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Ch-8

Solved examples

Q. A train starting from rest attains a velocity of 72 km/h in 5 minutes. Assuming that the acceleration is uniform, find i) the acceleration and ii) the distance travelled by the train for attaining the velocity.

i) $u = 0$

$V = 72 \text{ km/h} = \frac{72 \times 5}{18} = 20 \text{ m/s}$

$t = 5 \text{ min} = 5 \times 60 = 300 \text{ sec}$

$a = ?$

$a = \frac{V - u}{t}$

$= \frac{20 - 0}{300} = \frac{20}{300} = \frac{1}{15} \text{ m/s}^2$

ii) $u = 0$

$V = 20 \text{ m/s}$

$t = 300 \text{ s}$

$a = \frac{1}{15} \text{ m/s}^2$

$S = ?$

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

$$= 0 \times 300 + \frac{1}{2} \times \frac{1}{15} \times 300 \times 300$$

$$= 3000\ m$$

$$= 3\ km$$

Q. A car accelerates uniformly from 18 km/h to 36 km/h in 5 s. Calculate i) the acceleration and ii) the dist. covered by the car in that time.

i) $u = 18\ km/h = 18 \times \frac{5}{18} = 5\ m/s$

$V = 36\ km/h = 36 \times \frac{5}{18} = 10\ m/s$

$t = 5s$

$a = \frac{V - u}{t}$

$= \frac{10 - 5}{5} = \frac{5}{5} = 1\ m/s^2$

ii) $u = 5\ m/s$

$v = 10\ m/s$

$t = 5s$

$a = 1\ m/s^2$, $S = ?$

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

$= 5 \times 5 + \frac{1}{2} \times 1 \times 25$

$= 25 + \frac{1}{2} \times 25^{12.5}$

$= 25 + 12.5$

$= 37.5\ m$

Q. The brakes applied to a car produce an acceleration of $6\ m/s^2$ in the opposite direction of motion. If the car takes 2 s to stop after the application of brakes, calculate the distance it travels during this time.

$u = 0\ m/s$

$a = 6\ m/s^2$

$v = 0\ m/s$

$t = 2\ s$

$S = ?$

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

$= 0 \times 2 + \frac{1}{2} \times 6^3 \times 4$

$= 24\ m$

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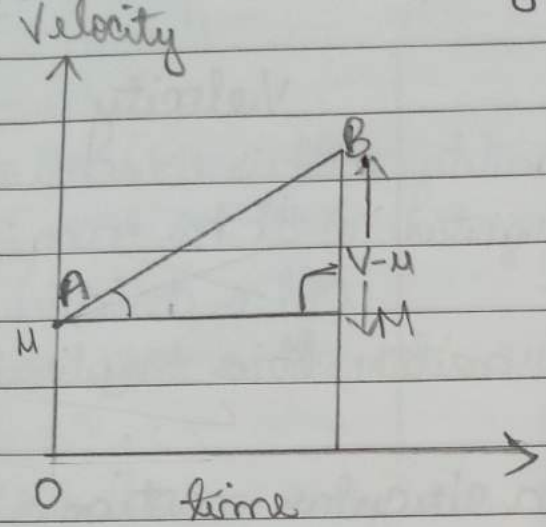
Prove that $V = u + at$, by V-T graph.



Slope of $AB = \frac{BM}{MA} = \frac{V-u}{t}$

$a = \frac{V-u}{t}$

$at = V-u$

$\boxed{V = u + at}$

Q. Write any three differences b/w distance and displacement.

Distance	Displacement
i) Distance is a scalar quantity.	ii) Displacement is a vector quantity.
ii) Distance is always positive.	ii) Displacement may be neg, positive
iii) It depends on path.	iii) It does not depend on path.

Q. Write differences b/w speed and velocity.

Speed	Velocity
i) It is a scalar quantity.	i) It is a vector quantity.
ii) It has only magnitude.	ii) It has magnitude as well as direction.
iii) It is always positive.	iii) It is negative, and 0.

Q. What is uniform circular motion.
⇒ ~~The~~

Q. If velocity is a vector quantity

Q. Define acceleration. Write its SI unit.
⇒ Rate of change of its velocity is called acceleration
SI unit is m/s^2

Q. The body is thrown vertically upward the velocity is 50 m/s. After what time the body will attain the same position?
Note: Take $g = 10 m/s^2$

$a = -g$

$= -10\ m/s^2$

$V = u + at$

$50 = 0 + (-10 \times t)$

$50 = -10t$

Q. Define rest and motion.

Rest ⇒ When a body does not change its position with respect to time, the body is said to be at rest.

Motion ⇒ When a body changes its position with respect to time, the body is said to be in motion.

~~Q. Define origin.~~

⇒

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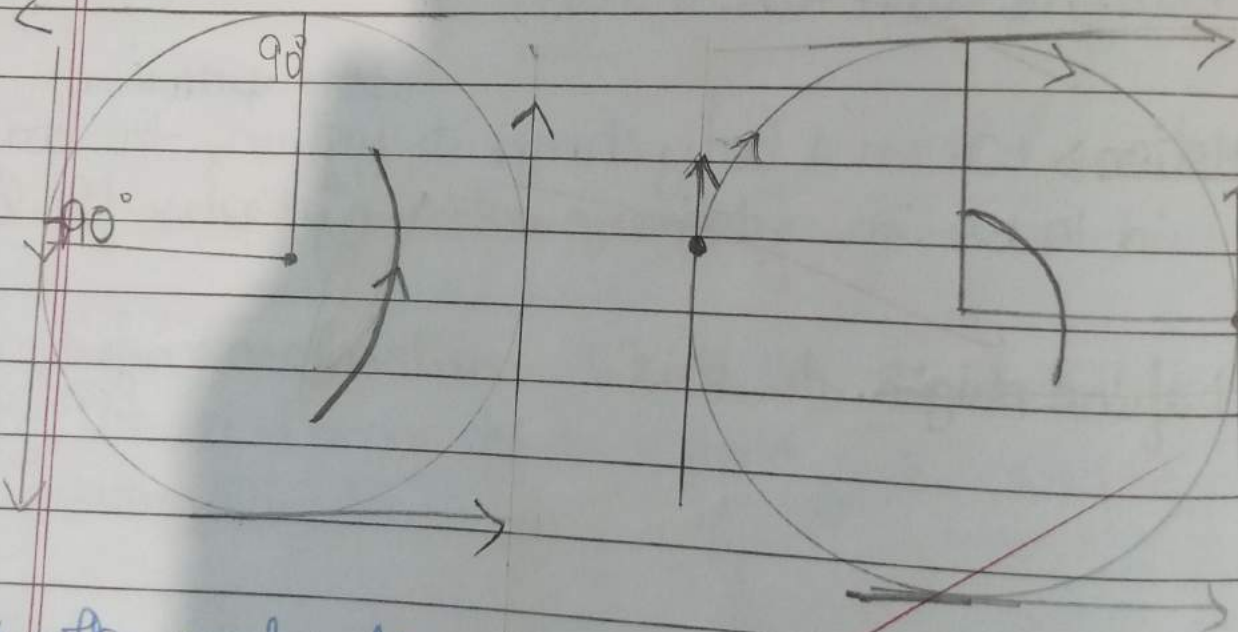
Uniform circular motion -

When a body or particle moves on a circular path with a constant speed, the body is said to be in uniform circular motion.

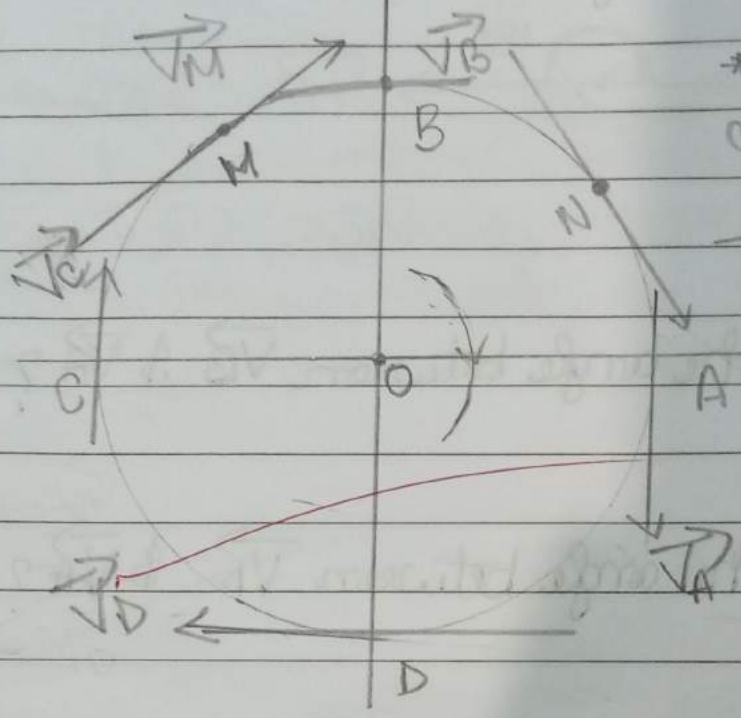
Note: In uniform circular motion, the speed of the body remains constant, whereas, the direction of the body continuously changes.

* The direction of velocity of the body can be formed by drawing tangent as shown in fig



* The acceleration experienced by a body moving in uniform circular motion is given as

Concept



* Moving with constant speed V (= 5m/s)

Here,

$\vec{V_M}$ → Velocity at point M

$\vec{V_N}$ → Velocity at point N

$\vec{V_M} \neq \vec{V_N}$

But, $|\vec{V_M}| = |\vec{V_N}|$

$= V = 5 m/s$

* $\vec{V_N} \neq \vec{V_D}$

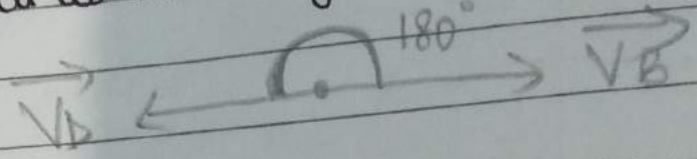
But, $|\vec{V_N}| = |\vec{V_D}|$

$V = 5 m/s$

$V_N = V_D = V$

$= 5 m/s$

Q What is the angle between $\vec{V_B}$ & $\vec{V_D}$?



$\Rightarrow 180°$

Q. What is the angle between $\vec{V_B}$ & $\vec{V_A}$?

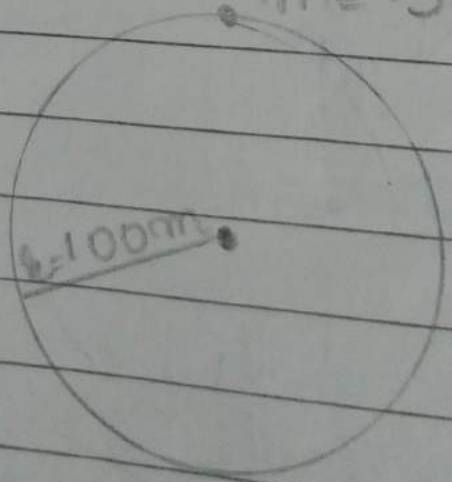
$= 90°$

Q What is the angle between $\vec{V_B}$ & $\vec{V_A}$?

$= 90°$

Q. A body of a mass 5 kg moving on a circular track of a radius 100m. If body complete with constant speed cover 4 round in 20 sec. Find the acceleration of the body.

$\Rightarrow$ mass = 5kg



$V = \frac{\text{distance}}{\text{time}}$

$= \frac{2\pi r}{t}$

$= \frac{2 \times 22}{5 \times 7} \times 100^{20}$

$=$

$a = \frac{V^2}{R}$

$=$

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Ex-8.3

Q. Usha swims in a 90m long pool. She covers 180 m in one minute by swimming from one end to the other and back along the same straight path. Find the average speed and average velocity of Usha.

Distance = 180m

Displacement = 0m

Time = 1min = 60s

∴ Average Speed = $\frac{\text{Total distance}}{\text{Time}}$

$= \frac{180}{60} = 3$

$= 3 m/s$

Average velocity = $\frac{\text{Displacement}}{\text{Total time}}$

$= \frac{0}{60} = 0 m/s$

Ex- 8.4

Q. Starting from a stationary position, Rahul paddles his bicycle to attain a velocity of 6 ms^{-1} in 30s. Then he applies brakes such that the velocity of the bicycle comes down to 4 ms^{-1} in the next 5s. Calculate the acceleration of the bicycle in both the cases.

$u = 0$

$v = 6 m/s$

$t = 30 s$

$a = ?$

~~$v = u + at$~~ $a = \frac{v-u}{t}$

$= \frac{6-0}{30} = \frac{6}{30} = 0.2 m/s^2$

And,

$u = 6 m/s$

$v = 4 m/s$

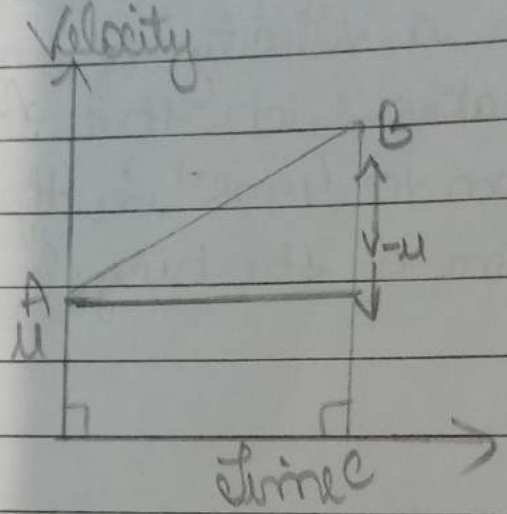
$t = 5s$

$a = \frac{v-u}{t}$

$= \frac{4-6}{5} = \frac{-2}{5} = -0.4 m/s^2$

Q. Prove that:

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



$v = u + at$

Squaring both sides

$v^2 = (u + at)^2$

$\Rightarrow v^2 = u^2 + a^2t^2 + 2uat$

$\Rightarrow v^2 - u^2 = a^2t^2 + 2uat$

$\Rightarrow v^2 - u^2 = 2a\left(\frac{1}{2}at^2 + ut\right)$

$\Rightarrow v^2 - u^2 = 2ax$

$\Rightarrow v^2 - u^2 =$

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

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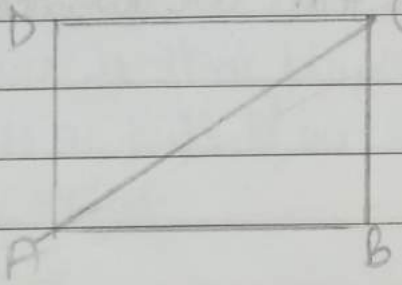
Pg-100

2. A farmer moves along the boundary of a square field of side 10 m in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds from his initial position?



∴ 40 m is travelled in 40 sec.

Total time = 2 min 20 sec.
= 2 × 60 + 20 sec
= 140 sec.

initial point = A
Final point = C
Displacement = A to C
By pythagorus theorem,

$\sqrt{10^2 + 10^2}$

$\sqrt{100 + 100}$

$\sqrt{200}$

$10\sqrt{2}$

Farmer completed round in 40 s

∴ Total no. of rounds = $\frac{7}{\frac{14\phi}{2}}$ = 3.5 m

3. Which of the following is true for displacement

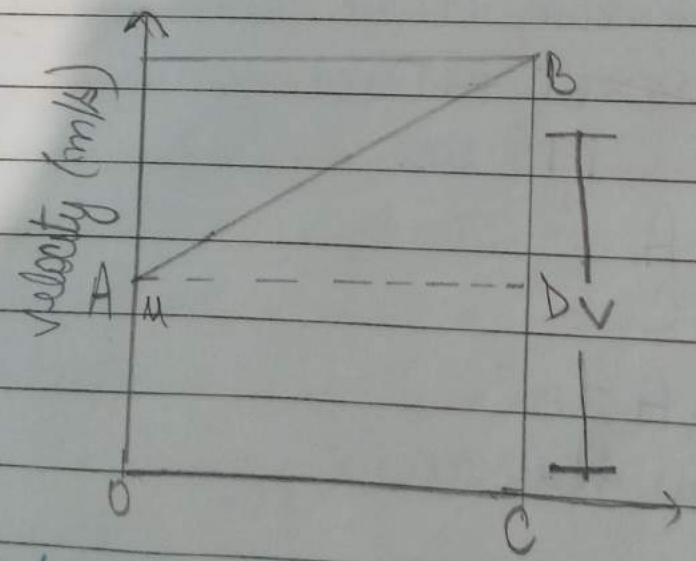
a) It cannot be zero.

⇒ False

b) Its magnitude is greater than the distance travelled by the object.

⇒ False

Ex-85



$S = \frac{(OA + BC)}{2} \times OC$

$= \frac{(U+V)}{2} \times t$