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(1) What is uniform circular motion? How is uniform circular motion regarded as an accelerated motion?

Ans) Uniform circular motion is a specific type of motion in which an object travels in a circle with a constant speed. Uniform circular motion is accelerated because the velocity changes due to continuous change in the direction of motion.

(2) An object is moving with uniform speed in a circle of r. Calculate the distance & displacement (a) when it completes half the circle (b) when it completes full circle (c) what type of motion does the object possess?

Ans: The Radius of the circle is R

(i) When it Completes half circle

Distance = $\frac{\text{Circumference}}{2}$

$= \frac{2\pi R}{2}$

Distance $\Rightarrow \pi R$

Displacement = $R + R = 2R$

(ii) When it completes 3/4th of the circle :-

The distance Covered = $\frac{3}{4}$ th of Circumference

$\Rightarrow \frac{3}{4} \times 2\pi R$

$\Rightarrow \frac{3}{2} \pi R$

The Displacement = AB

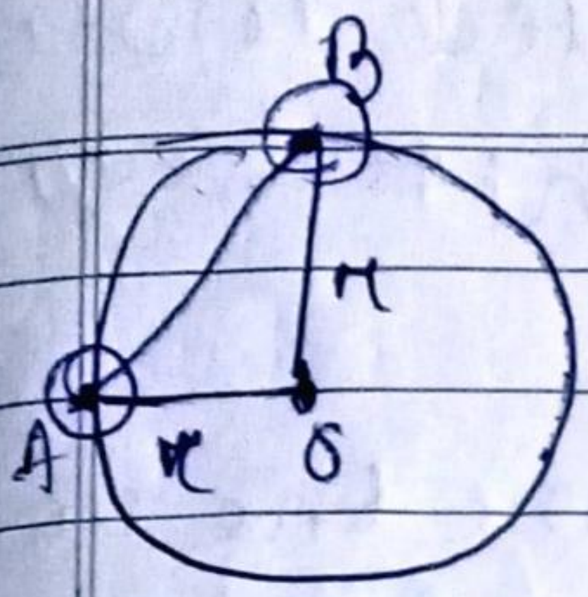
By using Pythagoras theorem

$\Rightarrow AB^2 = R^2 + R^2$

$\Rightarrow AB^2 = 2R^2$

$\Rightarrow AB = \sqrt{2R}$

$\Rightarrow$ Distance = $\frac{3}{2}\pi$



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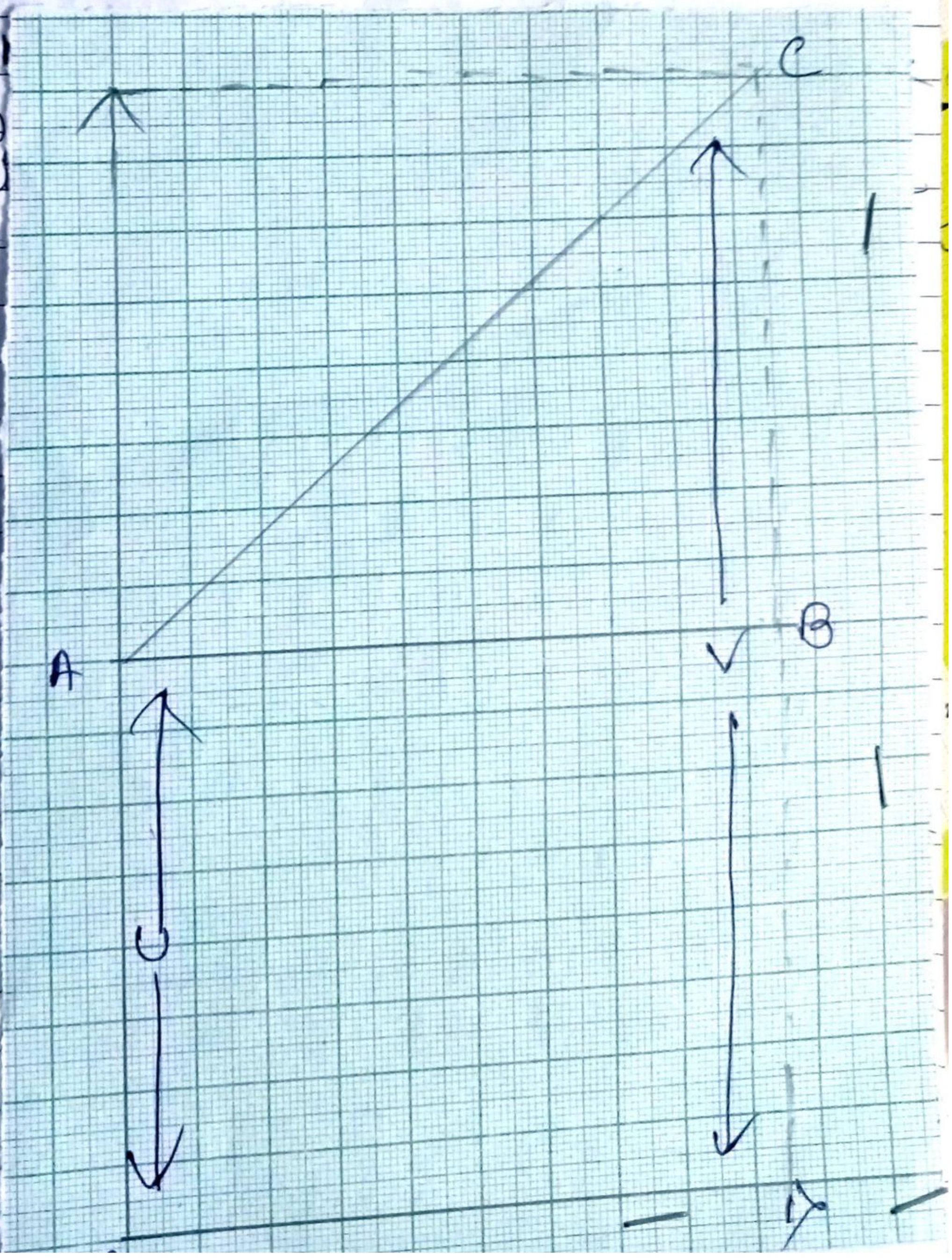

(4) Write the three equation for the uniformly accelerated motion. Also derive the second & third equation by graphical method?

Ans) The three equation for the uniformly accelerated motion are:-

$$V = U + at$$

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

$$V^2 = U^2 + 2as$$

(ii) Second equation of motion:-

We know that the area under the area under the velocity time graph for a given time interval represents the distance covered by the uniformly accelerated object in that interval of time.

∴ Distance (displacement) travelled by the object in time 't' is :-

S = area of trapezium OSQP + Area of Rectangle OSQP + Area of triangle PRQ

$\Rightarrow$ OQRS = OS × OP + $\frac{1}{2}$ × PR × PQ

(area of rectangle = length × breadth

(area of triangle - ~~$\frac{1}{2}$~~ $\frac{1}{2}$ × B × H)

$\Rightarrow$ $t \cdot x \; U + \frac{1}{2} \times t \times (v - u)$

$\Rightarrow$ from the first equation $v - u = at$

$\Rightarrow$ $ut + \frac{1}{2} \times t \times at$

Thus $S = ut + \frac{1}{2} at^2$ ..... (ii)

This is the second equation of uniformly accelerated motion.

(iii) Third equation of motion: Distance travelled by the object in time interval t is S = area of trapezium OSQP

$\Rightarrow \frac{1}{2}(OP + SQ) \times OS$

$\Rightarrow OP = SR$

$\Rightarrow \frac{1}{2} \times (SR + SQ) \times OS$ ..... (iii)

Acceleration, a = slope of the velocity time graph PQ

Or $a = \frac{RQ}{PR} = \frac{SQ - SR}{OS}$

Or $OS = \frac{SQ - SR}{a}$ ..... (iv)

Putting this value in equation (iii) we get

$$S = \frac{1}{2}(SR + SQ)\left(\frac{SQ - SR}{a}\right)$$

Or $S = \frac{1}{2a}(AQ^2 - SR^2)$

Or $S = \frac{1}{2a}(v^2 - u^2)$

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

Or $v^2 = u^2 + 2as$ ..... (v)