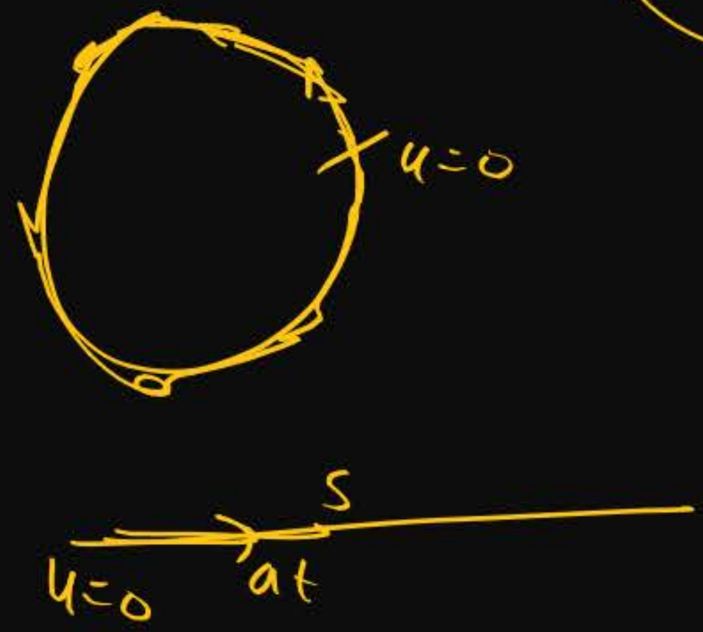
$= 40\ m/s^2$

Question

A particle starts moving on a circular path from rest, such that its tangential acceleration varies with time as $a_t = kt$. Distance traveled by particle on the circular path in time t is

1. $\dfrac{kt^3}{3}$
2. $\dfrac{kt^2}{6}$
3. $\dfrac{kt^3}{6}$ Ans
4. $\dfrac{kt^2}{2}$

$a_t = Kt$



$\dfrac{dv}{dt} = Kt$

$\int dv = \int Kt\, dt$

Speed $v = \dfrac{Kt^2}{2}$

$\dfrac{d(\text{disp})}{dt} = \dfrac{Kt^2}{2}$

$\text{disp} = \dfrac{Kt^2}{2} dt$

$= \dfrac{K}{2} \int t^2 dt = \dfrac{K}{2} \dfrac{t^3}{3}$

$= \dfrac{Kt^3}{6}$

acc^n	Tangentic	Angular acc	centripetal acc^n
$\vec{a}$	$\vec{a}_t$	α	$\vec{a}_c$

$\vec{a} = \vec{a}_t + \vec{a}_c$

$|\vec{a}| = \sqrt{a_t^2 + a_c^2}$ **

$\vec{a}_t = \frac{d|\vec{v}|}{dt}$

$\boxed{a_t = R\alpha}$

$\alpha = \frac{d\omega}{dt}$

$\boxed{a_c = v^2/R}$

$\omega = \frac{d\theta}{dt}$

$\boxed{\alpha = \frac{d\omega}{dt}}$

$\boxed{\text{Speed } (v) = R\omega}$

$\boxed{a_t = R\alpha}$

Uniform circul motn

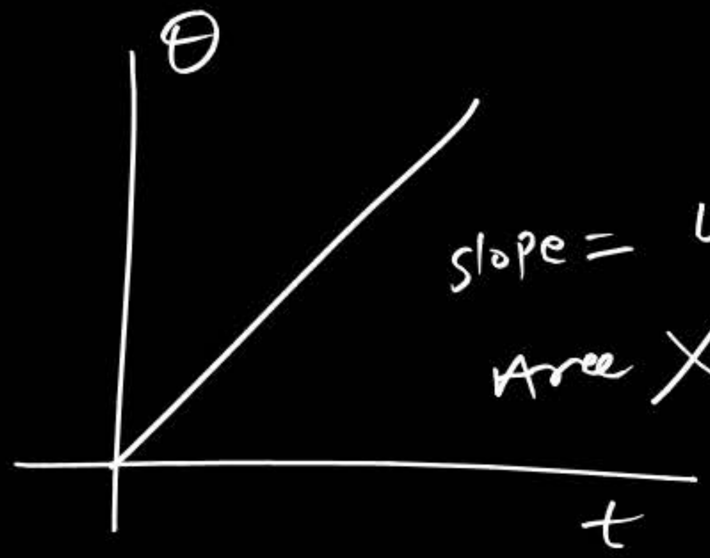
$\alpha = 0$
$a_t = 0$
$(\omega = \text{const}^n)$

$\boxed{\theta = \omega t}$

NUCM

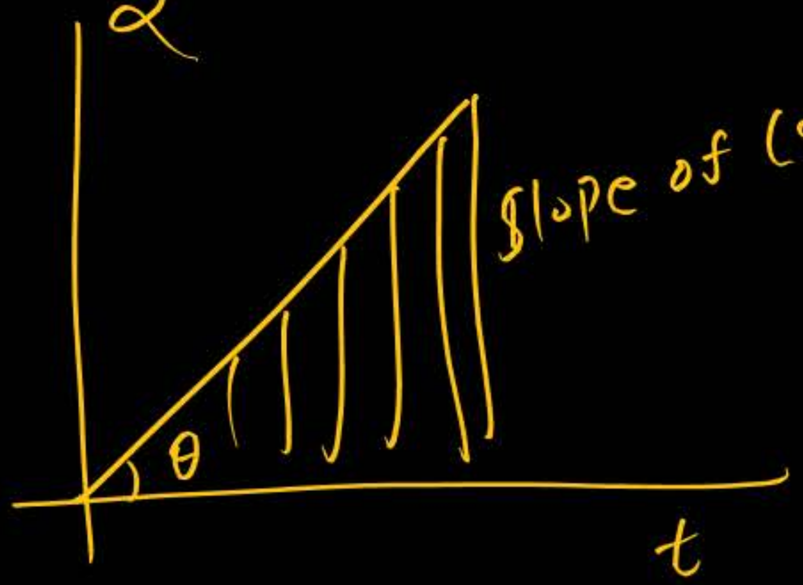
$a_t \neq 0$
$\alpha \neq 0$

$\boxed{\vec{a} = \vec{a}_t + \vec{a}_c}$

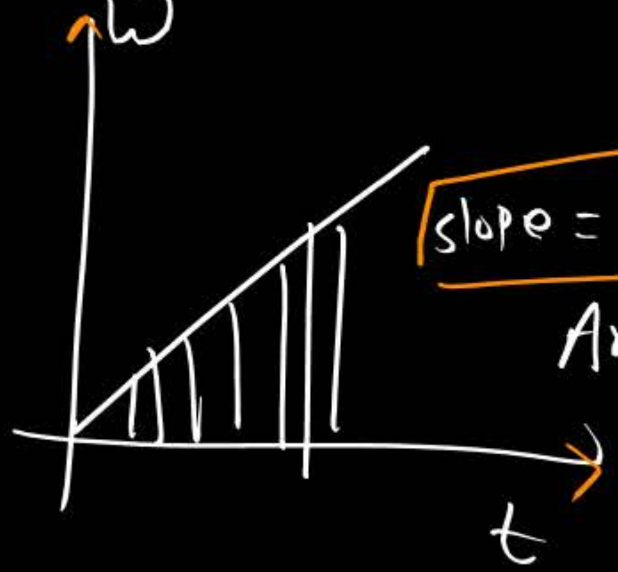


slope $= \omega$

Area ✗



Slope of $(\alpha/t) =$ नालो ?



$\boxed{\text{slope} = \alpha}$

Area = Angular disp^n.

Area of α/t graph $= \Delta\omega$

THANK YOU