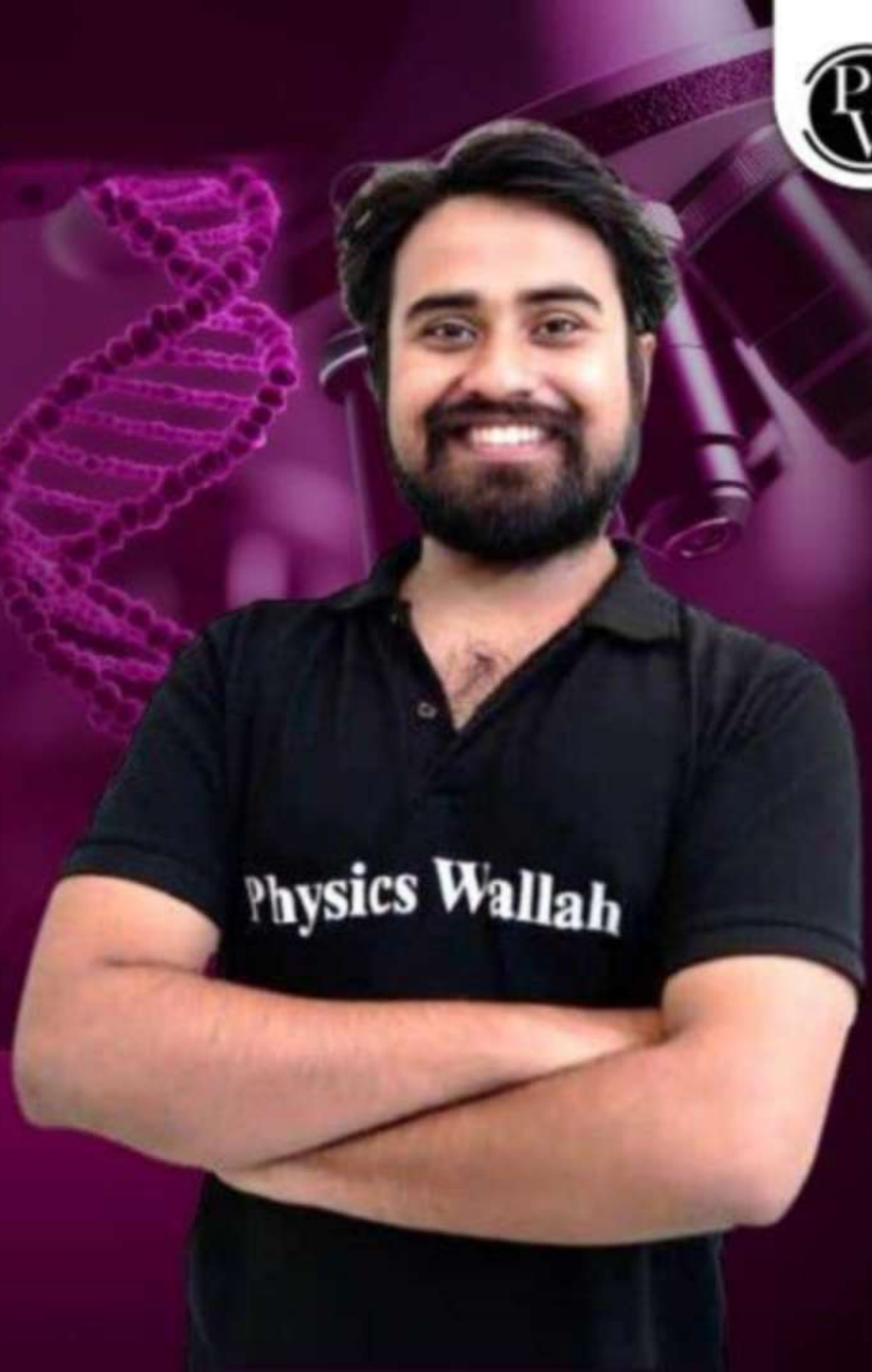
PRACHAND NEET

ONE SHOT

Physics

MOTION IN STRAIGHT LINE



By – Brofessor Dr. Aayudh

Topics *to be covered*

1. Part 1 – Basic Maths ✓
2. Part 2 – Introduction ✓
3. Part 3 – Distance and Displacement ✓
4. Part 4 – Speed Velocity Average Instantaneous ✓
5. Part 5 – Change in velocity, acceleration & bros ✓
6. Part 6 – Circle & Keel on Wheel ✓

Topics *to be covered*

7. Part 7 – ❤️❤️DILBAR QUESTIONS❤️❤️
8. Part 8 – Non Uniform acceleration
9. Part 9 – Uniform acceleration
10. Part 10 – Motion under Gravity
11. Part 11 – Graphs on Steroids
12. Part 12 – Theory and AR
13. Part 13 – Revision and PUPPY POINTS

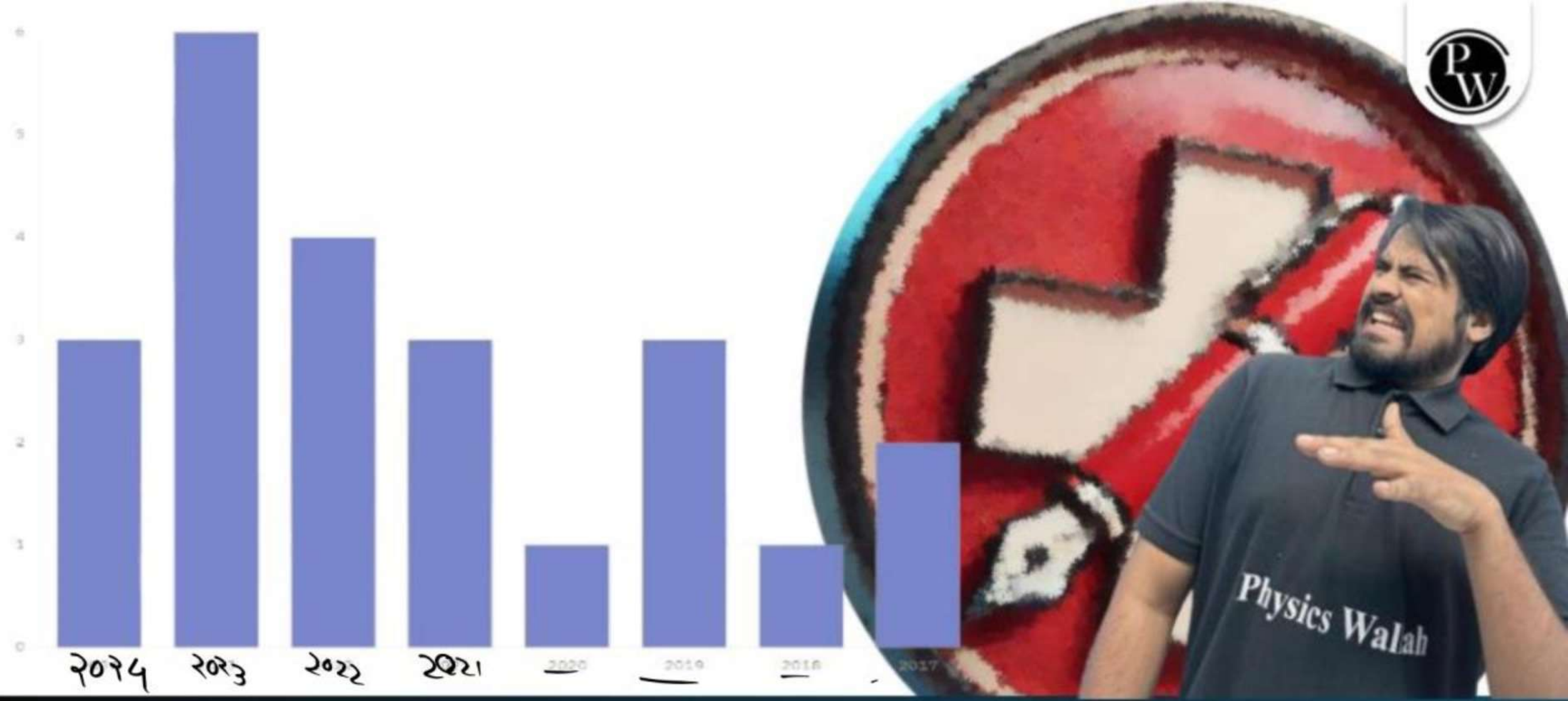
mix

PRACHAND SERIES

TELEGRAM CHANNEL

NEET SYLLABUS

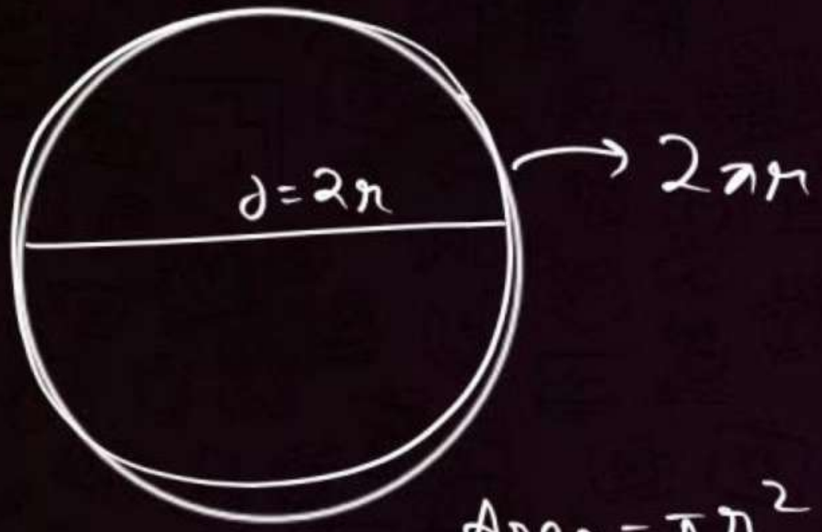
- The frame of reference
- Motion in a straight line
- Position- time graph
- Speed and velocity
- Uniform and non-uniform motion
- Average speed and instantaneous velocity
- Uniformly accelerated motion
- Velocity-time, position-time graph, relations for uniformly accelerated motion



BROFESSOR ANALYSIS

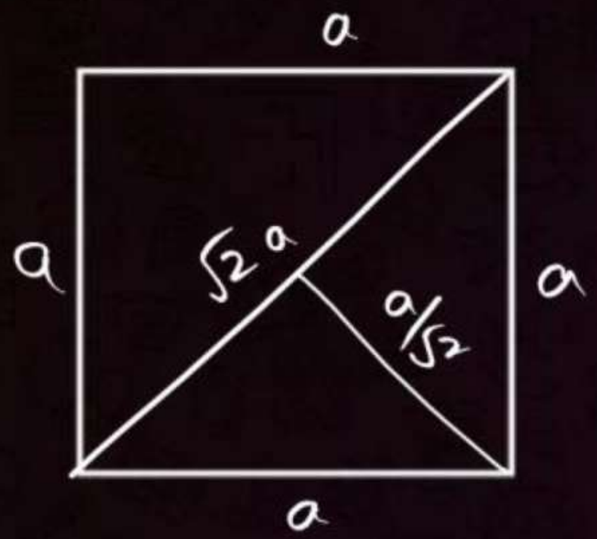
Part 1 – Basic Maths

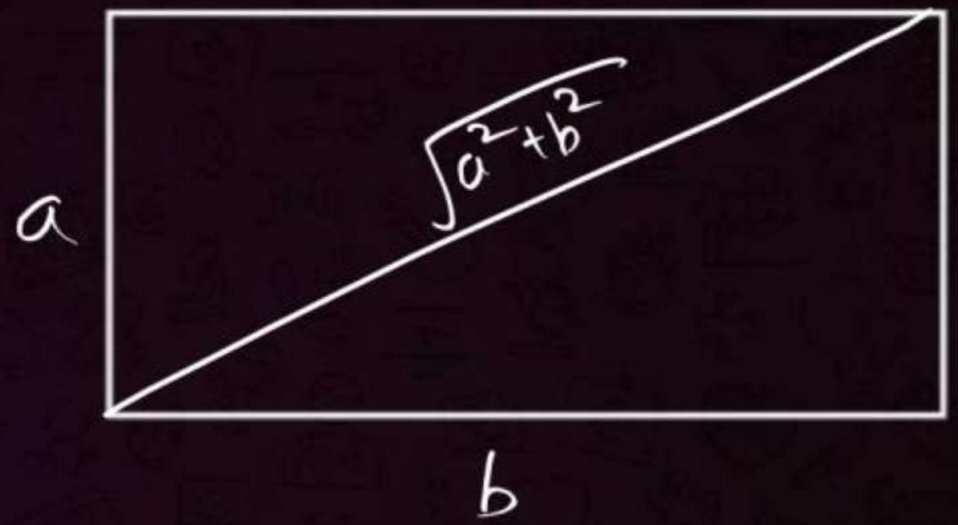
1.1 GEOMETRY



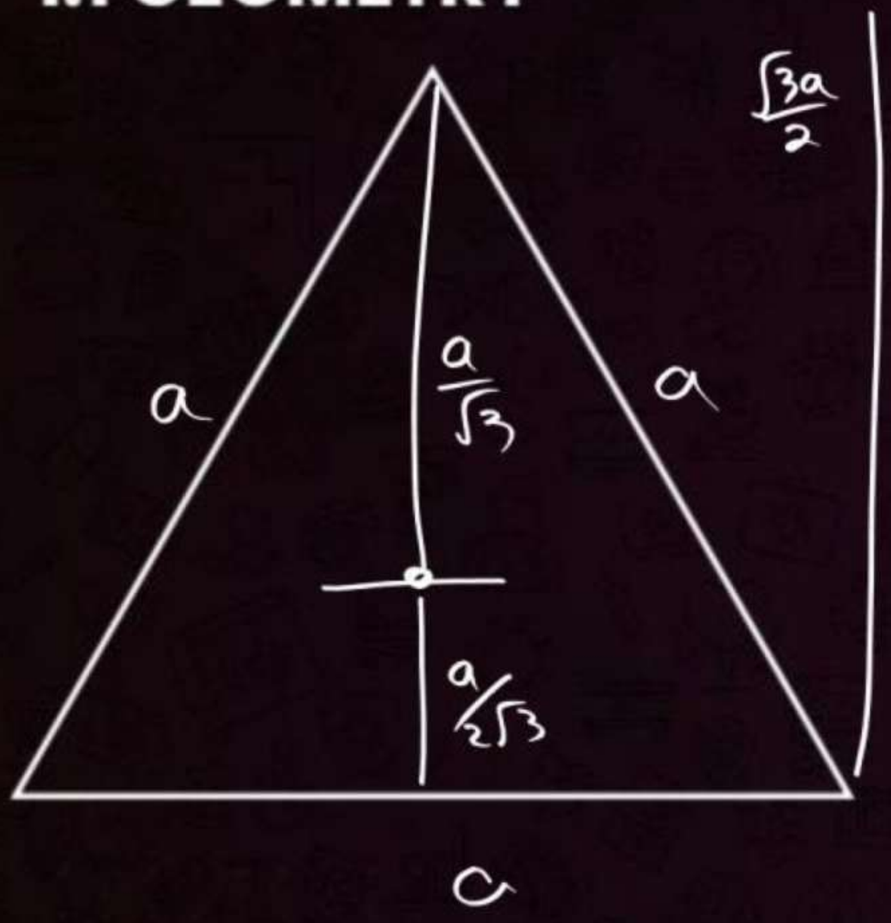
$\text{Area} = \pi r^2$

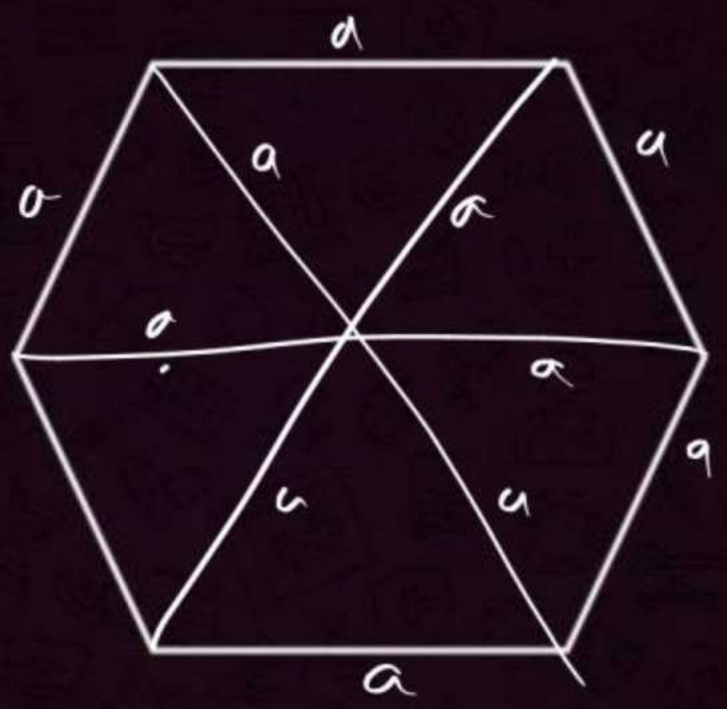
1.1 GEOMETRY

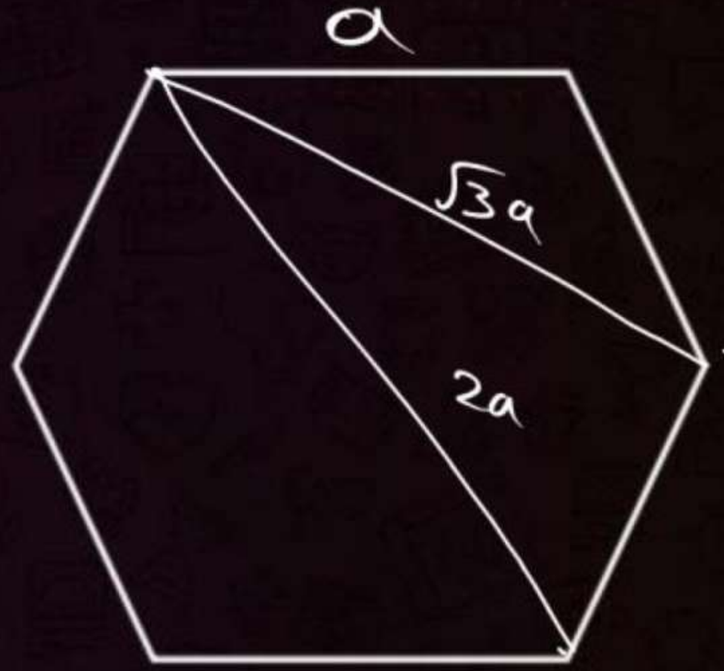




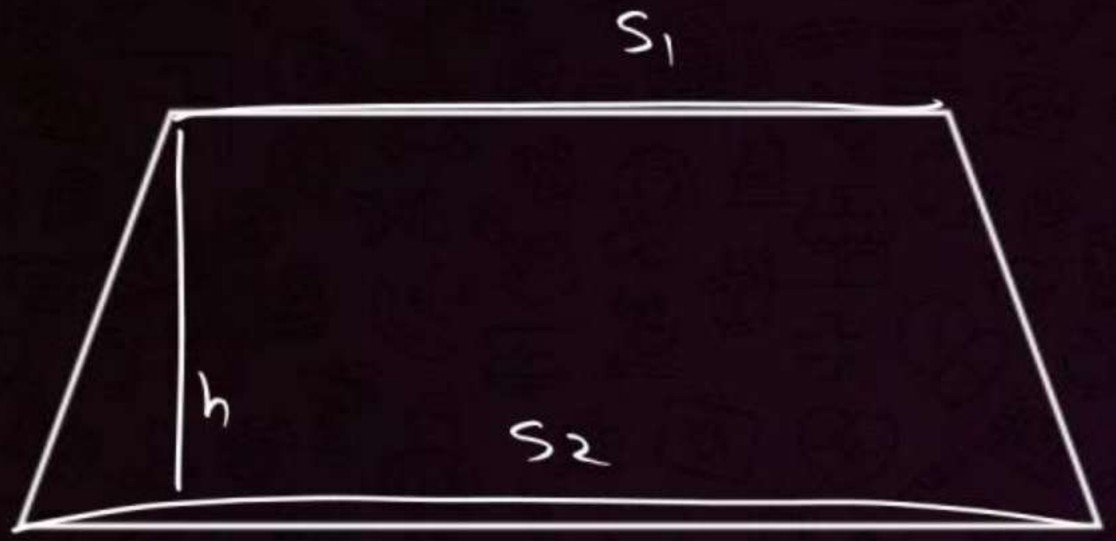
1.1 GEOMETRY



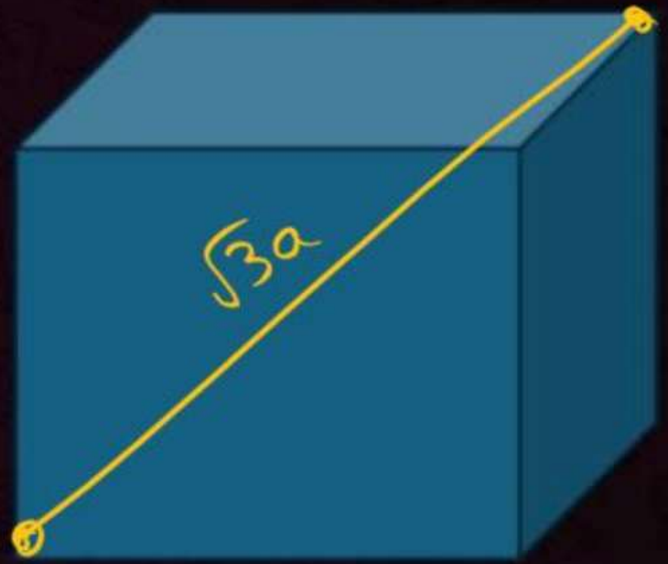




1.1 GEOMETRY



$$\text{Area} = \frac{1}{2}(s_1+s_2)\,h$$



1.2 x/√x

$\frac{2}{\sqrt{2}} = \frac{\sqrt{2}\sqrt{2}}{\sqrt{2}} = \sqrt{2}$

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

$\frac{8}{\sqrt{8}} = \sqrt{8} = 2\sqrt{2}$

$\frac{10}{\sqrt{10}} = \sqrt{10}$

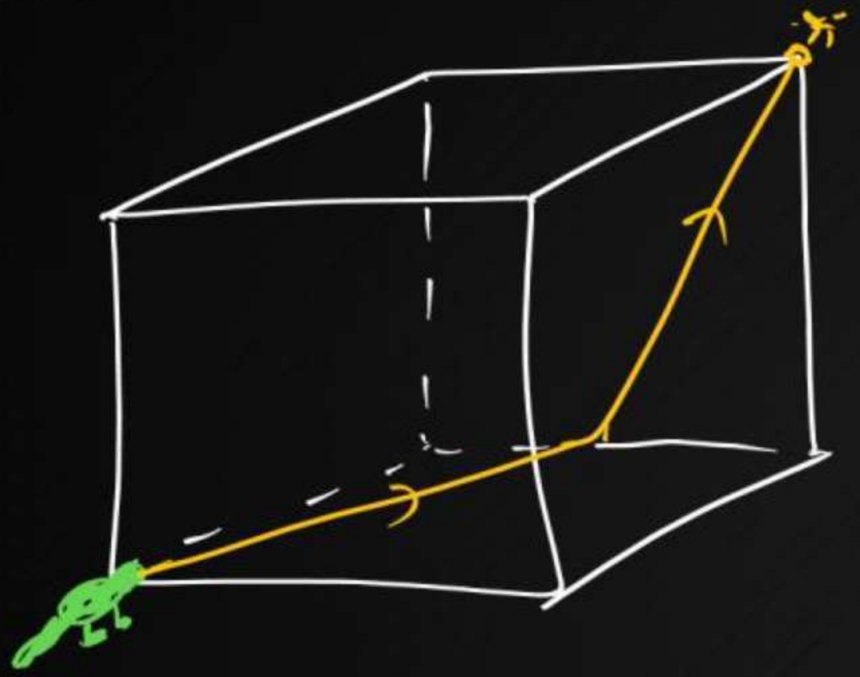
(A) 10

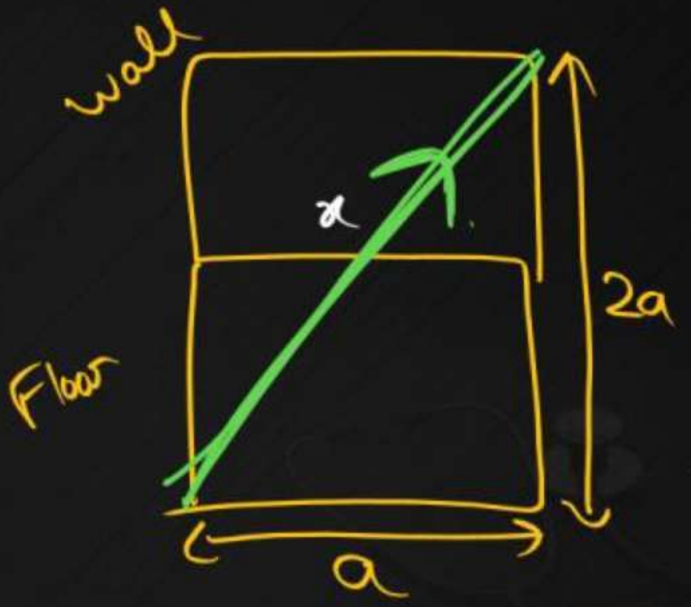
(B) $\sqrt{10}$

(C) $1/\sqrt{10}$

(D) $1/10$

Chipkali





(A) ~~$\sqrt{5}a$~~

(B) $2a$

(C) ~~$\sqrt{5}a$~~

(D) $\sqrt{6}a$

$$x^2 = a^2 + (2a)^2$$

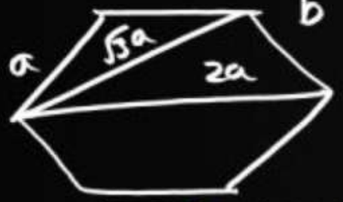
$$x^2 = a^2 + 4a^2$$

$$x^2 = 5a^2$$

$$\boxed{x = \sqrt{5}a}$$

PUPPY POINTS - 1

$2\pi r$



$\sqrt{5}a$ (lizard)

$\frac{x}{\sqrt{x}} = \sqrt{x}$

Pyth.

3, 4, 5 ✓

6, 8, 10

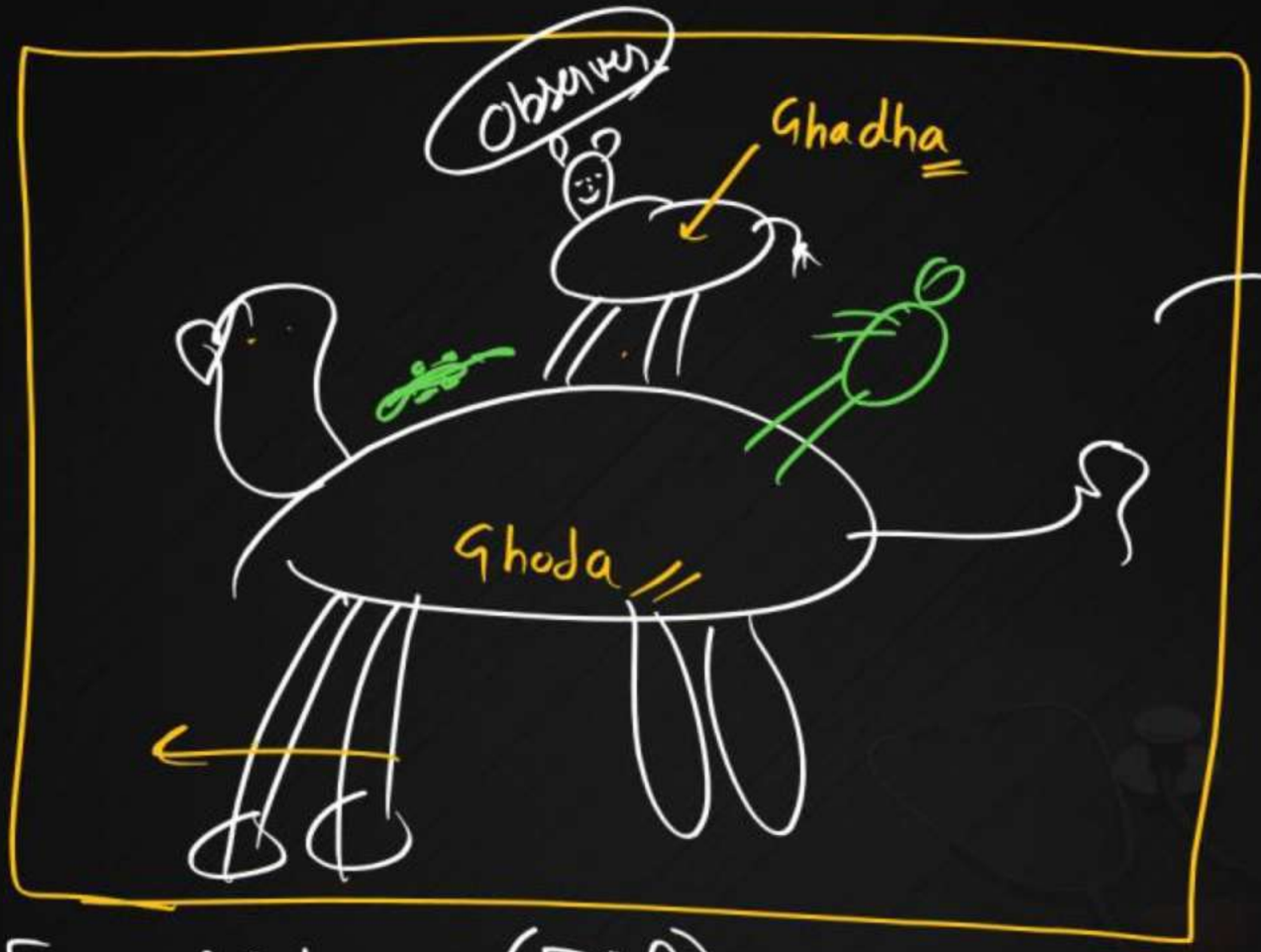
5, 12, 13

7, 24, 25

$a, a, a\sqrt{2}a$

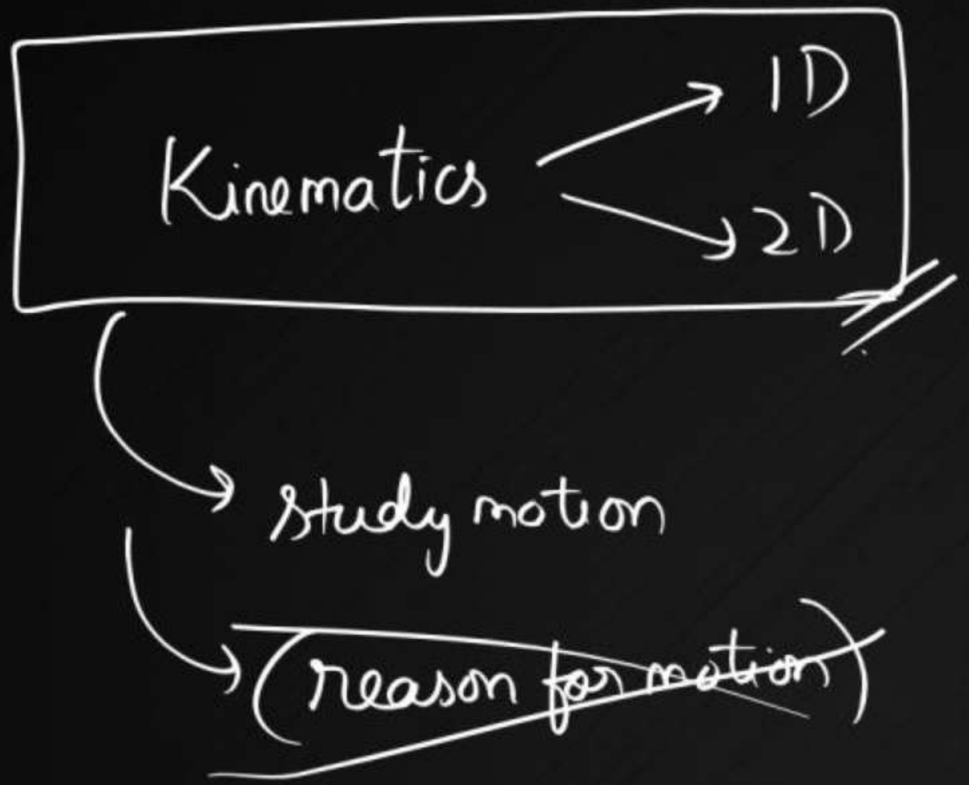
$a, a, a - \sqrt{3}a$

Part 2 – Introduction



Frame of Reference (FOR)

❤ observer is assumed to be at rest


Kinematics
1D
2D
Study motion
(reason for motion)

Difficulty Level : Easy

QUESTION-01

A branch of physics dealing with motion without considering its causes is known as

[NCERT Based]

1. Statics
2. Dynamics
3. Kinematics ✓
4. Hydrodynamics

2.1 Observer, Origin & Frame of Reference

- A **frame of reference (FOR)** is a set of coordinates that can be used to determine positions and velocities of objects in that frame
- Different **FOR** move relative to one another.

- An **observer** is someone who assigns coordinates to everything that happens around them.
- **Observer** is generally considered to be a separate, uninvolved witness to the universe
- **Observer** always stays in frame of reference
- **Observer** is always considered at rest

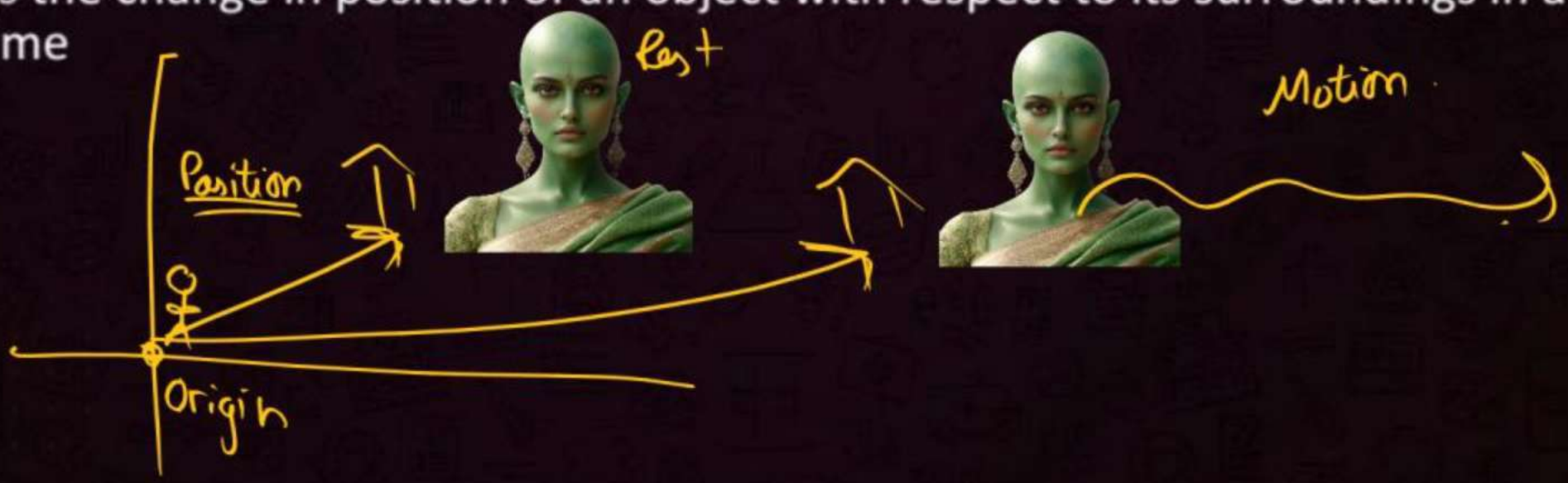
- **Origin** is always considered at zero in FOR

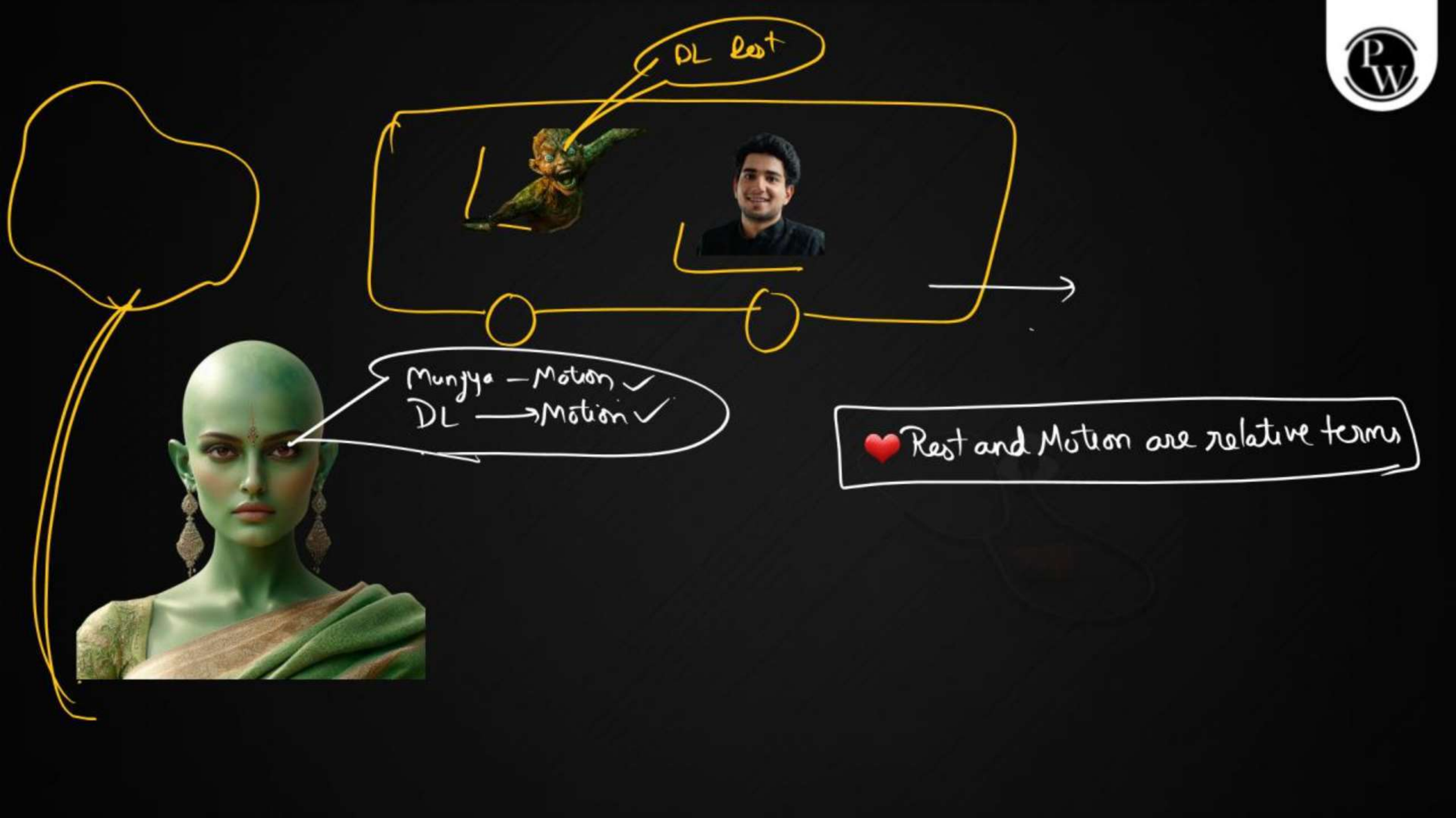
2.2 Position, Rest, Motion

❤️ **Position** is the location of an object in space at a given time. It is defined relative to a reference point, often called the origin.

❤️ **Rest** is the state of an object that is not moving relative to a frame of reference or another object

❤️ **Motion** is the change in position of an object with respect to its surroundings in a given interval of time




DL Rest
Munjya – Motion ✓
DL → Motion ✓
❤ Rest and Motion are relative terms

2.3 Meaning of Average & Instantaneous

$$\text{average} = \frac{\text{total}}{\text{total}}$$

$$i = \frac{q}{t} =$$

$$i_{avg} = \frac{\text{total charge}}{\text{total time}} = \frac{\Delta q}{\Delta t}$$

$$v = \frac{x}{t}$$

$$v_{avg} = \frac{\text{total displacement}}{\text{total time}} = \frac{\Delta x}{\Delta t}$$

Instantaneous ⟹ time bahut kaam

$$\lim_{t \to 0}$$

$d \rightarrow$ Bahut chutti sa..

$$i_{inst} = \frac{dq}{dt}$$

$$v_{inst} = \frac{dx}{dt}$$

2.4 Meaning of Change & Difference

Change = Final − Initial → +ve, −ve, 0

Difference = Bada − Chota → 0, +ve, cannot be −ve

Q 10 Rs → 5 Rs

(Change = F − I = 5 − 10 = −5
Difference = B − C = 10 − 5 = +5)

2.5 Meaning of Relative

Division

relative density = $\frac{\text{density}}{\text{density of water}}$

reative Molar Mass = $M_1 -$

relative refractive index = $\frac{\mu_1}{\mu_2}$

Subtraction (Vector)

$\bar{V}_{rel} = \bar{V}_2 - \bar{V}_1$

$\bar{a}_{rel} = \bar{a}_2 - \bar{a}_1$

$\bar{\omega}_{rel} = \bar{\omega}_2 - \bar{\omega}_1$

Part 3 – Distance and Displacement

3.1 Distance

Distance is a scalar quantity that refers to "how much ground an object has covered" during its motion.

The total length of the actual path followed by an object is called as distance.

Always positive

Can never decrease

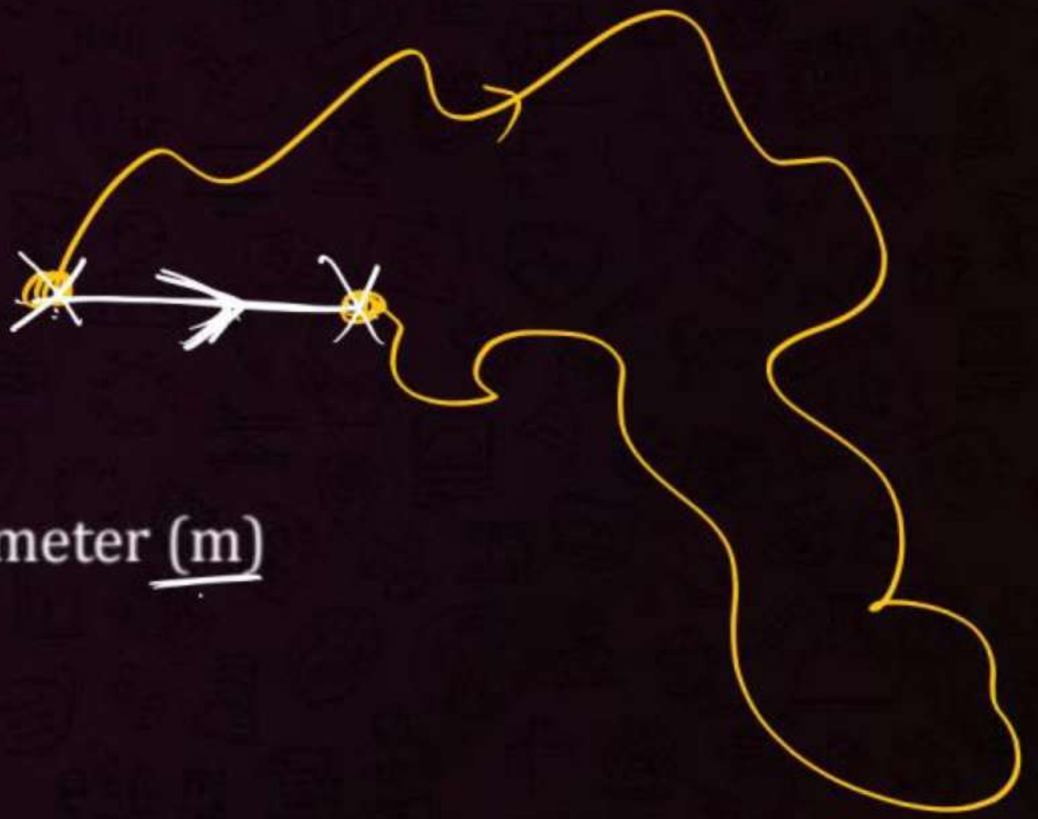
SCALAR ✓

SI unit to measure distance and displacement is meter (m)

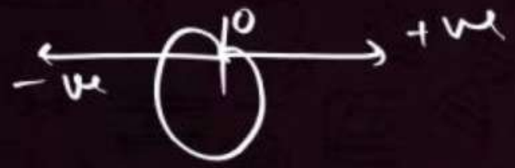
3.2 Displacement

The straight line (shortest) distance between two points, directed from one position to other is called as displacement of an object between those positions.

Does not depend on path



It may be positive/negative/zero



VECTOR

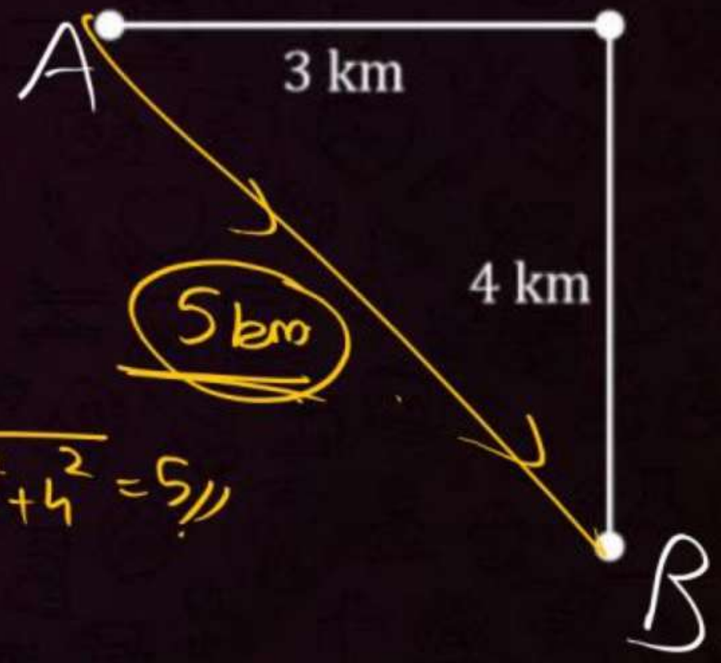
SI unit to measure distance and displacement is meter (m)

Difficulty Level : Easy

QUESTION-02

Calculate Distance and Displacement in going from A to B [Prachand 2024]

1. 7km , 7km
2. 5km , 5km
3. 5km, 7km
4. 7km, 5km

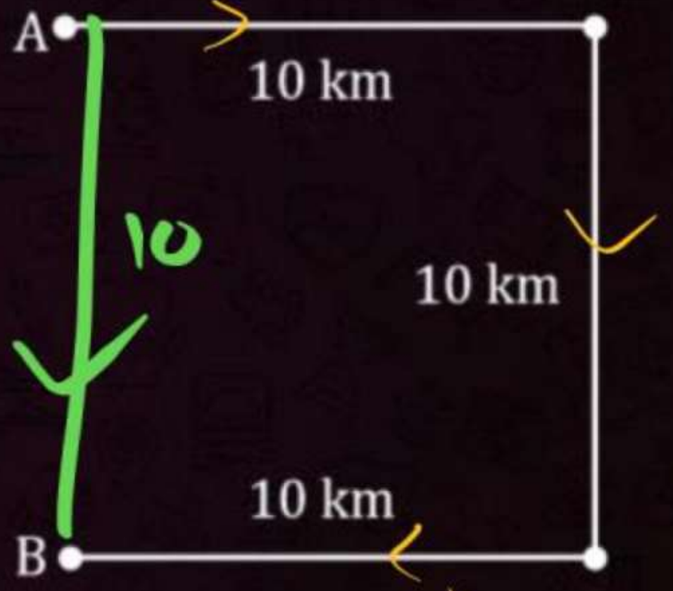


$\sqrt{3^2+4^2}=5$

Difficulty Level : Easy

QUESTION-03

Calculate Distance and Displacement in going from A to B [Prachand 2024]

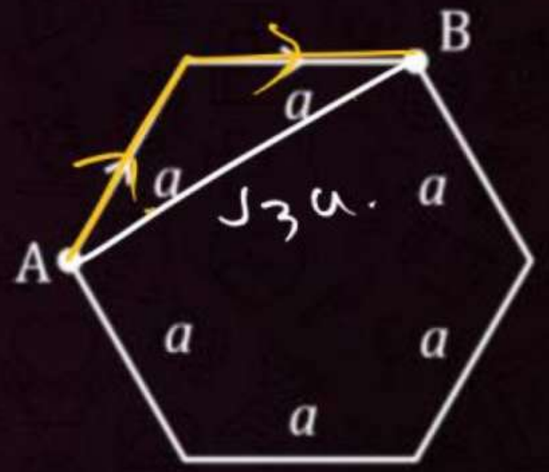


1. 10 km , 10 km
2. 20 km , 30 km
3. 30 km, 20 km
4. 30 km, 10 km

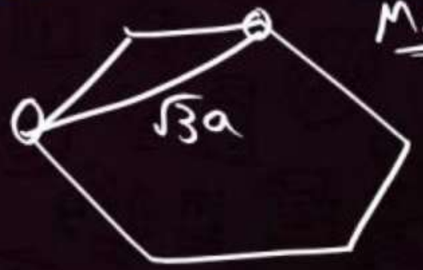
Difficulty Level : Medium

QUESTION-04

Calculate Distance and Displacement in going from A to B [Prachand 2024]



1. $a\sqrt{2}, a\sqrt{2}$
2. $3a, a\sqrt{3}$
3. $3a, 2a$
4. $2a, a\sqrt{3}$



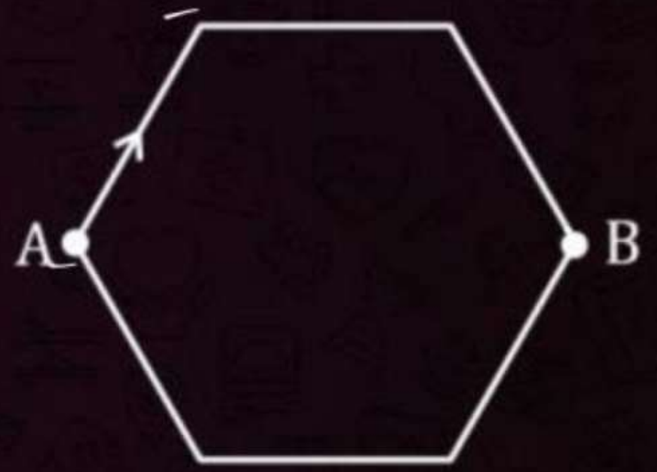
Mama

Difficulty Level : Easy

QUESTION-05

Calculate Distance and Displacement in going from A to B. (Side a)

[Prachand 2024]



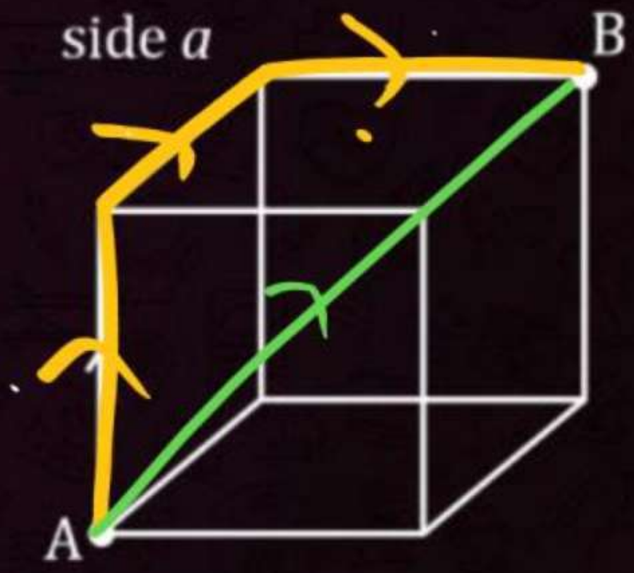
1. $a\sqrt{2}, a\sqrt{2}$
2. $3a, a\sqrt{3}$
3. $3a, 2a$
4. $2a, a\sqrt{2}$

Difficulty Level : Easy

QUESTION-06

Calculate Distance and Displacement in going from A to B [Prachand 2024]

1. $a\sqrt{2}, a\sqrt{2}$
2. $3a, a\sqrt{3}$ ✓
3. $3a, 2a$
4. $2a, a\sqrt{2}$

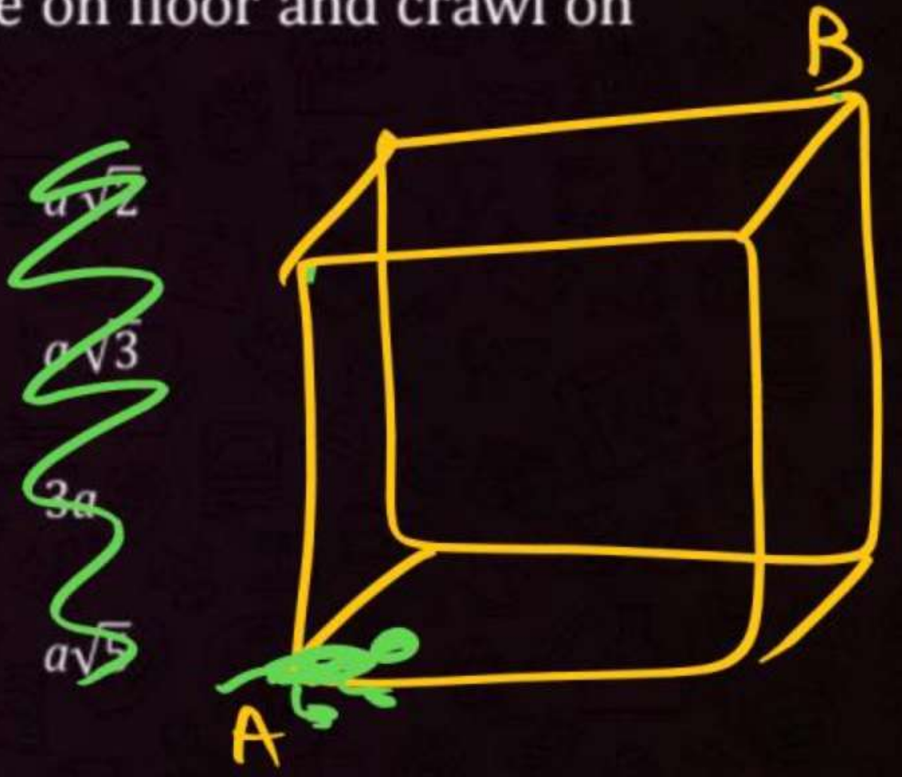


Difficulty Level : Hard

QUESTION-07

What distance a lizard must travel to go from A to B in minimum time assuming it moves with constant speed. (Lizard is allowed to move on floor and crawl on wall but it cannot fly)

1. $a\sqrt{2}$
2. $a\sqrt{3}$
3. $3a$
4. $a\sqrt{5}$

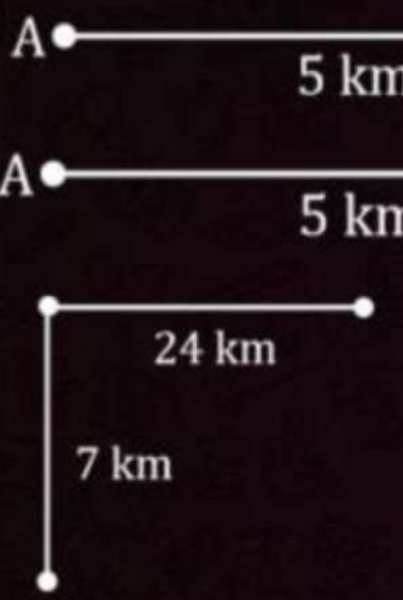


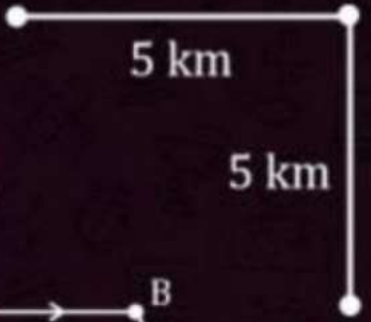
Puppy 1 – Distance & Displacement

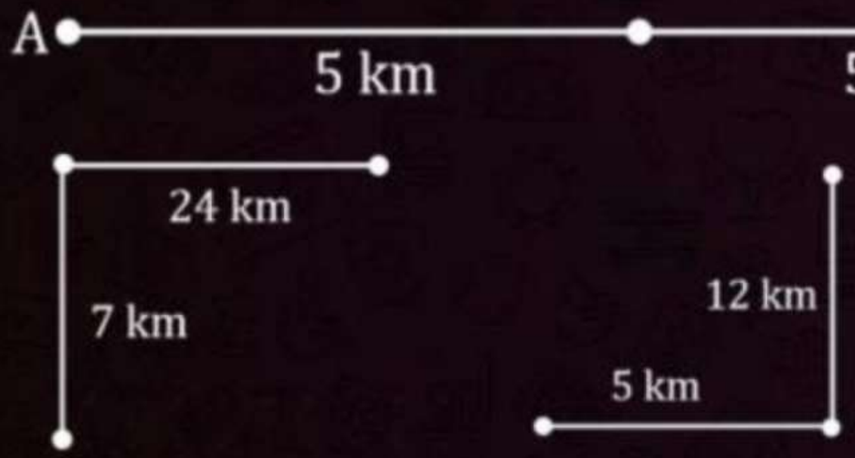
(HW)

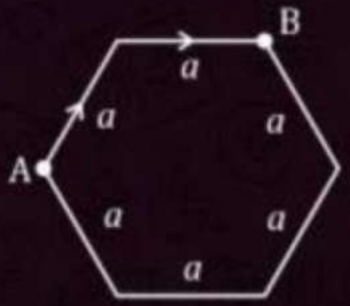
Difficulty Level : Easy

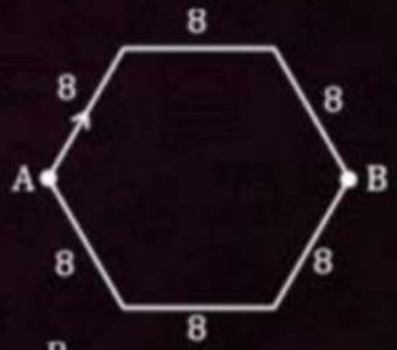
Find Distance & Displacement in going from A to B

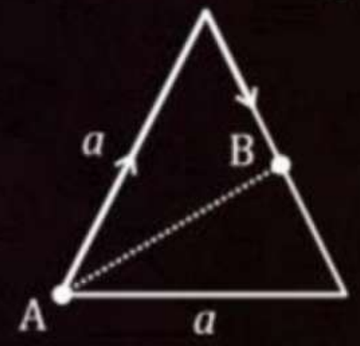


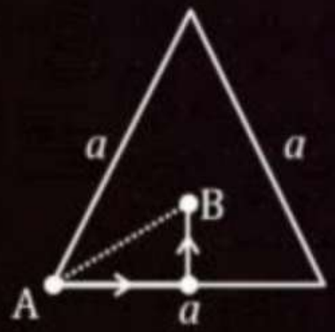


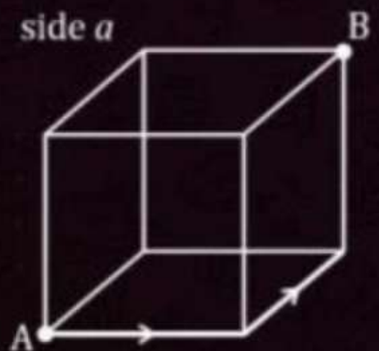


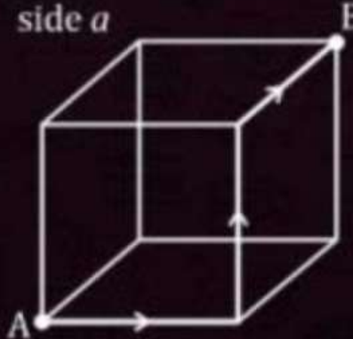


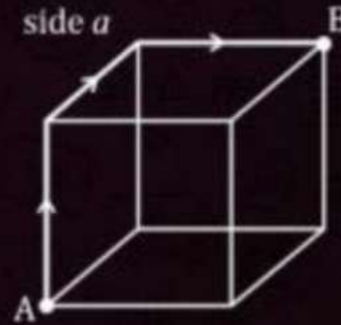












Difficulty Level : Easy

QUESTION-08

Which of the following statements is incorrect? [NCERT Based]

1. Path length is a scalar quantity whereas displacement is a vector

2. The magnitude of displacement is always equal to the path length traversed by an object over a given time interval.

3. The displacement depends only on the end points whereas path length depends on the actual path followed.

4. The path length is always positive whereas displacement be positive, negative and zero.

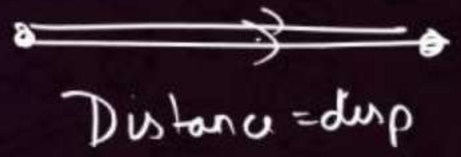
Difficulty Level : Easy

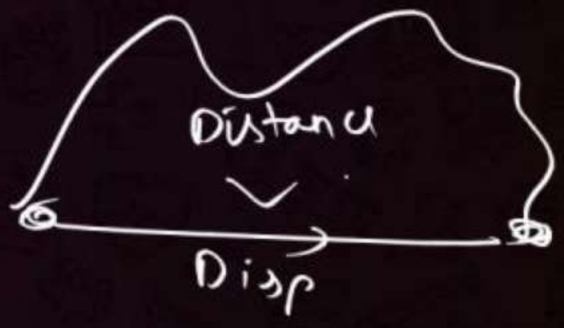
QUESTION-09

The numerical ratio of distance to displacement is

[NCERT Based]

1. Always equal to one
2. Always less to one
3. Always greater than one
4. Equal to or more than one





$$\frac{D}{disp} \geq 1$$

QUESTION-10

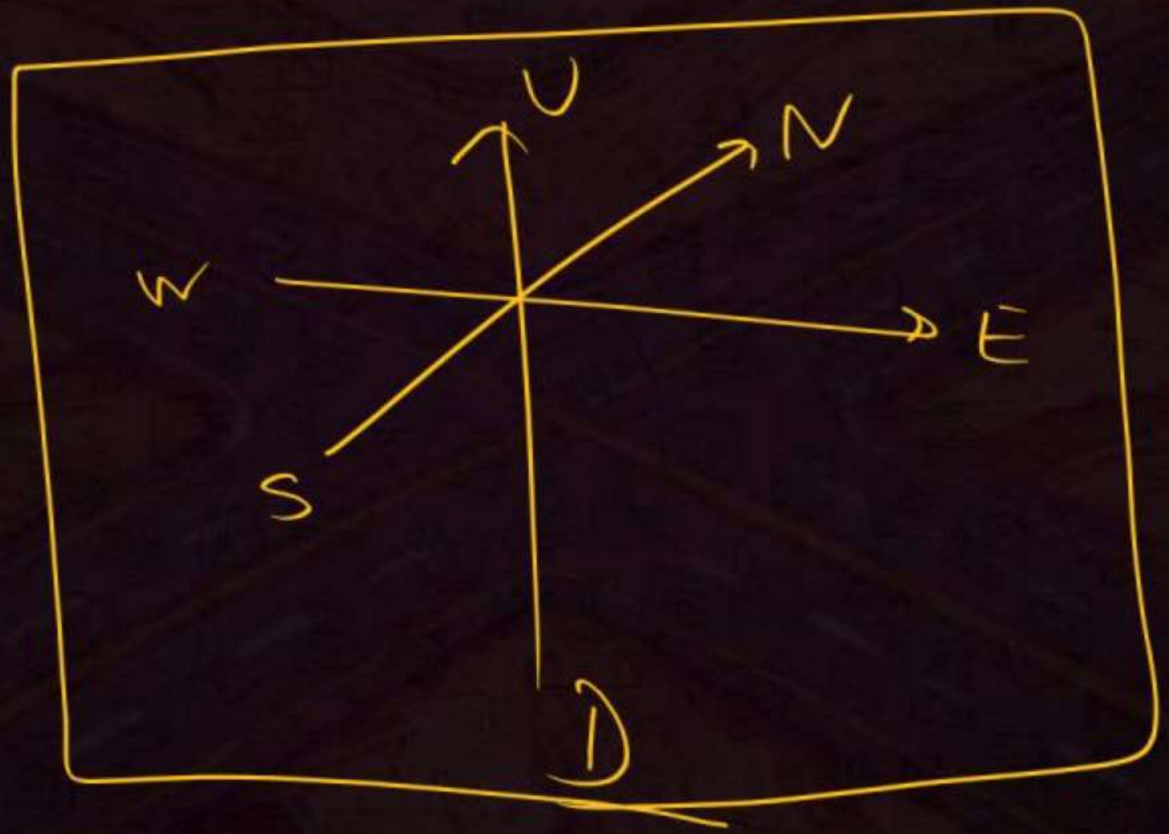
Difficulty Level : Easy

Which of the following statements in incorrect? [NCERT Based]

1. Displacement is independent of the choice of origin of the axis.
2. Displacement may or may not be equal to the distance travelled
3. When a particle returns to its starting point, its displacement is not zero.
4. Displacement does not tell the nature of the actual motion of a particle between the points

3.3 Direction based Questions

(Vectors)



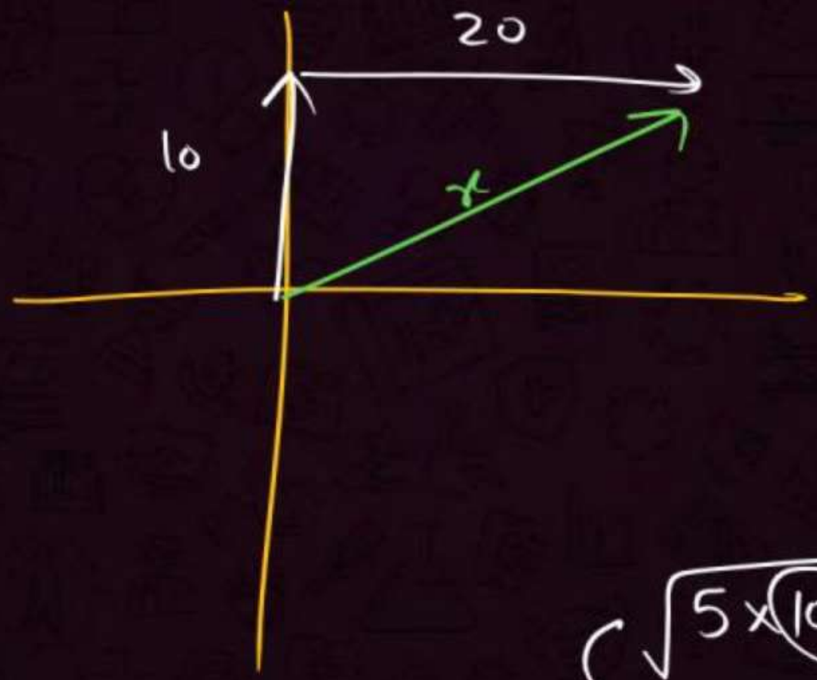
Difficulty Level : Easy

QUESTION-11

If a man goes 10 m toward north and 20 m toward east, then his displacement

[NCERT Based]

1. 22.5 m
2. 25 m
3. 25.5 m
4. 30 m



$10^2 + 20^2 = x^2$

$x = \sqrt{100+400}$

$x = \sqrt{500} = 10\sqrt{5}$

$= 10 \times 2.2$

$= 22$

$\sqrt{5 \times 100}$

$\therefore 10\sqrt{5}$

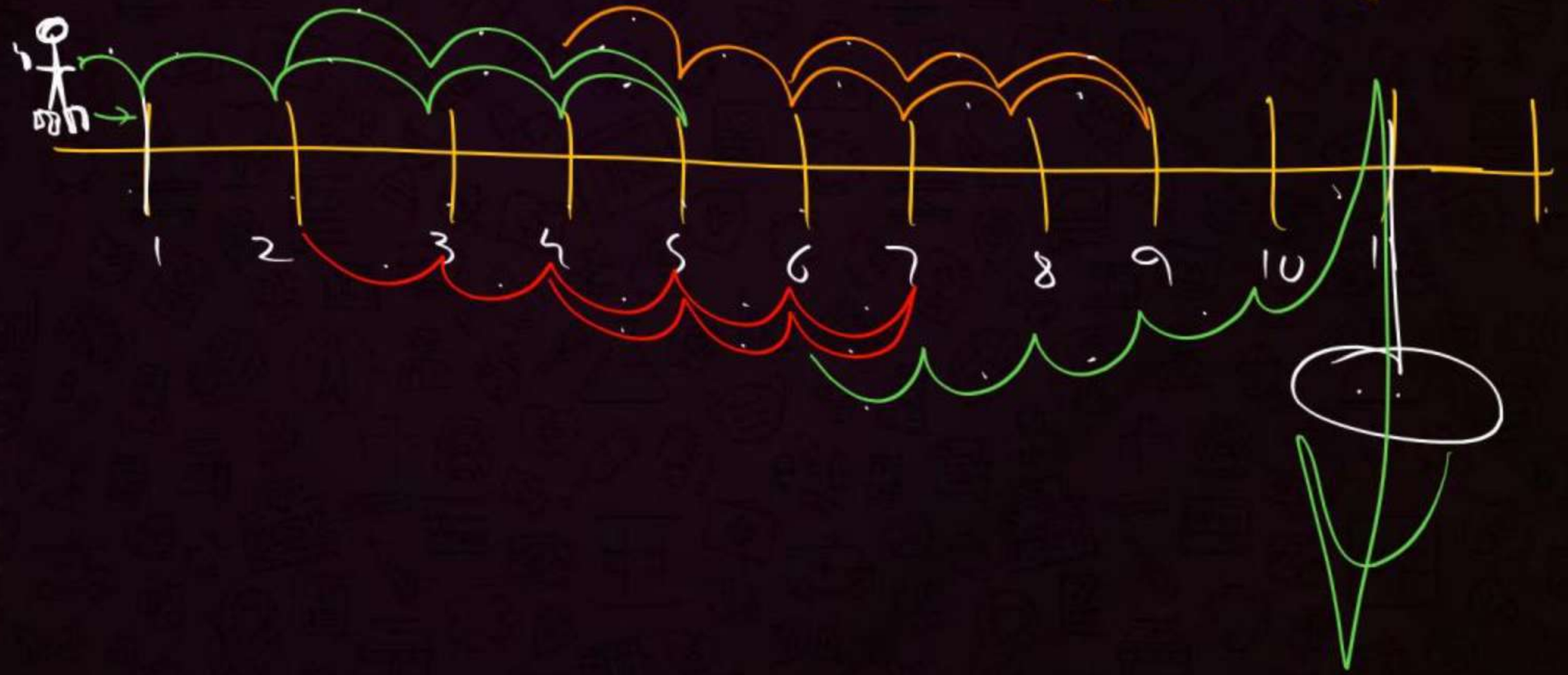
3.4 Drunkard Questions

Difficulty Level : Medium

QUESTION-12

A drunkard is walking long a straight road. he takes 5 steps forward and 3 streps backward and so on. Each step is 1 m long the takes 1s. There is a pit on the road 11 m away from the starting point. The drunkard will fall into the pit after.

[NCERT Based]



1. 21 s
2. 29 s
3. 31 s
4. 37 s

Difficulty Level : Medium

QUESTION-12

f=5 b=3 f+b=8 f−b=?

A drunkard is walking long a straight road. he takes 5 steps forward and 3 streps backward and so on. Each step is 1 m long the takes 1s. There is a pit on the road 11 m away from the starting point. The drunkard will fall into the pit after.

[NCERT Based]

11 −2
9 −2
7 −2
5 +8+8+8 = 29

1. 21 s
2. 29 s
3. 31 s
4. 37 s

Puppy 2 – Bewada Questions

Difficulty Level : Medium

Find Time/Steps to fall in a the pit

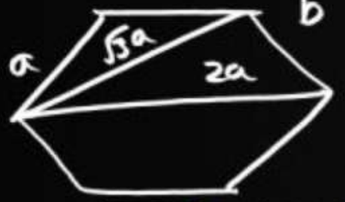
a. A person moves 10 m forward and 2 m backward. When will it reach 24 m if it moves one meter every second

b. A person walks 20 steps forward and five steps backward. After how many steps will it reach a hundred steps forward

c. A person moves 5 m forward and 2 m backward. When will it reach 12 m forward, if it moves 1 m every second.

PUPPY POINTS - 1

$2\pi r$

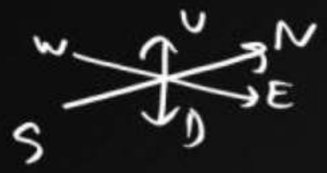


$\sqrt{5}a$ (lizard)

$\frac{x}{\sqrt{x}} = \sqrt{x}$

Pyth.
3, 4, 6
6, 8, 10
5, 12, 13
7, 24, 25
$a, a\sqrt{2}a$
$a, a, a-\sqrt{3}a$

Distance ≥ displacement
= → st. line without U turn



Drunk

$d-(f-b)\frac{}{(f+b)}$ till $\leq f$

Part 4 – Speed Velocity Average Instantaneous

4.1 Speed

Distance covered per unit time ✓

No idea about direction ✓

Can never be negative ✓

SCALAR ✓

m/s $[LT^{-1}]$

4.2 Velocity

Displacement covered per unit time ✓

Direction is must

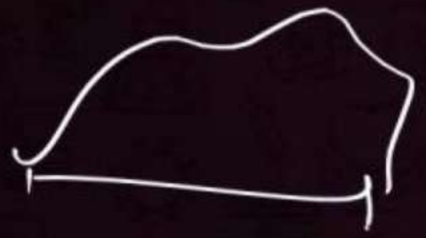
Can be positive/negative/zero ✓

VECTOR ✓

m/s $[LT^{-1}]$

4.3 Instantaneous Speed & Velocity

- Magnitude of instantaneous velocity is always equal to instantaneous speed
- Speedometer of a car measures instantaneous speed



H chutki sa chala (Distance = Displacement)

Difficulty Level : Easy

QUESTION-13

[NCERT Based]

Speedometer of a car measures

1. Average speed
2. Average velocity
3. Instantaneous speed
4. Instantaneous velocity

QUESTION-14

$0 < \text{speed} < v_0$

$-v_0 < \text{velocity} < v_0$

Difficulty Level : Hard

In one dimensional motion, instantaneous speed v satisfies $0 \le v < v_0$.

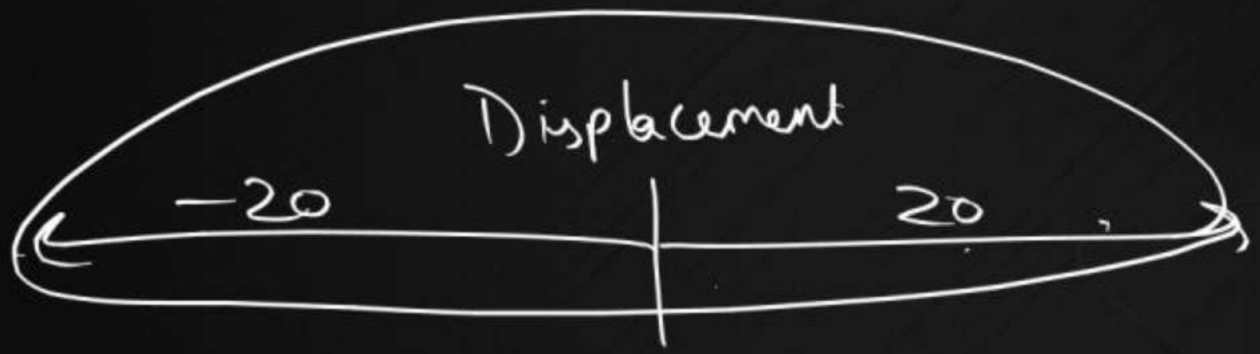
[NCERT Exemplar]

1. The displacement in time T must always take non-negative values. ✗
2. The displacement x in time T satisfies $-v_0 T < x < v_0 T$. ✓ (x = velocity × time)
3. The acceleration is always a non-negative number. ✗
4. The motion has no turning points. ✗

Speed → 0 to 2 m/s 10 sec

Distance = 0

Distance = 20 m



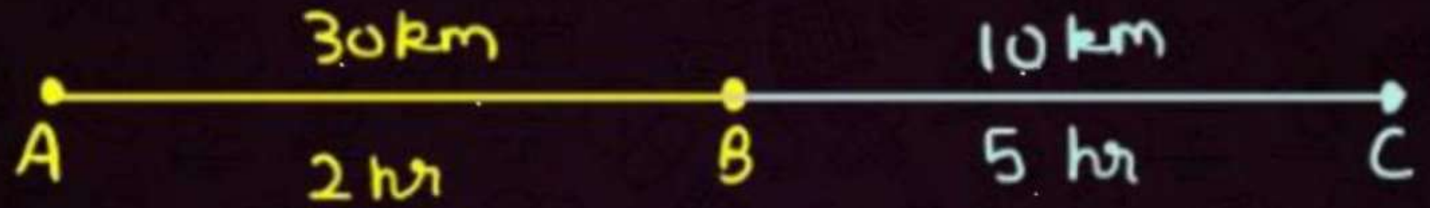
v_0

Distance v_0T

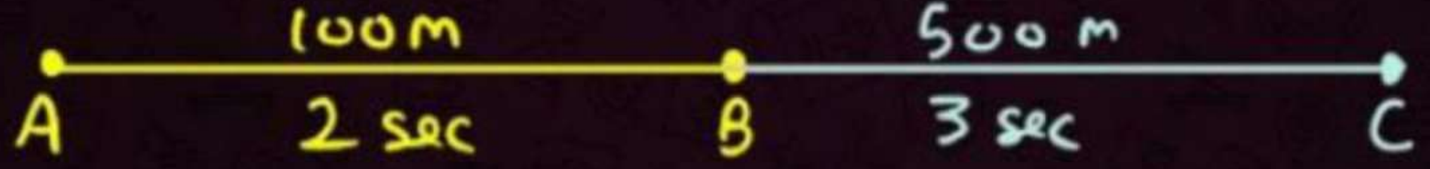
$-v_0T < \vec{a} < v_0T$

4.4 Average Speed

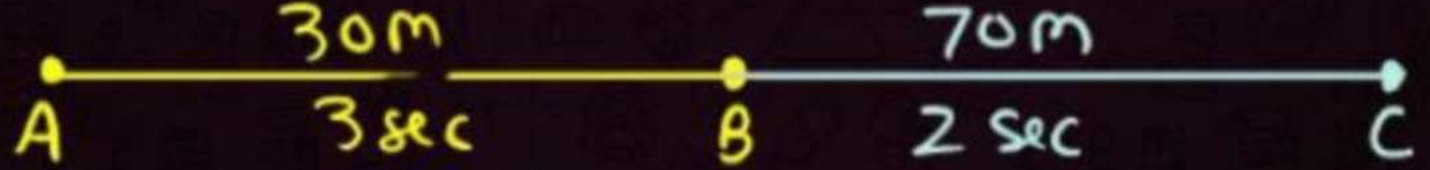
❤️ Total distance upon total time



$v_{avg} = \frac{30+10}{2+5} = \frac{40}{7}$ ✓



$v_{avg} = \frac{600}{5} = 120\ m/s$



$v_{avg} = 20\ m/s$

HW

Q

$v_{avg} = ??$

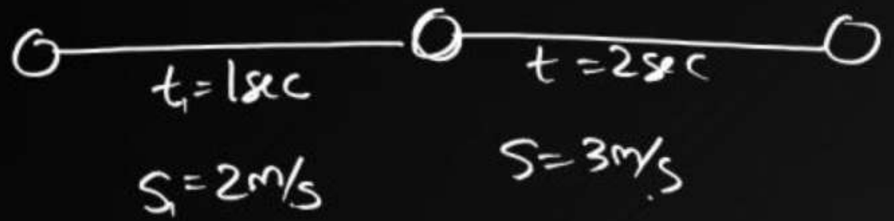
$d = \text{speed} \times \text{time}$

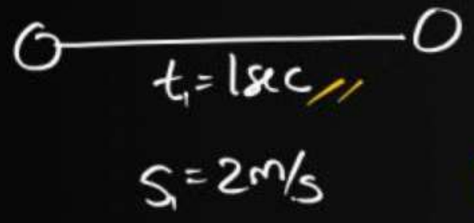
$d_1 = (2 \times 1 = 2\ \text{km})$ $\quad d_2 = (10 \times 5 = 50\ \text{km})$

$$v_{avg} = \frac{\text{total Distance}}{\text{total time}} = \frac{52}{7}\ \text{km/hr}$$

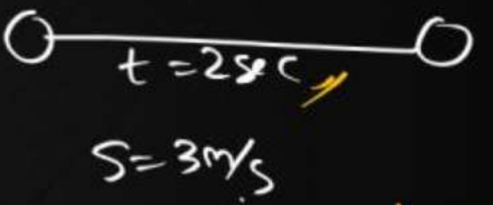
Avg wale questions //

- time added directly
- distance " "
- speed cannot be added directy



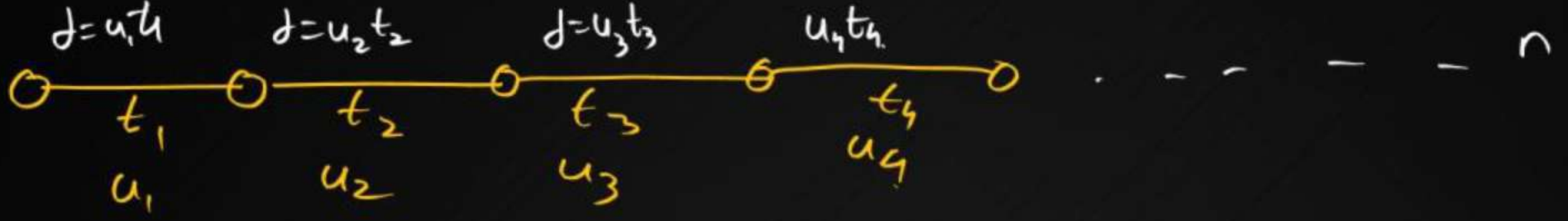


$d = St$
$= 2 \times 1 = 2\,m$



$d = St$
$= 3 \times 2$
$= 6m$

$$V_{avg} = \frac{\text{total Distance}}{\text{total time}} = \frac{8m}{3\,sec}$$



$$u_{avg} = \frac{u_1t_1 + u_2t_2 + u_3t_3 + \dots + u_nt_n}{t_1 + t_2 + t_3 + t_4 \dots t_n}$$

All time intervals are same,

$$u_{avg} = \frac{u_1t + u_2t + u_3t + u_4t \dots + u_nt}{t + t + t + t + \dots + t} = \frac{t(u_1 + u_2 + u_3 + \dots + u_n)}{nt}$$

$$\boxed{u_{avg} = \frac{u_1 + u_2 + u_3 + \dots + u_n}{n}}$$

Same time interval.

$$u_{avg} = \frac{u_1+u_2+u_3+---+u_n}{n}$$

$$= \frac{u_1+u_2}{2}$$

$$= \frac{u_1+u_2+u_3}{3}$$

$$= \frac{u_1+u_2+u_3+u_4}{4}$$

$$= \frac{u_1+u_2+u_3+u_4+u_5}{5}$$

Same distance interval.
(return, midjourney)

$$\frac{n}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2}+\frac{1}{u_3}+---+\frac{1}{u_n}$$

$$\frac{2}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2} \longrightarrow u_{avg} = \frac{2u_1u_2}{u_1+u_2}$$ ★(3P4Q)

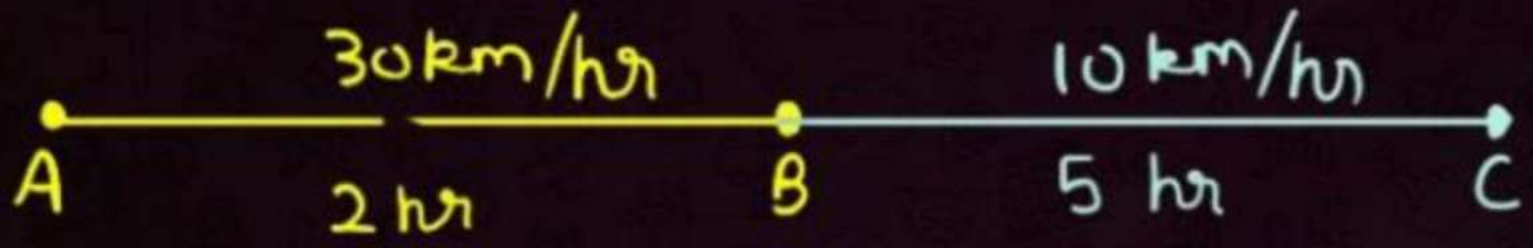
$$\frac{3}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2}+\frac{1}{u_3} \longrightarrow u_{avg} = \frac{3u_1u_2u_3}{u_1u_2+u_2u_3+u_3u_1}$$ ★(1P4Q)

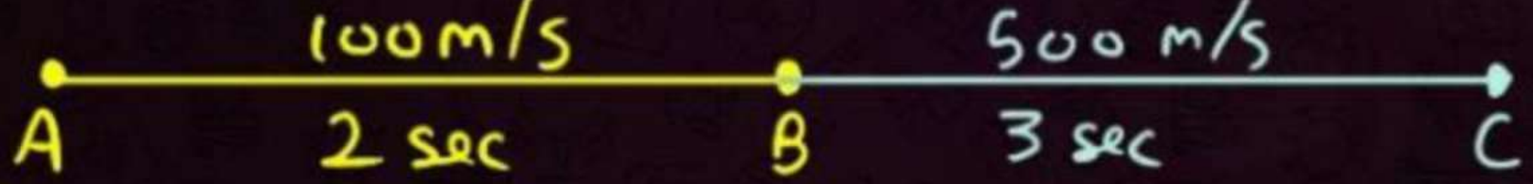
$$\frac{4}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2}+\frac{1}{u_3}+\frac{1}{u_4}$$

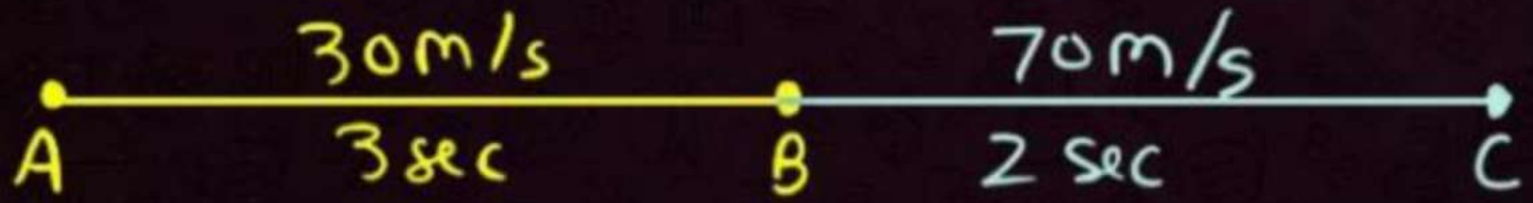
$$\frac{5}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2}+\frac{1}{u_3}+\frac{1}{u_4}+\frac{1}{u_5}$$

Puppy 3 – Time average speed

Difficulty Level : Easy

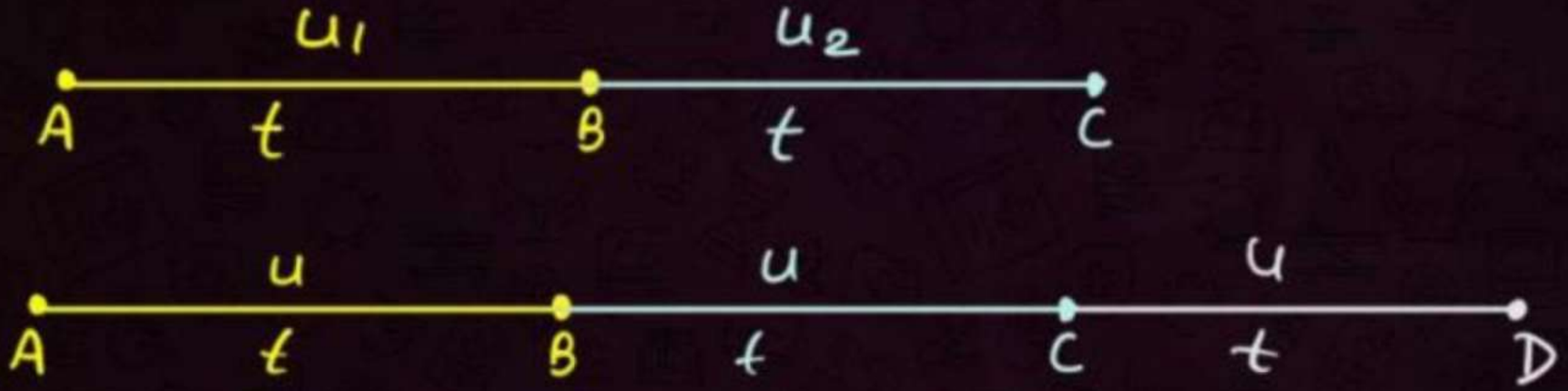






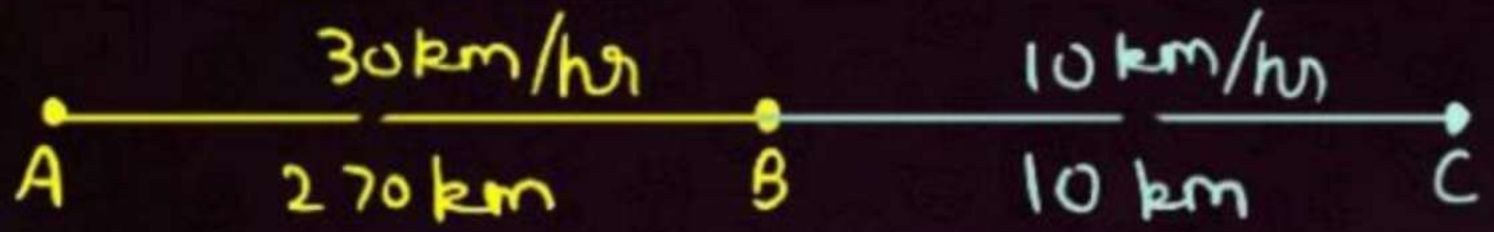
Puppy 4 – Time average speed

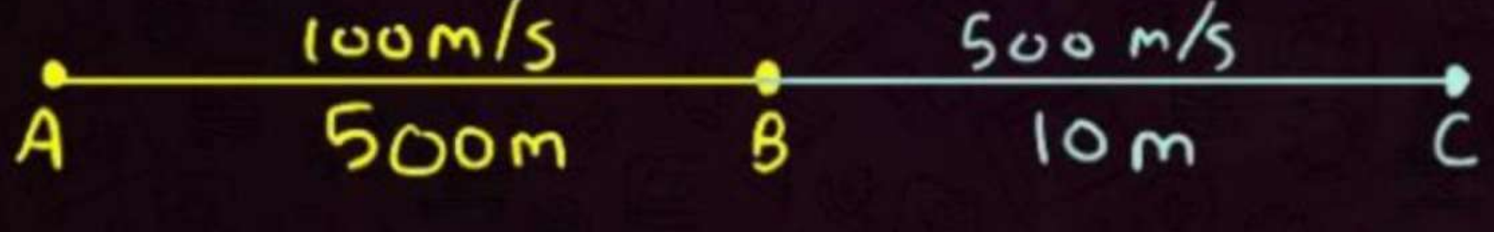
Difficulty Level : Easy

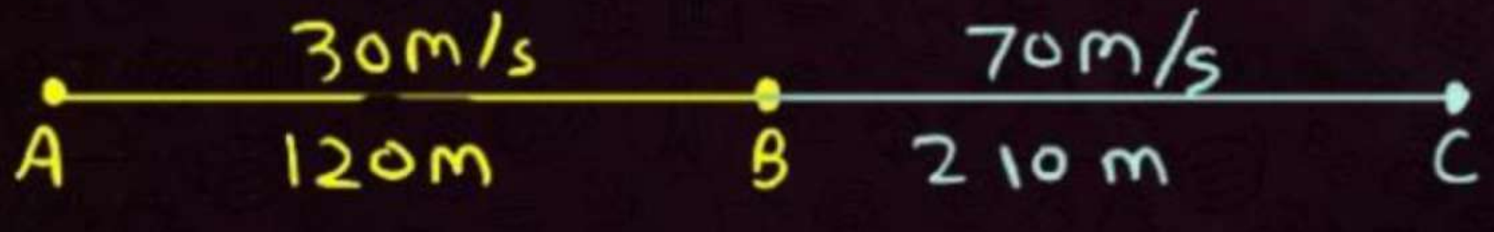


Puppy 5 – Distance average speed

Difficulty Level : Easy

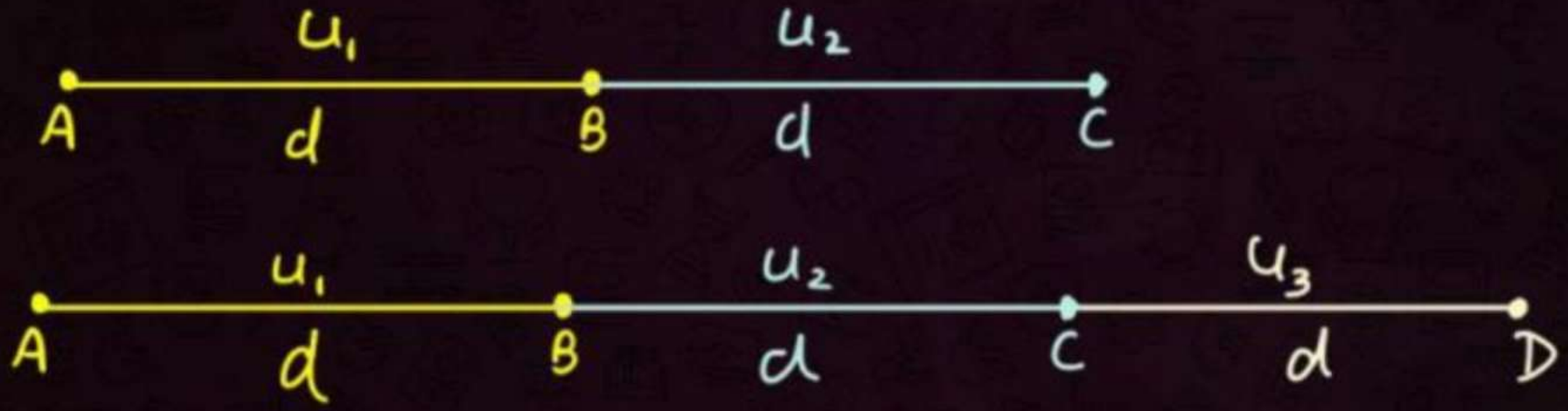






Puppy 6 – Distance average speed

Difficulty Level : Easy



QUESTION-15

A person travelling on a straight line moves with a uniform velocity v_1 for some time and with uniform velocity v_2 for the next equal time. The average velocity v is given by

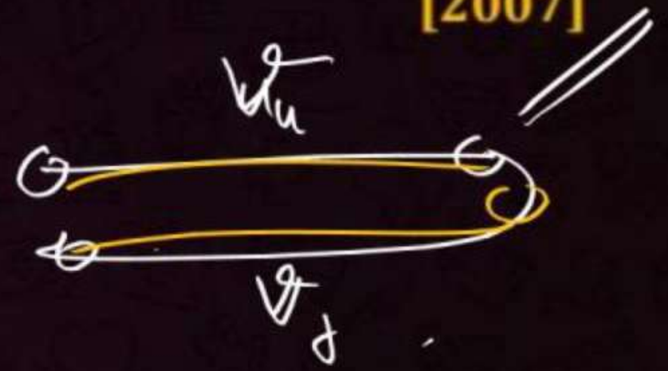
[HCV Objective I]

1. $v = \frac{v_1 + v_2}{2}$
2. $v = \sqrt{v_1 v_2}$
3. $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$
4. $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

Difficulty Level : Medium

QUESTION-16

A car moves from X to Y with a uniform speed v_u and returns to Y with a uniform speed v_d The average speed for this round trip is: [2007]



1. $\sqrt{v_u v_d}$
2. $\frac{v_d v_u}{v_d + v_u}$
3. $\frac{v_u + v_d}{2}$
4. $\frac{2 v_d v_u}{v_d + v_u}$

Difficulty Level : Medium

QUESTION-17

A particle covers half of its total distance with speed v_1 and the rest half distance with speed v_2 Its average speed during the complete journey is:

[2011 Mains]

1. $\frac{v_1 v_2}{v_1 + v_2}$
2. $\frac{2v_1 v_2}{v_1 + v_2}$
3. $\frac{v_1^2 v_2^2}{v_1^2 + v_2^2}$
4. $\frac{v_1 v_2}{2}$

Difficulty Level : Easy

QUESTION-18

A vehicle travels half the distance with speed v and the remaining distance with speed $2v$. Its average speed is: [2023]

1. $\frac{3v}{4}$
2. $\frac{v}{3}$
3. $\frac{2v}{3}$
4. $\frac{4v}{3}$

$\frac{2v_1v_2}{v_1+v_2}$

$\frac{2 \times v \times 2v}{v+2v} = \frac{4v}{3}$

Difficulty Level : Easy

QUESTION-19

A car covers the first half of the distance between two places at 40 km/h and another half at 60 km/h. The average speed of the car is: [1990]

1. 40 km/h
2. 48 km/h
3. 50 km/h
4. 60 km/h

$\frac{2u_1u_2}{u_1+u_2}$

$\frac{2\times40\times60}{40+60} = \frac{2\times40\times60}{100}$

$= 48$

Difficulty Level : Medium

QUESTION-20

A car moves a distance of 200 m. It covers the first half of the distance at speed 40 km/h and the second half of distance at speed v. The average speed is 48 km/h. The value of v is: [1991]

1. 56 km/h
2. 60 km/h
3. 50 km/h
4. 48 km/h

$$v_{avg} = \frac{2v_1v_2}{v_1+v_2}$$

$$48 = \frac{2\times 40\times v}{40+v}$$

$$3 \times 24 = \frac{40v}{40+v}$$

$$3 = \frac{5v}{40+v}$$

$$120+3v = 5v$$

$$120 = 5v-3v = 2v$$

$$v = 60$$

Difficulty Level : Hard

QUESTION-21

A body covers one-third of the distance with a velocity v_1 the second one-third of the distance with a velocity v_2, and the last one-third of the distance with a velocity v_3. The average velocity is:

$$v_{avg} = \frac{3v_1v_2v_3}{v_1v_2 + v_2v_3 + v_3v_1}$$

1. $\frac{v_1 + v_2 - v_3}{3}$
2. $\frac{3v_1v_2v_3}{v_1v_2 + v_2v_3 + v_3v_1}$
3. $\frac{2(v_1v_2 + v_2v_3 + v_3v_1)}{3}$
4. $\frac{2v_1v_2v_3}{3}$

Difficulty Level : Medium

QUESTION-22

(HW)

A bus travelling the first one-third distance at a speed of 10 km/h the next one-third at 20 km/h and at last one-third at 60 km/h. The average speed of the bus is:

[1997]

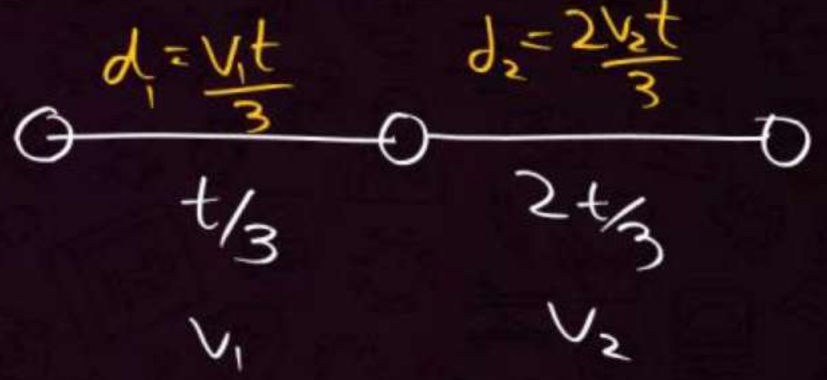
1. 9 km/h
2. 16 km/h
3. 18 km/h
4. 48 km/h

Difficulty Level : Hard

QUESTION-23

A person travels along a straight road for the first $\frac{t}{3}$ time with a speed v_1 and for next $\frac{2t}{3}$ time with a speed v_2. Then the mean speed v is given by

1. $v = \frac{v_1 + 2v_2}{3}$
2. $\frac{1}{v} = \frac{1}{3v_1} + \frac{2}{3v_2}$
3. $v = \frac{1}{3}\sqrt{2v_1 v_2}$
4. $v = \sqrt{\frac{3v_2}{2v_1}}$



$$v_{avg} = \frac{d_1 + d_2}{\frac{t}{3} + \frac{2t}{3}} = \frac{\frac{v_1 t}{3} + \frac{2v_2 t}{3}}{\frac{3t}{3}} = \frac{(v_1 + 2v_2)t}{3t} = \frac{v_1 + 2v_2}{3}$$

Difficulty Level : Hard

QUESTION-23

PUPPY

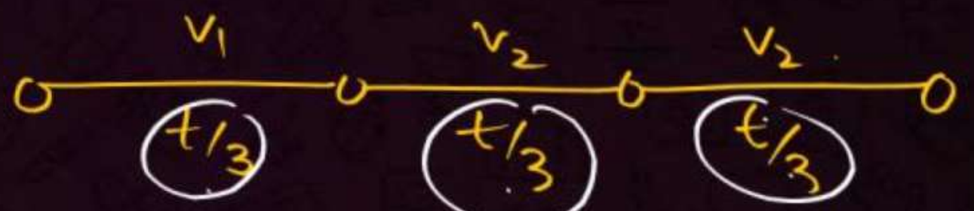
A person travels along a straight road for the first $\frac{t}{3}$ time with a speed v_1 and for next $\frac{2t}{3}$ time with a speed v_2. Then the mean speed v is given by

1. $v = \frac{v_1 + 2v_2}{3}$ ✓

2. $\frac{1}{v} = \frac{1}{3v_1} + \frac{2}{3v_2}$

3. $v = \frac{1}{3}\sqrt{2v_1v_2}$

4. $v = \sqrt{\frac{3v_2}{2v_1}}$



$\frac{v_1+v_2+v_2}{3}$ ✓

Difficulty Level : Hard

QUESTION-24

HW

If a car covers $2/5^{th}$ of the total distance with v_1 speed and $3/5^{th}$ distance with v_2 then average speed is:

1. $\frac{1}{2}\sqrt{v_1 v_2}$
2. $\frac{v_1 + v_2}{2}$
3. $\frac{2v_1 v_2}{v_1 + v_2}$
4. $\frac{5v_1 v_2}{3v_1 + 2v_2}$ ✓

$$v_{avg} = \frac{\text{total distance}}{\text{Total time}}$$

Same time

$$v_{avg} = \frac{v_1 + v_2 + \cdots}{n}$$

$$\frac{v_1 + v_2}{2}$$

Same v

$$\frac{n}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \cdots + \frac{1}{v_n}$$

$$\frac{2v_1v_2}{v_1 + v_2}$$

$3v_-$ -

Difficulty Level : YODHA

QUESTION-25

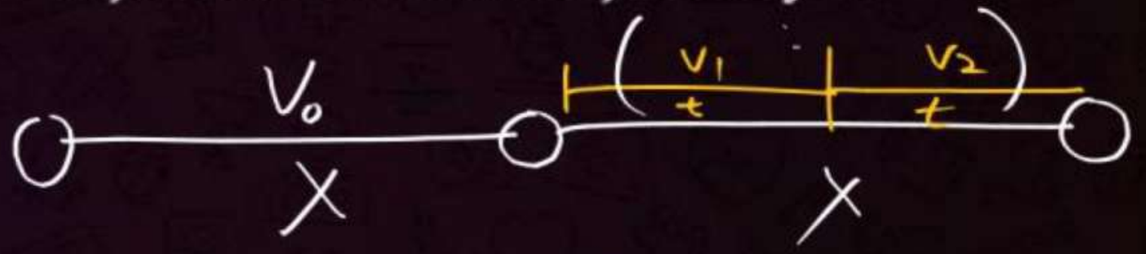
A point object traverses half the distance with velocity v_0. The remaining part of the distance is covered with velocity v_1 for the half time and with velocity v_2 for the rest half. The average velocity of the object for the whole journey is

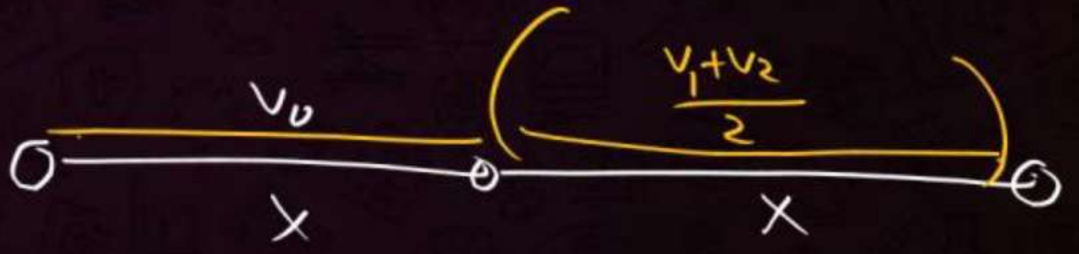
(1) $2v_1(v_0 - v_2)/(v_0 + 2v_1 + 2v_2)$

(2) $2v(v_0 + v_1)/(v_0 - v_1 + v_2)$

(3) $2v_0(v_1 + v_2)/(v_1 + v_2 + 2v_0)$

(4) $2v_2(v_0 - v_1)/(v_1 - 2v_2 + v_0)$





$$v_{avg} = \frac{2v_0\left(\frac{v_1+v_2}{2}\right)}{v_0+\left(\frac{v_1+v_2}{2}\right)} = \frac{2v_0(v_1+v_2)}{2v_0+v_1+v_2}$$

$$\frac{2V_0\left(\frac{V_1+V_2}{2}\right)}{\frac{2V_0+V_1+V_2}{2}}$$

Difficulty Level : YODHA

HW

QUESTION-26

A point object traverses half the time with velocity v_0. The remaining part of the time is covered with velocity v_1 for the half distance and with velocity v_2 for the rest half. The average velocity of the object for the whole journey is

1. $(v_0/2) + v_1v_2/(v_1 + v_2)$
2. $v_0/2 + 2v_1v_2/(v_1 + v_2)$
3. $v_0 + v_1v_2/(v_1 + v_2)$
4. $v_0 + 2v_1v_2/(v_1 + v_2)$

4.5 Average Velocity

- Total displcaement upon total time

- Average velocity = Average Speed (Displacement/Distance)

Speed = S
velocity = v
Distance = D
Displacement = x

$$S = \frac{D}{t} \qquad v = \frac{x}{t}$$

$$\frac{V}{S} = \frac{x}{D}$$

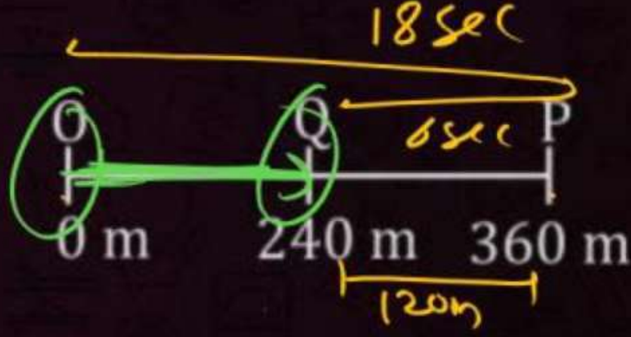
$$v_{avg} = S_{avg}\left(\frac{x}{D}\right)$$

Difficulty Level : Medium

QUESTION-27

A car is moving along a straight line OP as shown in the figure. It moves from O to P in 18 s and returns from P to Q 6s. Which of the following statements is not correct regarding the motion of the car?

[NCERT Based]



Speed $= \frac{360+120}{18+6} = \frac{480}{24} = 20\ m/s$

$\vec{v}_{avg} = \frac{240}{18+6} = \frac{240}{24} = 10\ m/s$

1. The average speed of the car in going from O to P and come back to Q is 20 ms^{-1}.
2. The average velocity of the car in going from O to P and come back to Q is 10 ms^{-1}
3. The average speed of the car in going from O to P and come back to O is 20 ms^{-1}. → No Comments
4. The average velocity of the car in going from O to P and come back to O is 20 ms^{-1}. →

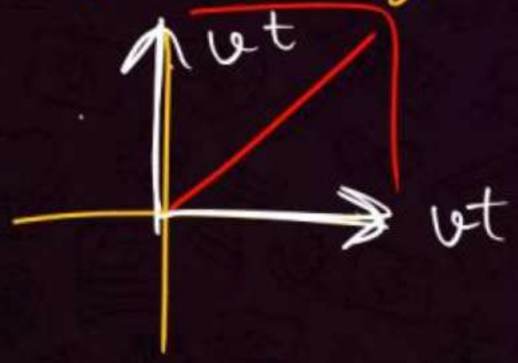
Difficulty Level : MEdium

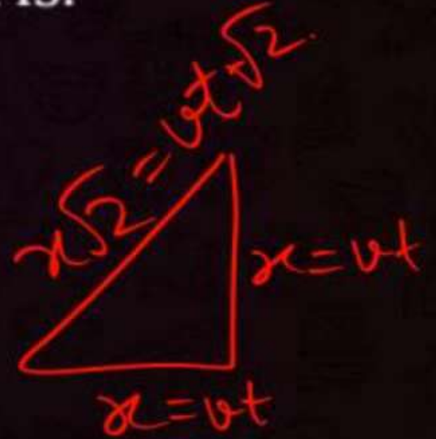
QUESTION-28

A man walks for some time 't' with velocity (v) due east. Then he walks for same time 't' with velocity (v) due north. The average velocity of the man is:

1. $2/v$
2. $\sqrt{2}v/3$
3. $3/v$
4. $v/\sqrt{2}$

Speed average = v



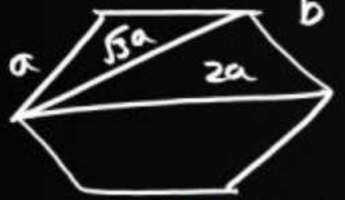


$$v_{avg} = \frac{\text{total displacement}}{\text{total time}} = \frac{vt\sqrt{2}}{2t}$$

$$\frac{\sqrt{2}v}{2} = \frac{v}{\sqrt{2}}$$

PUPPY POINTS - 1

$2\pi r$

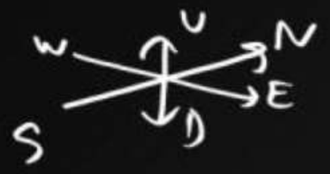


√5a (lizard)

$\frac{x}{\sqrt{x}} = \sqrt{x}$

Pyth.
3, 4, 6
6, 8, 10
5, 12, 13
7, 24, 25
a, a, a√2
a, a, a − √3a

Distance ≥ displacement
= → st. line without U turn



Drunk
$d - (f-b) - till \le f$
$(f+b)$

$|\vec{v}_{inst}| = speed_{inst}$

average speed ≥ avg velocity

$\vec{v}_{avg} = speed_{avg}\left(\frac{displacement}{distance}\right)$

$Speed_{avg} = \frac{total\ distance}{total\ time}$

$Velocity_{avg} = \frac{total\ displacement}{total\ time}$ v=8

same t

$u_{avg} = \frac{u_1+u_2+\cdots}{n}$ (same time)

$u_{avg} = \frac{u_1+u_2}{2} = \frac{u_1+u_2+u_3}{3}$

same −

$\frac{n}{u_{avg}} = \frac{1}{u_1} + \frac{1}{u_2} + \cdots$ (same distance: mid journey, return journey)

$u_{avg} = \frac{2u_1u_2}{u_1+u_2} = \frac{3u_1u_2u_3}{u_1u_2+u_3u_1+u_2u_3}$

Part 5 – Change in velocity, acceleration

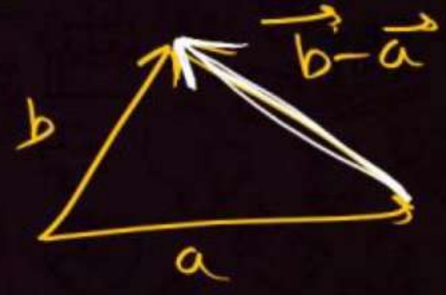
5.1 Change in velocity

❤️ **Final Velocity minus Initial Velocity**

$$\Delta \vec{v} = \vec{v} - \vec{u}$$

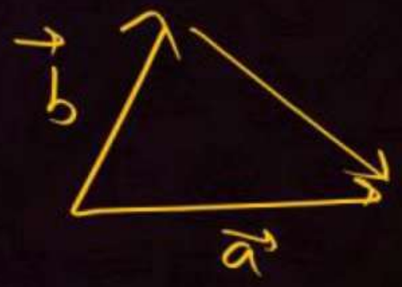
Vector

$\vec{b} - \vec{a}$

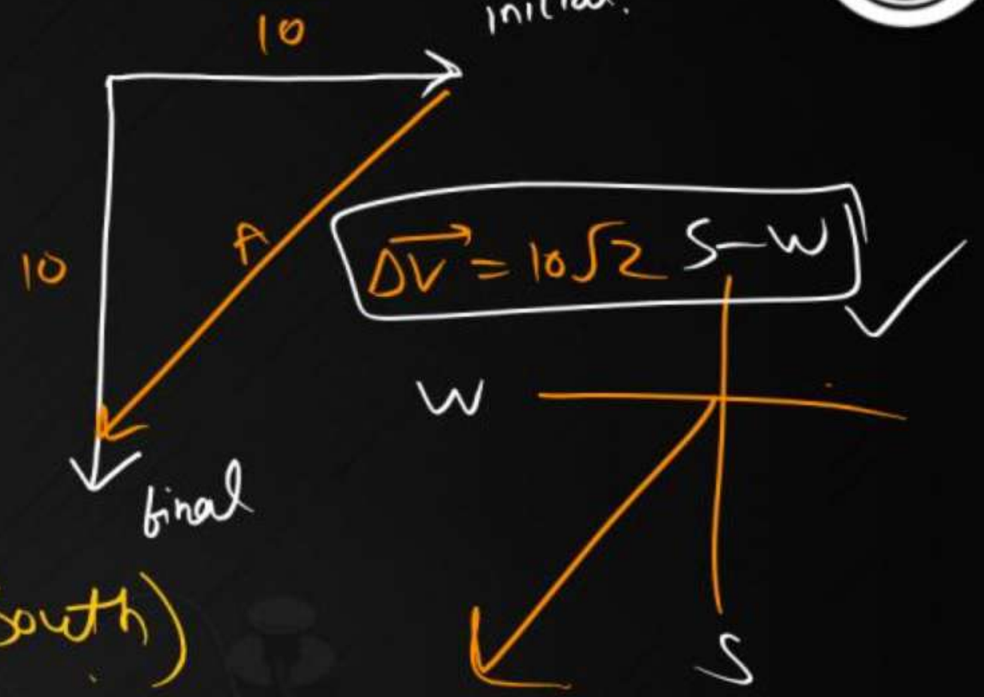


Direction head → b
tail → a

$\vec{a} - \vec{b}$



9



$\Delta\vec{v} =$

PUPPY

same speed ✱

$\Delta\vec{v} = v\sqrt{2}$ direction (final + initial ka velta)

$10\sqrt{2}$ SW

Difficulty Level : Easy

QUESTION-29

A motor car is going due north at a speed of 50 km/h. It makes a 90° left turn without changing the speed. The change in the velocity of the car is about

[HCV Objective I]

1. 50 km/h towards west
2. 70 km/h towards south-west
3. 70 km/h towards north-west
4. zero.

5.2 Acceleration

- **Change in Velocity per unit time**

$$a = \frac{\Delta \vec{v}}{t}$$

- For uniform motion (velocity constant, a is always zero)

5.3 Deceleration

❤ a is $-ve \longrightarrow$ deceleration

5.4 Retardation

❤ Retardation may be +ve or −ve.

Retardation means velocity becomess negative — False

Retardation means who a jisse speed kam ho

(A) $\vec{v} = 10\ m/s \longrightarrow 40\ m/s$ ✗

(B) $\vec{v} = 10\ m/s \longrightarrow 4\ m/s$ ✓ R, D

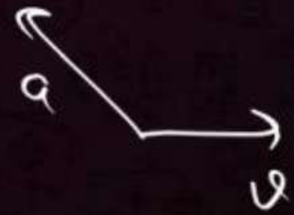
(C) $\vec{v} = -10\ m/s \longrightarrow -40\ m/s$ ✗, D

(D) $\vec{v} = -10\ m/s \longrightarrow -4\ m/s$ ✓ R

Vector

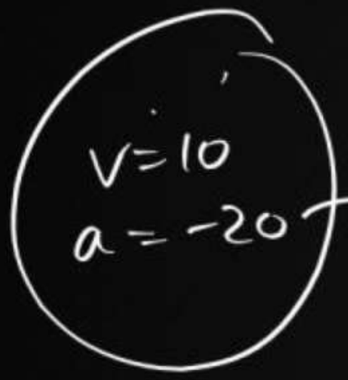
Retardation jab velocity se anti parallel

$a \cdot v < 0$



θ must be obtuse

$a = -20$ ⟶ Deceleration



Retardation

$V = -10$
$a = -20$

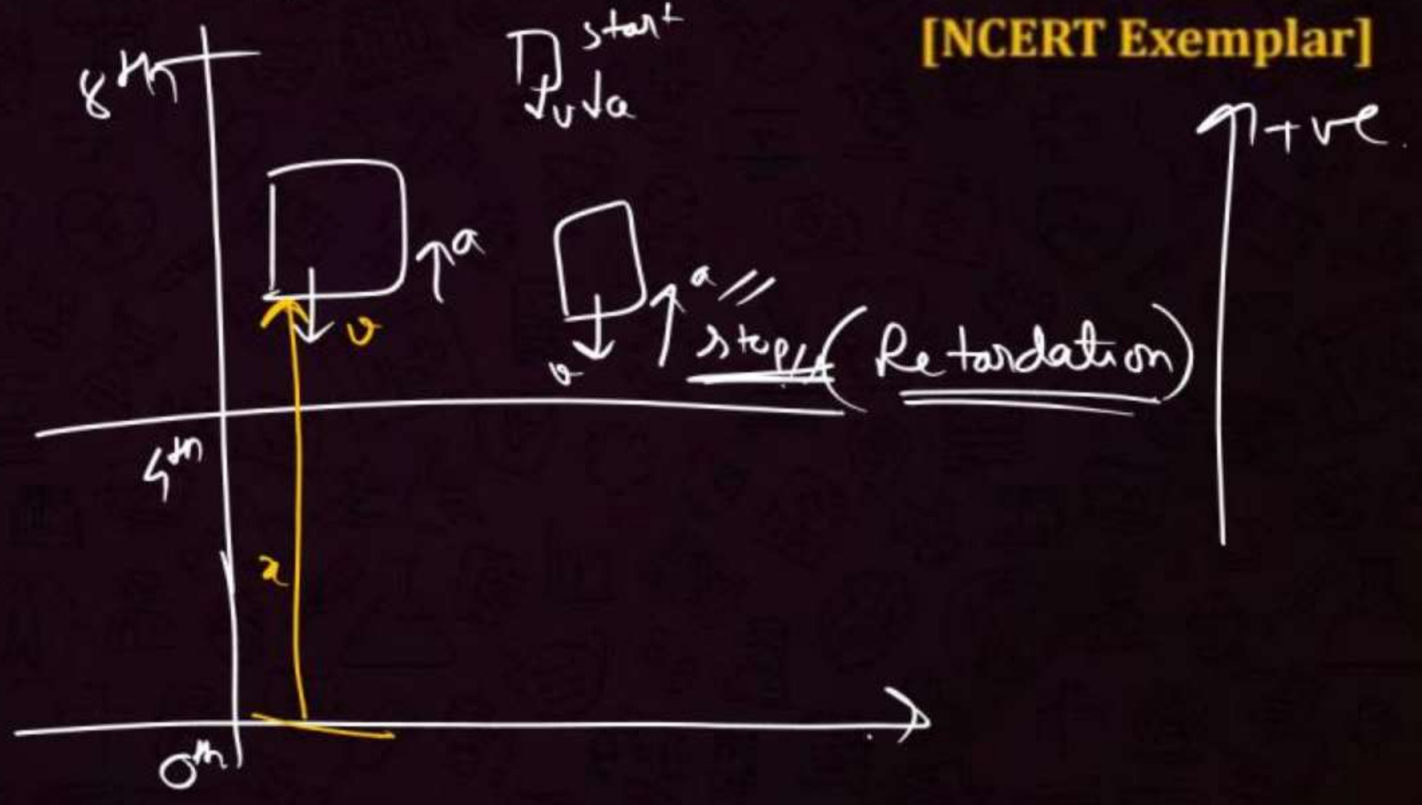
$V = -10$
$a = +20$ ⟶ Retardation

Difficulty Level : MEdium

QUESTION-30

A lift is coming from 8^{th} floor and is just about to reach 4^{th} floor. Taking ground floor as origin and positive direction upwards for all quantities, which one of the following is correct? [NCERT Exemplar]

1. $x < 0, v < 0, a > 0$
2. $x > 0, v < 0, a < 0$
3. $x > 0, v < 0, a > 0$
4. $x > 0, v > 0, a < 0$



5.5 Tangential & Normal Acceleration

a_t a_n

acceleration

- ① Change speed ⟶ a_t
- ② Change direction ⟶ a_n.

$\vec{v}$ → velocity $|\vec{v}|$ → speed.

- $\vec{a} = \frac{d\vec{v}}{dt}$ = acceleration
- $\frac{d|\vec{v}|}{dt} \rightarrow a_t$
- $\left|\frac{d\vec{v}}{dt}\right|$ = magnitude of acceleration

QUESTION-31

Difficulty Level : Hard

Which of the following statement is correct for retardation

1. –ve acceleration is called retardation
2. May be +ve and –ve acceleration is called retardation
3. Acceleration which is in the direction of motion
4. Acceleration which is parallel to the velocity.

QUESTION-32

Difficulty Level : Easy

(HW)

Which of the following is correct relation:

1. If $v = \cos t$ then acceleration is increasing
2. If velocity is constant then acceleration must be zero
3. If acceleration is constant then velocity must be constant ✗
4. If acceleration is zero, then velocity may increasing

QUESTION-33

Difficulty Level : Medium

Which of the following option is correct for acceleration

1. $\frac{d\vec{v}}{dt}$
2. $\frac{d^2\vec{x}}{dt^2}$
3. $\vec{v}\frac{d\vec{v}}{dx}$
4. all of these

Difficulty Level : MEdium

QUESTION-34

Which of the following option is correct for acceleration

1. $\frac{d\vec{V}}{dt}$
2. $\frac{d|\vec{V}|}{dt}$
3. $\left|\frac{d\vec{V}}{dt}\right|$
4. none of these

Difficulty Level : Hard

QUESTION-35

Which of the following option is correct for tangential acceleration

1. $\frac{d\vec{V}}{dt}$
2. $\frac{d|\vec{V}|}{dt}$
3. $\left|\frac{d\vec{V}}{dt}\right|$
4. none of these

Difficulty Level : Hard

QUESTION-36

Which of the following option is correct for magnitude of acceleration

1. $\frac{d\vec{V}}{dt}$
2. $\frac{d|\vec{V}|}{dt}$
3. $\left|\frac{d\vec{V}}{dt}\right|$
4. none of these

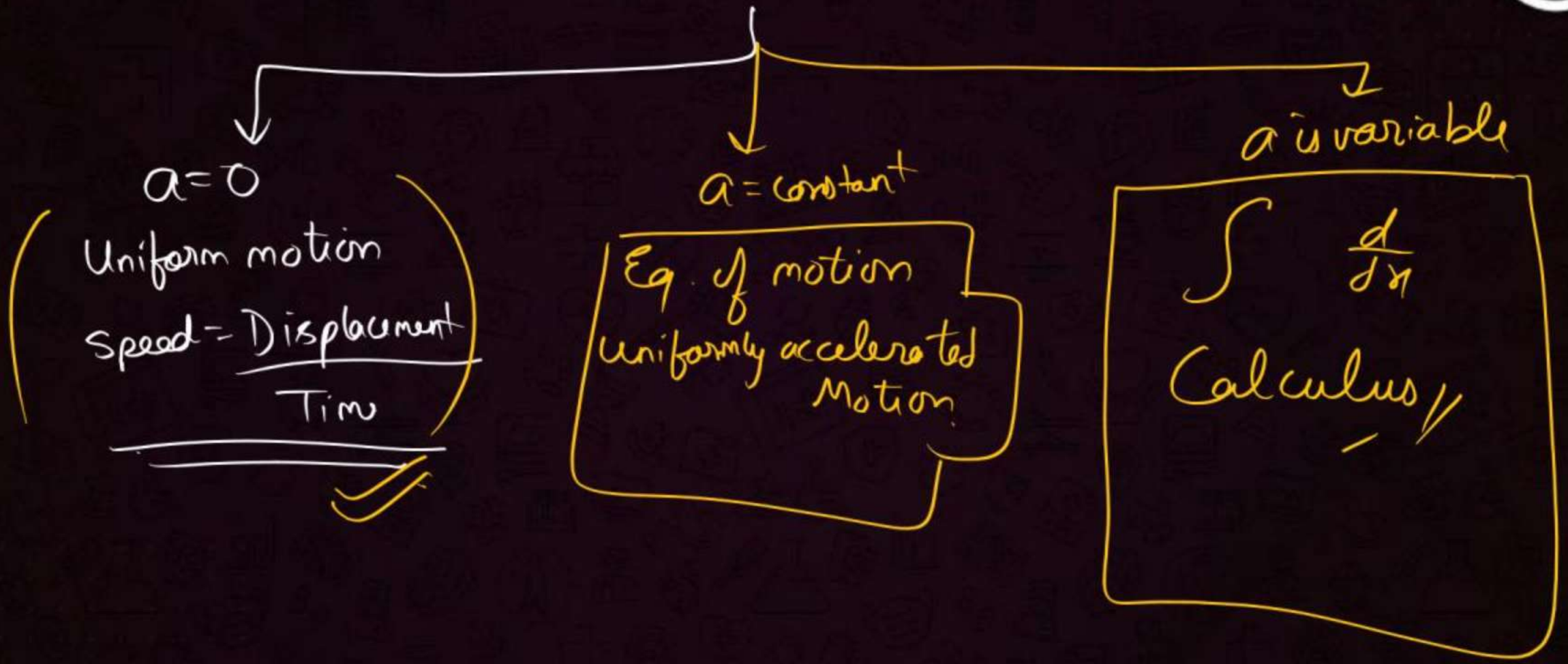
Difficulty Level : Easy

QUESTION-37

Acceleration of a particle changes when

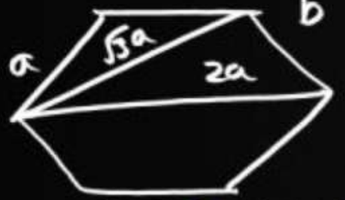
1. Direction of velocity changes
2. Magnitude of velocity changes
3. Both of above
4. Speed changes

5.6 Classification of motion based on acceleration



PUPPY POINTS - 1

$2a\sqrt{2}$



$\sqrt{5}a$ (like ord)

$\frac{x}{\sqrt{a}} = \sqrt{x}$

Pyth.
3, 4, 6
6, 8, 10
5, 12, 13
7, 24, 25
$a, a\sqrt{2}a$
$a, a, a-\sqrt{3}a$

Distance ≥ displacement
= → st. line without U turn

Drunk
$d-(f-b)$ till $\leq f$
$(f+b)$

$|\vec{v}_{inst}| = \text{speed}_{inst}$

average speed ≥ avg velocity

$\vec{v}_{avg} = \text{speed}_{avg}\left(\frac{\text{displacement}}{\text{distance}}\right)$

$\text{Speed}_{avg} = \frac{\text{total distance}}{\text{total time}}$

$\text{Velocity}_{avg} = \frac{\text{total displacement}}{\text{total time}}$

same t

$u_{avg} = \frac{u_1+u_2+\cdots}{n}$

$u_{avg} = \frac{u_1+u_2}{2} = \frac{u_1+u_2+u_3}{3}$

same -

$\frac{n}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2}+\cdots$ (same distance: mid journey, return journey)

$u_{avg} = \frac{2u_1u_2}{u_1+u_2} = \frac{3u_1u_2u_3}{u_1u_2+u_3u_1+u_2u_3}$

$\Delta\vec{v} = \vec{v}_f - \vec{v}_i$

same speed u in N to E

$\Delta\vec{v} = u\sqrt{2}\,\text{S}\underline{\text{E}}$

$a = \frac{\Delta\vec{v}}{t}$

deceleration = -ve a

retardation makes speedless

$a.v < 0$ → change direction

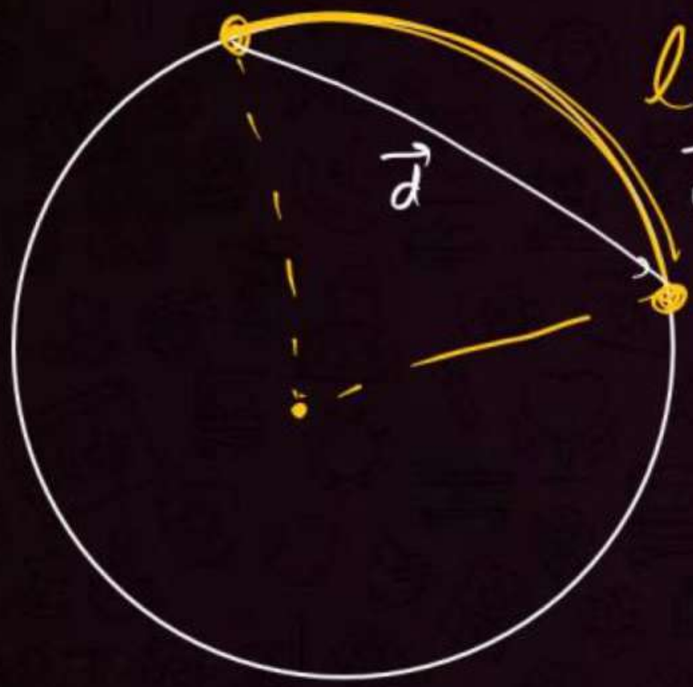
$a = a_t + a_n$

$a_t = \frac{d|v|}{dt}$ → change in speed

$\left|\frac{dv}{dt}\right|$ = magnitude of acceleration

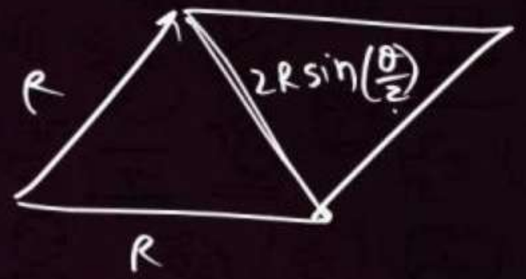
Part 6 – Circle & Keel on Wheel

6.1 Circle – Distance Displacement

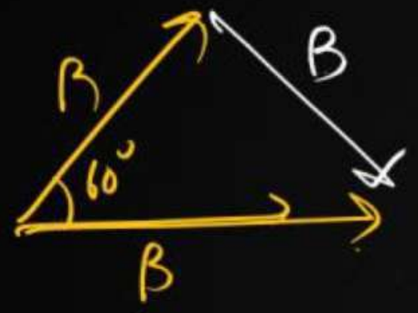


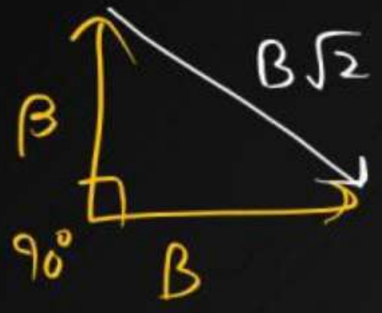
$\ell = R\theta$ → radian

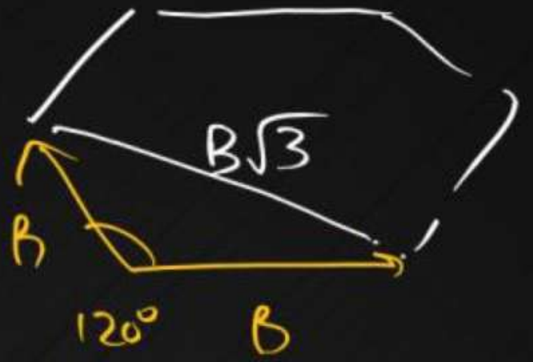
$\vec{d} = 2R\sin\left(\frac{\theta}{2}\right)$



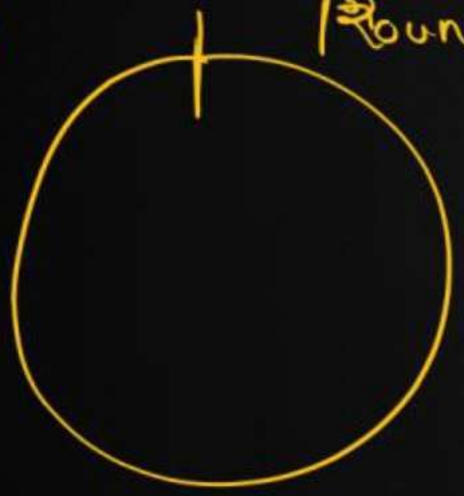
Babli subtraction







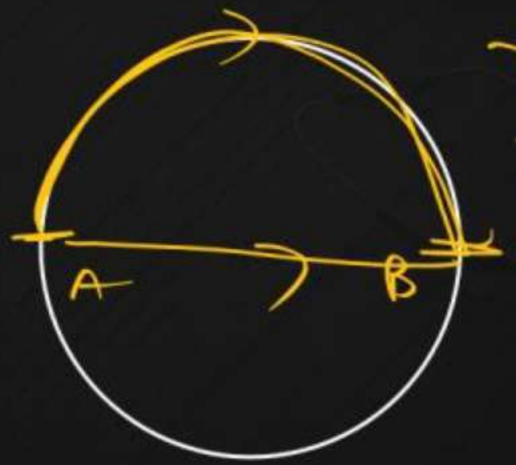
(I) Round



$\vec{D} = 2\pi r$

$\vec{d} = 0$ (kyu?)

(II)



$\vec{D} = \pi R$

$\vec{d} = 2R$

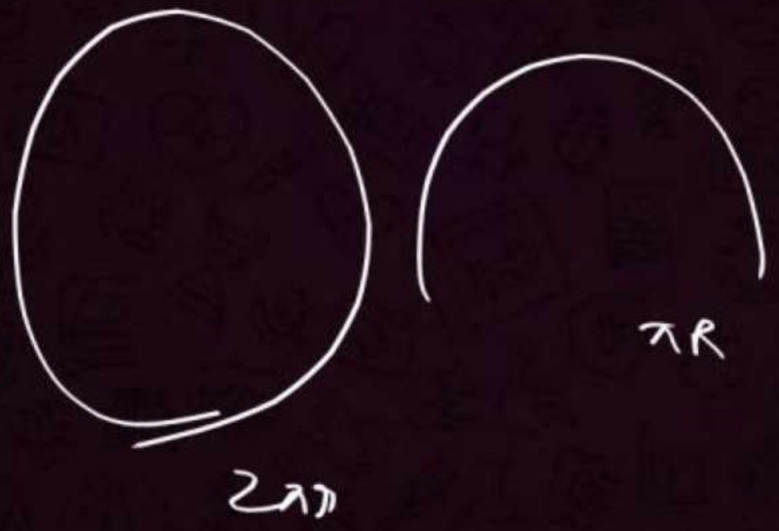
Difficulty Level : MEdium

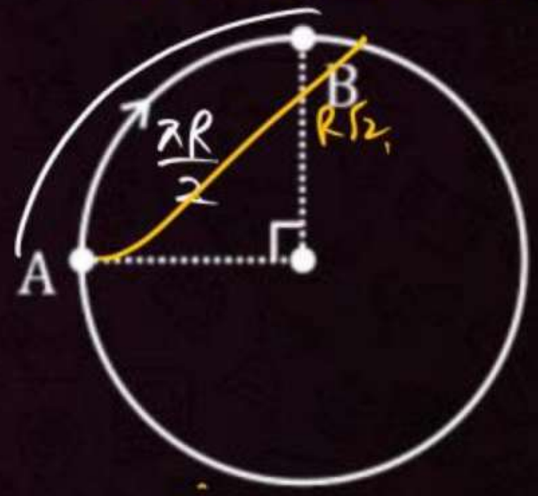
QUESTION-38

Calculate Distance and Displacement in going from A to B, radius of circle is a

[Prachand 2024]

1. $2\pi a , 2\pi$
2. $a\pi , 2\pi\sqrt{3}$
3. $\pi a/4 , 2\pi$
4. $\pi a/2 , a\sqrt{2}$



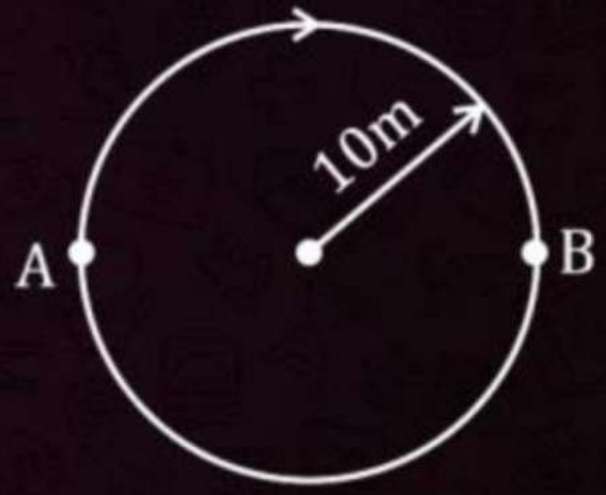


Difficulty Level : MEdium

QUESTION-39

Calculate Distance and Displacement in going from A to B, radius of circle is a

[Prachand 2024]



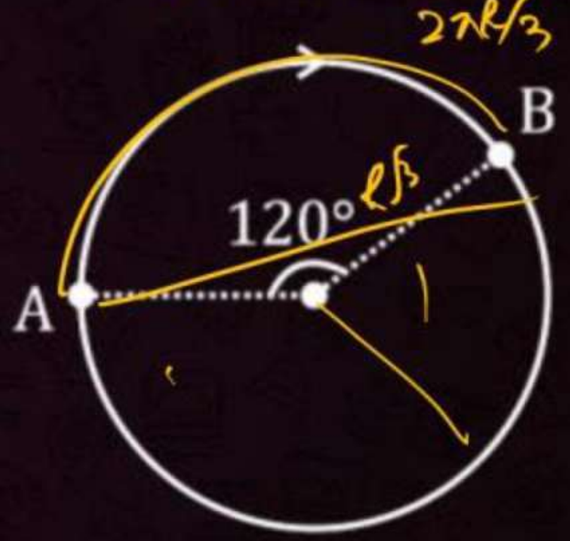
1. $2\pi a , 2\pi$
2. $a\pi , 2a$
3. $\pi a/4 , 2\pi$
4. $\pi\, a/4 , a\sqrt{2}$

Difficulty Level : MEdium

QUESTION-40

Calculate Distance and Displacement in going from A to B, radius of circle is a

[Prachand 2024]



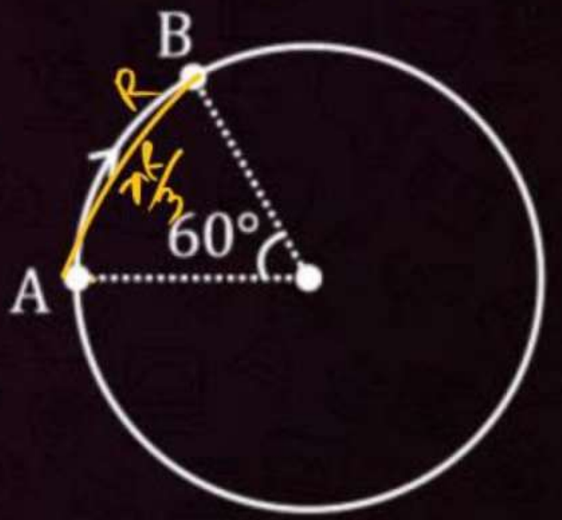
1. $2\pi a , 2\pi$
2. $a\pi , 2a$
3. $\pi a/3 , a\sqrt{3}$
4. $\pi a/4 , a\sqrt{2}$

Difficulty Level : MEdium

QUESTION-41

Calculate Distance and Displacement in going from A to B, radius of circle is a

[Prachand 2024]



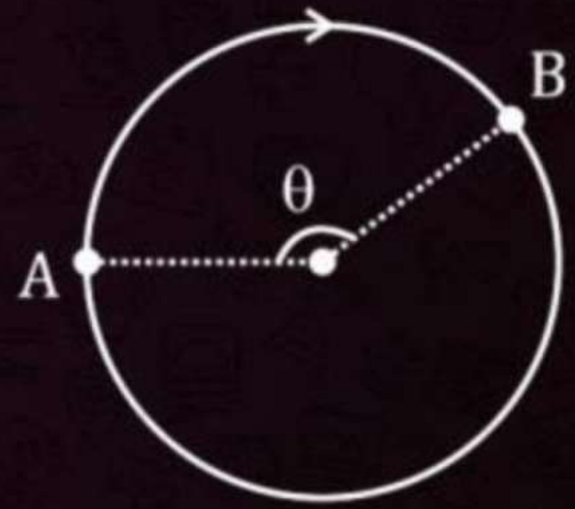
1. $2\pi a , 2\pi$
2. $A\pi/6 , 2a$
3. $\pi a/3 , a\sqrt{3}$
4. $\pi a/6 , a$

Difficulty Level : Hard

QUESTION-42

Calculate Distance and Displacement in going from A to B, radius of circle is a (θ is in radian)

[Prachand 2024]



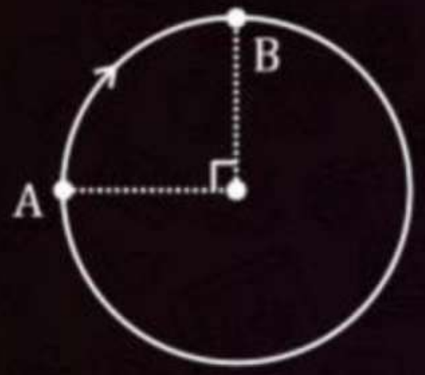
1. $a\theta/2\pi$, $2a\sin(\theta/2)$
2. $a\theta/\pi$, $2a\cos(\theta/2)$
3. $a\theta$, $2a\sin(\theta/2)$
4. $a\pi\theta$, , $2a\cos(\theta/2)$

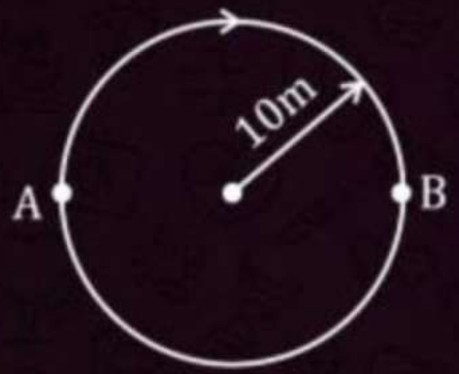
Puppy 7 – Circle ki Baate

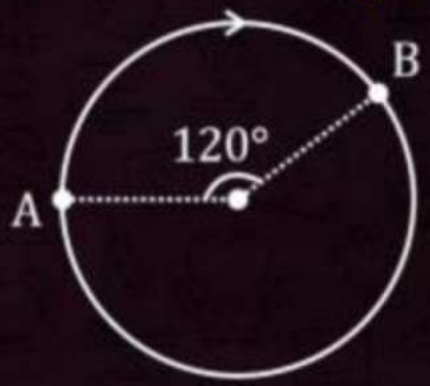
Difficulty Level : Medium

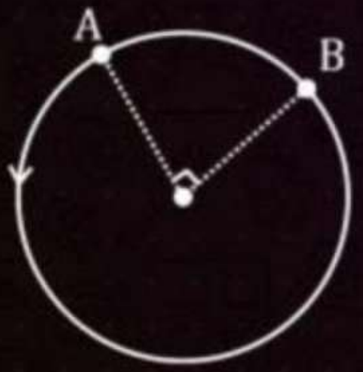
Calculate Distance and Displacement in going from A to B, radius of circle is a

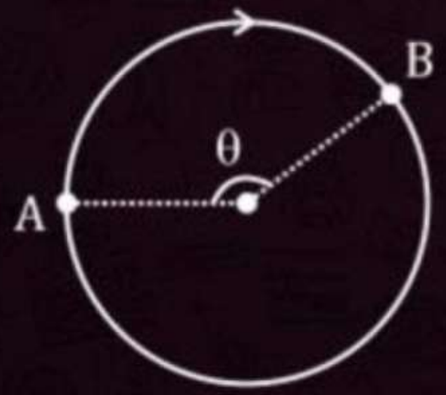
[Prachand 2024]

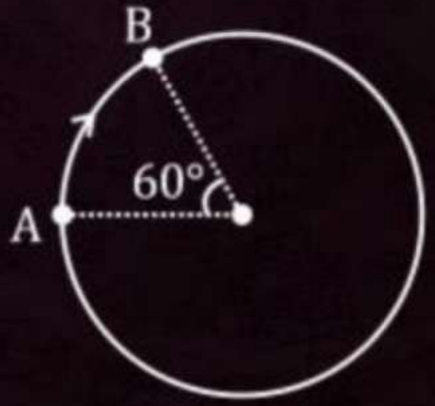




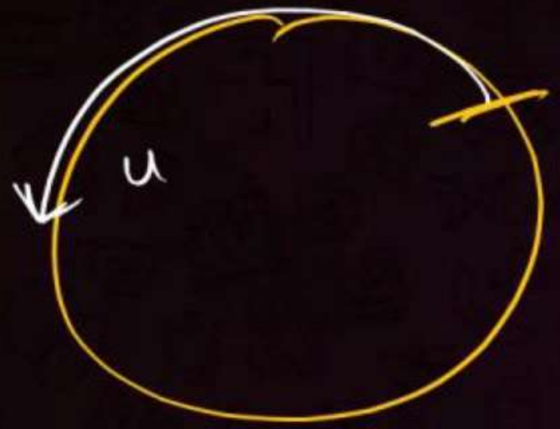








6.2 Circle – Average Speed Velocity



average speed u

$$\vec{v}_{avg} = u\left(\frac{\vec{d}}{D}\right)$$

$$\vec{v}_{avg} = u\left(\frac{2R\sin(\theta/2)}{R\theta}\right)$$

$$\vec{v}_{avg} = \frac{2u\sin(\theta/2)}{\theta}$$

Difficulty Level : Easy

QUESTION-43

A particle moves along a semicircle of radius 10 m in 5 seconds. The average velocity of the particle is:

1. 2π ms^{-1}
2. 4π ms^{-1}
3. 2 ms^{-1}
4. 4 ms^{-1}

Difficulty Level : Easy

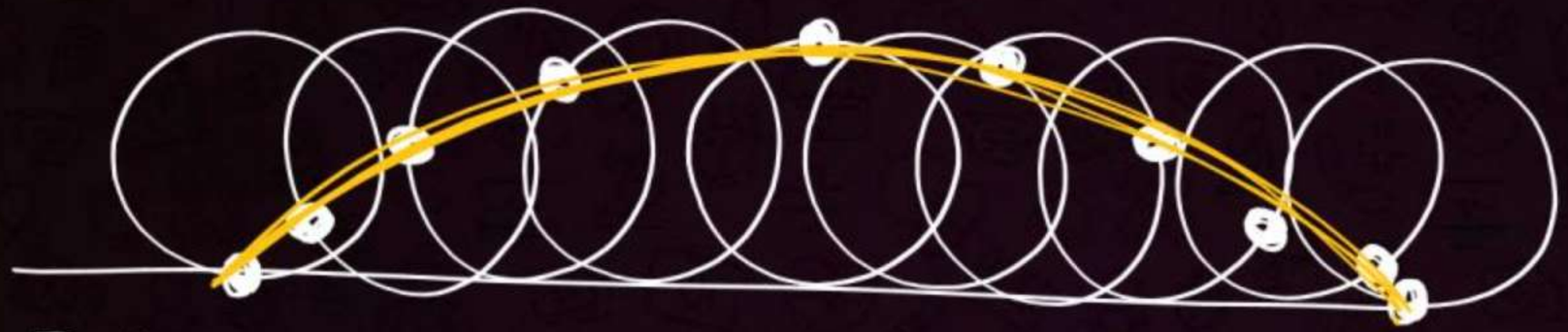
QUESTION-45

A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 s for every circular lap. The average velocity and average speed for each circular lap respectively is: [2006]

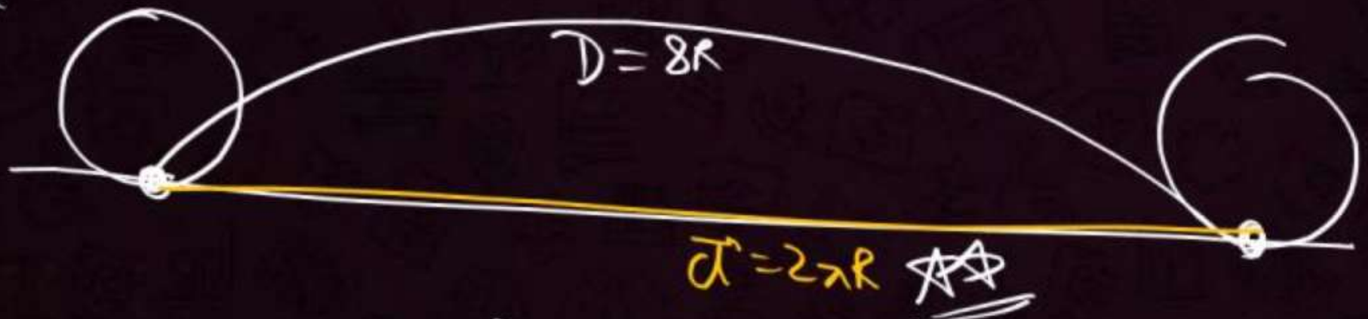
1. 0, 0
2. 0, 10 m/s
3. 10 m/s, 20 m/s
4. 20 m/s, 0

6.3 Keel On Wheel

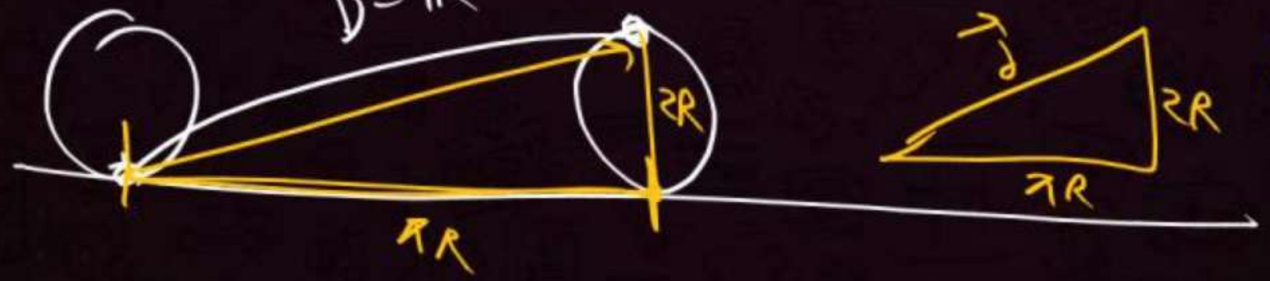
Concept – Cycloid $= 8R$



Full



Half



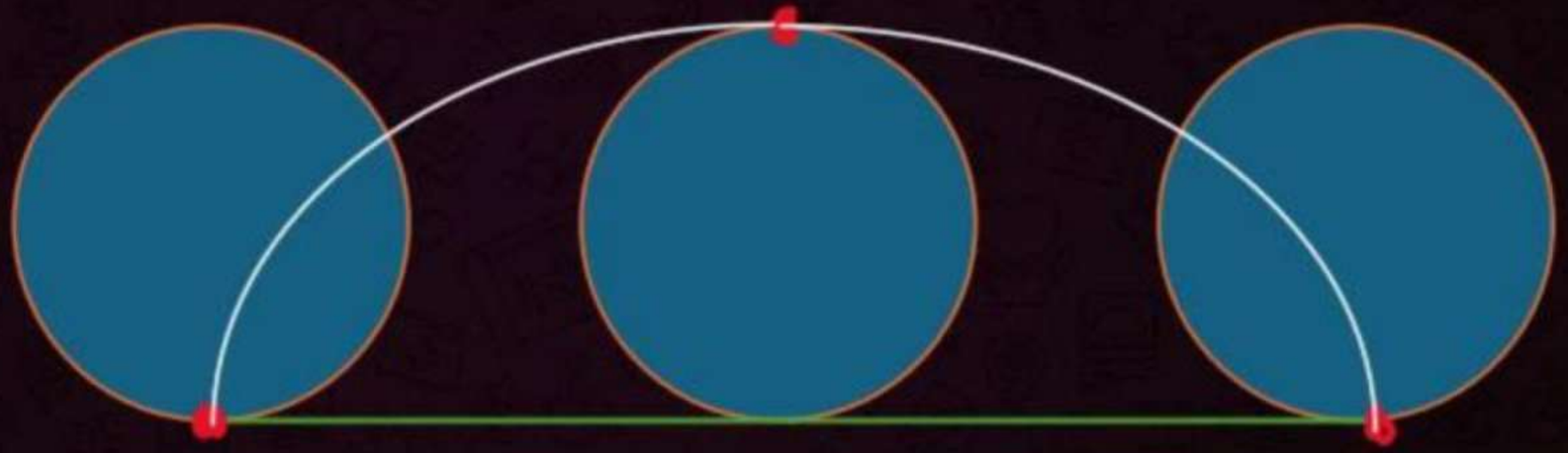
$d = \sqrt{(\pi R)^2 + (2R)^2}$

$\boxed{\vec{d} = R\sqrt{\pi^2 + 4}}$

Difficulty Level : MEdium

QUESTION-46

What is the displacement of the point of the wheel initially in contact with the ground after a full revolution



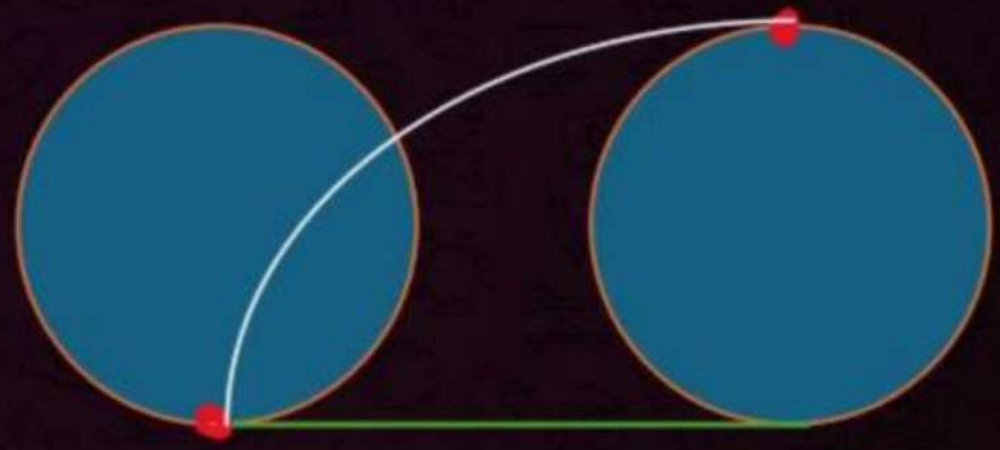
1. $2\pi R$
2. $R\sqrt{\pi^2+4}$
3. $4R$
4. $8R$

Difficulty Level : Hard

QUESTION-47

HW

What is the displacement of the point of the wheel initially in contact with the ground after a half revolution

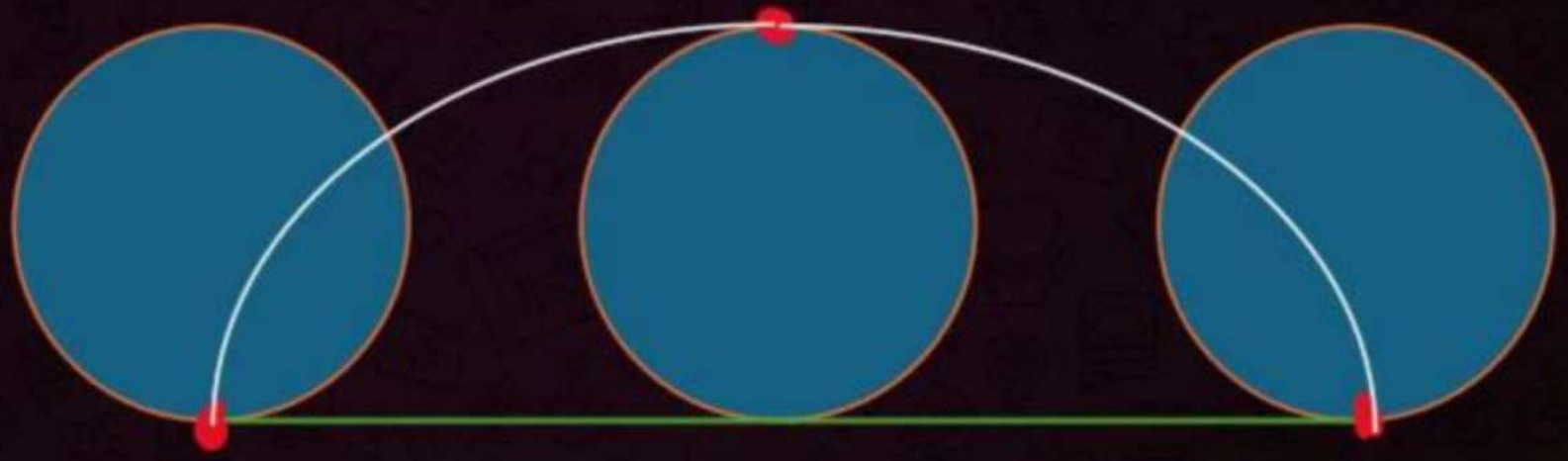


1. $2\pi R$
2. $R\sqrt{\pi^2+4}$
3. $4R$
4. $8R$

Difficulty Level : MEdium

QUESTION-48

What is the distance traveled by the point of the wheel initially in contact with the ground with after a full revolution

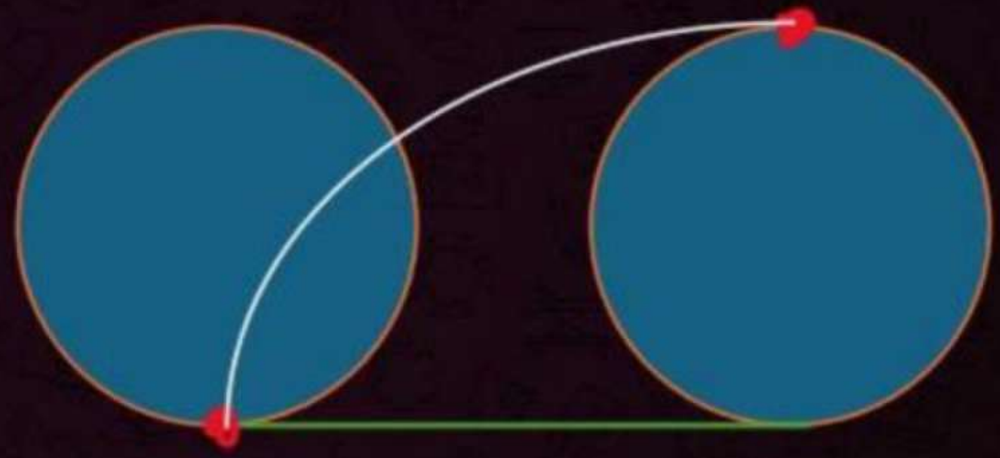


1. $2\pi R$
2. $R\sqrt{\pi^2+4}$
3. $4R$
4. $8R$

Difficulty Level : MEdium

QUESTION-49

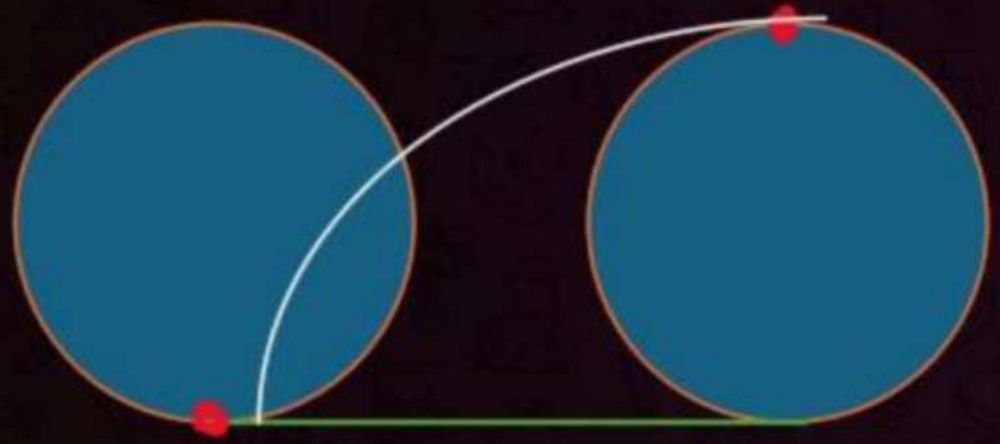
What is the distance traveled by the point of the wheel initially in contact with the ground after a half revolution

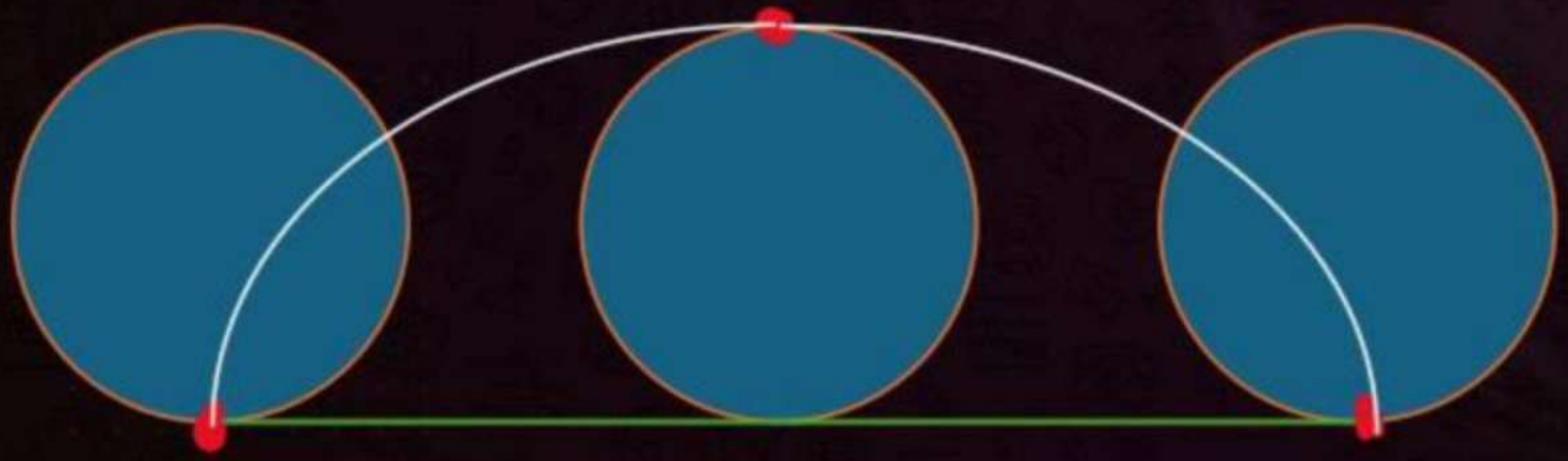


1. $2\pi R$
2. $R\sqrt{\pi^2+4}$
3. $4R$
4. $8R$

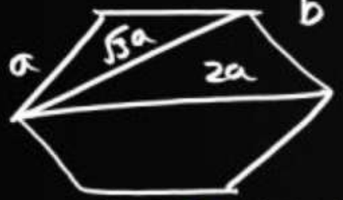
Puppy 8 – KEEL ON Wheel

Difficulty Level : Hard





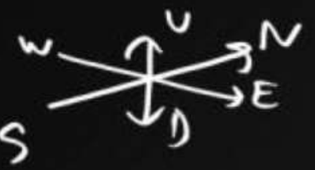
PUPPY POINTS - 1



$\frac{x}{\sqrt{a}} = \sqrt{x}$

Pyth.
3,4,6
6,8,10
5,12,13
7,24,25
$a, a\sqrt{2}a$
$a, a, a-\sqrt{3}a$

Distance ≥ displacement
= → st. line without U turn



Drunk
$d-(f-b)-till \le f$
$(f+b)$

$|\vec{v}_{inst}|$ = speed inst

average speed ≥ avg velocity

$\vec{v}_{avg}$ = speed avg $\left(\frac{displacement}{distance}\right)$

$Speed\ avg = \frac{total\ distance}{total\ time}$

$Velocity\ avg = \frac{total\ displacement}{total\ time}$

same t

$u_{avg} = \frac{u_1+u_2+\cdots}{n}$

$u_{avg} = \frac{u_1+u_2}{2} = \frac{u_1+u_2+u_3}{3}$

same x –

$\frac{n}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2}+\cdots$ (same distance mid journey return journey)

$u_{avg} = \frac{2u_1u_2}{u_1+u_2} = \frac{3u_1u_2u_3}{u_1u_2+u_3u_1+u_2u_3}$

$\Delta\vec{V} = \vec{V}_f - \vec{V}_i$

same speed u in N to E

$\Delta\vec{V} = u\sqrt{2}\,SE$

$a = \frac{\Delta\vec{V}}{t}$

deceleration = –ve a

retardation makes speedless

$a.v < 0$ → change direction

$a = a_t + a_n$

$a_t = \frac{d|v|}{dt}$ → change in speed

$\left|\frac{dv}{dt}\right|$ = magnitude of acceleration

D = 2πR
$\vec{x} = 0$

D = πR
$\vec{x} = 2R$

D = πR/2
$\vec{x} = R\sqrt{2}$

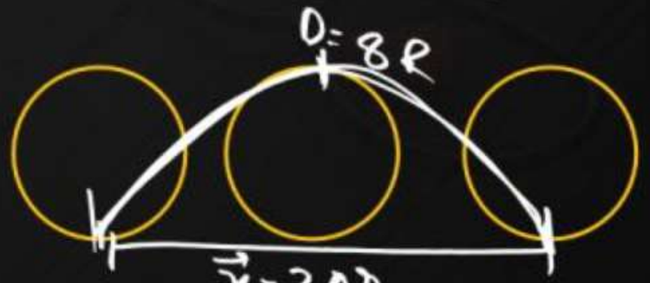
D = 2πR/3
$\vec{x} = R\sqrt{3}$

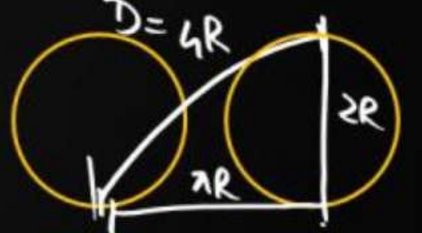
D = πR/3
$\vec{x} = R$

D = Rθ
$\vec{x} = 2R\sin\left(\frac{\theta}{2}\right)$

same speed u

$\vec{v}_{avg} = \frac{2u\sin(\theta/2)}{\theta}$





Part 7 -DILBAR QUESTIONS

QUESTION-50

Difficulty Level : YODHA

Pick the incorrect statement: [HCV Objective II]

1. Average speed of a particle in a given time is never less than the magnitude of the average velocity.

2. It is possible to have a situation in which $\left|\frac{d\vec{v}}{dt}\right| \neq 0$ but $\frac{d}{dt}|\vec{v}| = 0$.

3. The average velocity of a particle is zero in a time interval. It is possible that the instantaneous velocity is never zero in the interval.

4. The average velocity of a particle moving on a straight line is zero in a time interval. It is possible that the instantaneous velocity is never zero in the interval. (Infinite accelerations are not allowed.)

Difficulty Level : Hard

QUESTION-51

An object may have

[HCV Objective II]

1. varying speed without having varying velocity ✗
2. varying velocity without having varying speed ✓
3. Zero acceleration without having varying velocity ✗
4. Non-zero acceleration without having varying speed. ✗

constant velocity

Difficulty Level : Hard

QUESTION-52

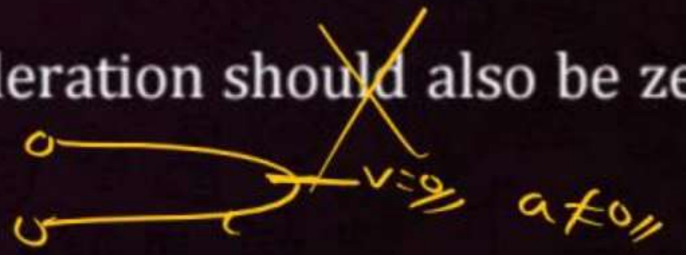
Mark the incorrect statements for a particle going on a straight line:

[HCV Objective II]

1. If the velocity and acceleration have opposite sign, the object is slowing down.

2. If the position and velocity have opposite sign, the particle is moving towards the origin.

3. If the velocity is zero at an instant, the acceleration should also be zero at that instant.



4. If the velocity is zero for a time interval, the acceleration is zero at any instant within the time interval.

$a = \frac{\Delta v}{t} = 0$

Difficulty Level : Hard

QUESTION-53

The velocity of a particle is zero at $t = 0$. Incorrect statement is [HCV Objective II]

1. The acceleration at $t = 0$ must be zero.
2. The acceleration at $t = 0$ may be zero.
3. If the acceleration is zero from $t = 0$ to $t = 10\ s$, the speed is also zero in this interval.
4. If the speed is zero from $t = 0$ to $t = 10\ s$ the acceleration is also zero in this interval.

Difficulty Level : Hard

QUESTION-54

Mark the correct statements: [HCV Objective II]

1. The magnitude of the velocity of a particle is equal to its speed.
2. The magnitude of average velocity in an interval is equal to its average speed in that interval.
3. It is possible to have a situation in which the speed of a particle is always zero but the average speed is not zero.
4. It is possible to have a situation in which the speed of the particle is never zero but the average speed in an interval is zero.

Difficulty Level : Easy

QUESTION-55

A particle moves with uniform velocity. Which of the following statements about the motion of the particle is true. [NCERT Based]

1. Its speed is zero
2. Its acceleration is zero
3. Its acceleration is opposite to the velocity
4. Its speed may be variable.

Difficulty Level : Hard

QUESTION-56

Match the Column I with Column II.

[NCERT Based]

1. $A \rightarrow p, B \rightarrow q, C \rightarrow r$
2. $A \rightarrow r, B \rightarrow q, C \rightarrow p$
3. $A \rightarrow r, B \rightarrow p, C \rightarrow q$
4. $A \rightarrow p, B \rightarrow r, C \rightarrow q$

Column-I (Physical quantity)		Column II (Formula)	
(A)	Instantaneous velocity, v	(p)	$\lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t}$
(B)	Instantaneous acceleration, a	(q)	$\frac{\Delta v}{\Delta t}$
(C)	Average acceleration, $\vec{a}$	(r)	$\lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$

$\frac{dv}{dt}$

$\frac{dx}{dt}$

Difficulty Level : YODHA

QUESTION-57

Which of the following statements is not correct? [NCERT Based]

1. The zero velocity of a body at any instant does not necessarily imply zero acceleration at that instant.

2. The kinematic equation of motions are true only for motion in which the magnitude and the direction of acceleration are constants during the course of motion.

3. The sign of acceleration tells use whether the particle's speed is increasing or decreasing.

4. All of these

Difficulty Level : Easy

QUESTION-58

What determines the natures of the path followed by the particle?

1. Speed
2. Velocity
3. Acceleration
4. Both (2) and (3)

Puppy 9 – True or False

Difficulty Level : Easy

a. When moving is a straight line average speed is equal to average velocity

b. When moving is a straight line without changing direction average speed is equal to average velocity

c. Instantons speed is always equal to magnitude of instantons velocity

d. When changing direction uniform motion is possible

e. Even when changing directions average speed is equal to average velocity

f. Even when changing directions instantons speed is equal to instant velocity

g. Average Speed is always greater than average velocity

h. Average Speed is always less than average velocity

i. When object comes back to its initial position average velocity becomes zero.

j. Only in uniform motion is it possible to have ratio of magnitude of average velocity equal to average speed.

Puppy 10 – True or False

Difficulty Level : Easy

a. When moving is a straight line average speed must be equal to average velocity

b. When moving is a straight line without changing direction average speed is equal to average velocity

c.Instantons speed is always equal to magnitude of instantons velocity

d. When changing direction uniform motion is possible

e. Even when changing directions average speed is equal to average velocity

f. Even when changing directions instantons speed is equal to instant velocity

g. Average Speed is always greater than average velocity

h. Average Speed is always less than average velocity

i. When object comes back to its initial position average velocity becomes zero

j. Only in uniform motion is it possible to have ratio of magnitude of average velocity equal to average speed.

Puppy 11 – Fill in the blanks

Difficulty Level : Easy

a. Displacement is a _____ (scalar/vector) quantity

b. Distance is a _____ (scalar/vector) quantity

c. length is a _____ (scalar/vector) quantity

d. Distance is always _____ (positive/negative/zero)

e. Displacement is always _____ (positive/negative/zero)

f. Distance depend upon _____ (path taken/end points)

g. Displacement depend upon _____ (path taken/end points)

h. Displacement is _____ (independent/dependent) of choice of axis

i. When particles returns to its original position, displacement is _____

j. When particles returns to its original position, distance is _____

k. Magnitude of displacement is _____ (greater than/lesser than/equal to) distance

l. Magnitude of displacement is _____ distance, if particle moves in a straight line.

m. Magnitude of displacement is _____ distance, if particle moves in a straight line without turning back

n. Straight line distance between two points is called _____

Part 8 – Non Uniform acceleration

8.1 Differentiation

$$\frac{d}{dx}x^n = nx^{n-1}$$

$$\frac{d}{dx}\left(\frac{1}{x^n}\right) = \frac{-n}{x^{n+1}}$$

$$\frac{d}{dx}x^2 = 2x$$

$$\frac{d}{dx}\left(\frac{1}{x^2}\right) = \frac{-2}{x^3}$$

$$\frac{d}{dx}x^{10} = 10x^9$$

$$\frac{d}{dx}\left(\frac{1}{x^{10}}\right) = \frac{-10}{x^{11}}$$

$$\frac{d}{dx}(x^5) = 5x^4$$

$$\frac{d}{dx}\left(\frac{1}{x^5}\right) = \frac{-5}{x^6}$$

$$\frac{d\sqrt{x}}{dx} = \frac{1}{2\sqrt{x}}$$

$$\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$$

$$\frac{d}{dx}(k) = 0$$

$$\frac{de^x}{dx} = e^x$$

$$\frac{de^{ax}}{dx} = ae^{ax}$$

Puppy 12 – Differentiate

Difficulty Level : Easy

$\frac{dx^1}{dx}$

$\frac{dx^{10}}{dx}$.

$\frac{d}{dx}\left(\frac{1}{x}\right)$

$\frac{d}{dx}\left(\frac{1}{x^{10}}\right)$

$\frac{d}{dx}(x^{1/2})$

$\frac{d}{dx}(x^{1/10})$

$\frac{d}{dx}(x^{-1/2})$

$\frac{d\left(x^{-1/10}\right)}{dx}$

8.2 Differentiation Type 1 - Direct

- $v = \frac{dx}{dt}$
- $a = \frac{dv}{dt} = \frac{d^2x}{dt^2} = v\frac{dv}{dx}$

Difficulty Level : Easy

QUESTION-59

The motion of a particle is described by the equation $x = at + bt^2$, where $a = 15$ cm s^{-1} and $b = 3$ cm s^{-2}. Its instantaneous velocity (in cm s^{-1}) at $t = 3s$ will be

[NCERT Based]

1. 33
2. 18
3. 16
4. 32

$$x = at + bt^2$$

$$V = \frac{dx}{dt} = a + 2bt$$

$a = 15 \quad t = 3s \quad b = 3$

$$V = 15 + 2 \times 3 \times 3$$

$$V = 15 + 18$$

$$V = 33$$

QUESTION-60

initial $t=0$

$(a-b)^2 = a^2 - 2ab + b^2$

Difficulty Level : Medium

A particle moves along the X-axis as

$x = u(t-2s) + a(t-2s)^2$.

$u(t-2) + a(t^2 - 4t + 4)$

[HCV Objective II]

1. the initial velocity of the particle is u ✗
2. the acceleration of the particle is a ✗
3. the acceleration of the particle is $2a$ ✓
4. at $t = 0$ s particle is at the origin. ✗

$\vec{x} = ut - 2u + at^2 - 4at + 4a$

$\vec{v} = \frac{dx}{dt} = (u - 4a) + 2at$

$\vec{a} = \frac{dv}{dt} = 2a$

QUESTION-61

MIP

Difficulty Level : ~~Medium~~ Hard

The position of a particle is given by $\vec{r}(t) = 4t\hat{i} + 2t^2\hat{j} - 5\hat{k}$ where t is in seconds and r in meter. Find the magnitude and direction of velocity $v(t)$, at $t = 1$ s, with respect to x-axis

[2023-Manipur]

1. $4\sqrt{2}\ ms^{-1}, 45°$
2. $4\sqrt{2}\ ms^{-1}, 60°$
3. $3\sqrt{2}\ ms^{-1}, 30°$
4. $3\sqrt{2}\ ms^{-1}, 45°$

	$\hat{i}$	$\hat{j}$	$\hat{k}$
$\vec{r} =$	$4t$	$2t^2$	-5
$\vec{v} =$	4	$4t$	0
At $t=1$	(4)	(4)	

Difficulty Level : Easy

QUESTION-62

Motion of a particle is given by equation $S = (3t^3 + 7t^2 + 14t + 8)\text{m}$. The value of acceleration of the particle at $t = 1$ sec. is: [2000]

$v = 9t^2 + 14t + 14$

$a = 18t + 14$

$= 18 + 14$

$= 32$

1. $10\ \text{m/s}^2$
2. $32\ \text{m/s}^2$ ✓
3. $23\ \text{m/s}^2$
4. $16\ \text{m/s}^2$

Difficulty Level : Easy

QUESTION-63

The position of an object moving along x-axis is given by $x = a + bt^2$, where $a = 8.5$ m and $b = 2.5$ ms^{-2} and t is measured in seconds. The instantaneous velocity (in ms^{-1}) at t = 3 sec will be

[NCERT Based]

1. 5
2. 10
3. 15
4. 20

QUESTION-64

Difficulty Level : Medium

The displacement of a body is given to be proportional to the cube of time elapsed. The magnitude of the acceleration of the body is. [NCERT Based]

1. Increasing with time ✓
2. Decreasing with time ×
3. Constant but not zero ×
4. Zero. ×

$x = kt^3$

$v = 3kt^2$

$a = 6kt$

$a \propto t$

Difficulty Level : Hard

HW

QUESTION-65

The variation of speed (in ms^{-1}) of an object with time (in seconds) is given by the expression $v(t) = v_0 - 5t + 5t^2$. [NCERT Based]

1. At time $t = 0$ s, the instantaneous acceleration is zero
2. At time $t = 0$ s, there is a deceleration of the object
3. At time $t = 1$s, the object is at rest
4. At time $t = 1$ s, the instantaneous acceleration is zero

8.3 Differentiation Type 2 - Indirect

$x = \frac{t^3}{3} - \frac{t^2}{2}$ ...

$v = t^2 - t$ ...

$a = 2t - 1$ ...

a when v is zero

$0 = t^2 - t$

$t^2 = t$

$t = 1\,sec$

$a = 2 \times 1 - 1$

$= 2 - 1$

$= 1\ m/s^2$

When v is max $a = \frac{dv}{dt} = 0$

When x is max $v = \frac{dx}{dt} = 0$

When a is max $\frac{da}{dt} = 0$

v, a, x is zero.

QUESTION-66

Difficulty Level : Hard

The motion of a particle is described by $x = x_0(1 - e^{-kt})$; $t \quad 0, x_0 > 0, k = 0$.
With what velocity does the particle start?

[NCERT Based]

1. x_0/k
2. x_0k
3. k/x_0
4. $2x_0k$

$t=0$

$x = x_0 - x_0 e^{-kt}$

$v = \frac{dx}{dt} = -x_0(-k)e^{-kt}$

$v = kx_0 e^{-kt}$

$v = kx_0$

$x = x_0 - x_0 e^{-kt}$

$\therefore$ 0

$v = (-x_0)(-k)e^{-kt}$

$v = x_0 k e^{-kt}$

$V = x_0 k$

$\frac{de^{at}}{dx} = ae^{at}$

$t=0$

$e^0 = 1$

QUESTION-67

Difficulty Level : Hard

The velocity of the particle at any time t is given by $v = 2t(3 - t)ms^{-1}$. At what time is its velocity maximum?

[NCERT Based]

$a = \frac{dv}{dt} = 0$ Condition

1. 2 s
2. 3 s
3. 2/3 s
4. 3/2 s ✓

$v = 6t - 2t^2$

$a = \frac{dv}{dt} = 0 = 6 - 4t = 0$

$6 = 4t$

$t = \frac{6}{4} \frac{3}{2}$

QUESTION-68

Difficulty Level : Medium

The motion of a particle along a straight line is described by equation: $x = 8 + 12t - t^3$ where x is in meter and t in second. The retardation of the particle when its velocity becomes zero, is: [2012 Pre]

1. $24\ ms^{-2}$
2. Zero
3. $6\ ms^{-2}$
4. $12\ ms^{-2}$

$x = 8 + 12t - t^3$

$v = 12 - 3t^2 = 0 \rightarrow 12 = 3t^2$

$t = 2, -2$

$a = -6t$

$a = -6 \times 2$

$= \pm 12\ m/s^2$.

QUESTION-69

Difficulty Level : Medium

A particle moves along a straight line OX. At a time t (in seconds) the distance x (in meters) of the particle from O is given by $x = 40 + 12t - t^3$. How long would the particle travel before coming to rest? [2006]

(1) 14 m

(2) 16 m

(3) 56 m

(4) 40 m

QUESTION-70

Difficulty Level : Medium

hw

A particle moves along a straight line such that its displacement at any time t is given by $s = (t^3 - 6t^2 + 3t + 4)$ metres. The velocity when the acceleration is zero is:

[1994]

1. 3 m/s
2. 42 m/s
3. -9m / s
4. -15m / s

QUESTION-71

Difficulty Level : Medium

The position x of a particle varies with time, (t) as $x = at^2 - bt^3$. The acceleration will be zero at time t is equal to: [1997]

1. $\frac{a}{3b}$
2. zero
3. $\frac{2a}{3b}$
4. $\frac{a}{b}$

$\vec{x} = at^2 - bt^3$

$\vec{v} = 2at - 3bt^2$

$\vec{a} = 2a - 6bt = 0$

$2a = 6bt$

$t = \frac{2a}{6b}$

$t = \frac{a}{3b}$

Difficulty Level : Hard

QUESTION-72

Two cars P and Q start from a point at the same time in a straight line and their positions are represented by $X_P(t) = at + bt^2$ and $X_Q(t) = ft - t^2$. At what time do the cars have the same velocity? [2016-II]

$x = at + bt^2 \quad x = ft - t^2$

$v = a + 2bt \quad v = f - 2t$

$a + 2bt = f - 2t$

$2bt + 2t = f - a$

$2t(b+1) = f - a$

$t = \frac{f-a}{2(b+1)}$

1. $\frac{a+f}{2(1+b)}$
2. $\frac{f-a}{2(1+b)}$
3. $\frac{a-f}{1+b}$
4. $\frac{a+f}{2(b-1)}$

Difficulty Level : Hard

QUESTION-73

For a particle displacement time relation is $t = \sqrt{x} + 3$ Its displacement when its velocity is zero: [1999]

$t - 3 = \sqrt{x}$

$x = (t-3)^2$

$x = t^2 - 6t + 9$

$v = 2t - 6 = 0$ $\Rightarrow t = 3$

$a = 2$

1. 2 m
2. 4 m
3. 0 ✓
4. None of these

QUESTION-74

Difficulty Level : YODHA

The displacement x of a particle varies with time t as $x = ae^{-\alpha t} + be^{\beta t}$ where a, b, α and β are positive constants. The velocity of the particle will [2005]

1. Be independent of β ✗
2. Drop to zero when $\alpha = \beta$ ✗
3. Go on decreasing with time ✗
4. Go on increasing with time ✓

$$x = ae^{-\alpha t} + be^{\beta t}$$

$$v = a(-\alpha)e^{-\alpha t} + b(\beta)e^{\beta t}$$

$$\vec{a} = a(-\alpha)(-\alpha)e^{-\alpha t} + b(\beta)(\beta)e^{\beta t}$$

$$\vec{a} = a\alpha^2 e^{-\alpha t} + b\beta^2 e^{\beta t}$$

$+ve$

$a + ve$ always

v will always increase

Difficulty Level : Hard

QUESTION-75

The position x of a particle with respect to time t along x-axis is given by $x = 9t^2 - t^3$ where x is in metres and t in second. What will be the position of this particle when it achieves maximum speed along the +ve x direction? [2007]

$a = 0$

HW

(1) 54 m

(2) 81 m

(3) 24 m

(4) 32 m

Difficulty Level : Hard

QUESTION-77

An object falling thrown a fluid is observed to have acceleration given by $a = g - bv$ where $g =$ gravitational acceleration and b is constant. After a long time of released, it is observed to fall with constant speed. the value of constant speed is

[NCERT Based]

$(a=0)$

$\vec{a} = g - bv$

0

$g = bv$

$v = g/b$

1. g/b
2. b/g
3. bg
4. b

8.4 Differentiation Type 3 - Timeless

(Tough)

$$a = v\frac{dv}{dx}$$

Difficulty Level : Hard

QUESTION-78

A particle of unit mass undergoes one dimensional motion such that its velocity varies according to $v(x) = \beta x^{-2n}$ where β and n are constants and x is the position of the particle. The acceleration of the particle as a function of x, is given by: [2015]

$v = \frac{\beta}{x^{2n}}$

1. $-2n\beta^2 x^{-4n-1}$
2. $-2\beta^2 x^{-2n+1}$
3. $-2n\beta^2 e^{-4n+1}$
4. $-2n\beta^2 x^{-2n-1}$

$\frac{dv}{dx} = \frac{-2n\beta}{x^{2n+1}}$

$a = v\frac{dv}{dx} = \frac{\beta}{x^{2n}} \times \frac{-2n\beta}{x^{2n+1}} = \frac{-2n\beta^2}{x^{4n+1}} = -2n\beta^2 x^{-4n-1}$

$$v = 10x^3$$

$$\frac{dv}{dx} = 30x^2$$

$a = ??$

$$a = v\frac{dv}{dx} = 10x^3 \times 30x^2$$

$$a = 300x^5$$

8.4 Differentiation Type 3 – Timeless ($v = a\sqrt{bx + c}$)

$$v = A\sqrt{Bx + C}$$

$$\vec{a} = \frac{A^2 B}{2}$$

Puppy 13 – $v = a\sqrt{bx + c}$

Difficulty Level : Hard

$v = a\sqrt{bx + c}$

$\vec{a} = \frac{a^2 b}{2}$

$v = K\sqrt{x}$

$\vec{a} = k^2/2$

$v = 2\sqrt{3x - 2}$

$\vec{a} = \frac{4 \times 3}{2} = 6$

$v = \sqrt{x + 3}$

$\vec{a} = \frac{1}{2}$

Difficulty Level : Hard

QUESTION-80

A particle moving along a straight line has a velocity v ms^{-1}, when it cleared a distance of x m. these two are connected by the relation $v = \sqrt{49 + 1x}$. When its velocity is 1 ms^{-1}, its acceleration (in ms^{-2}) is

[NCERT Based]

1. 2
2. 7
3. 1
4. 0.5

$V = A\sqrt{Bx + C}$

$a = \frac{A^2 B}{2}$

$V = 1^2 \times \frac{1}{2}$

Difficulty Level : Hard

QUESTION-82

A body moving with some initial velocity and having uniform acceleration attains a final velocity v m/s after travelling x m. If its final velocity is $v = \sqrt{180 - 7x}$, find the acceleration (in m/s^2) of the body. [NCERT Based]

1. -3.5
2. -7
3. -15
4. -30

$\vec{a} = \frac{1^2 \times -7}{2} = -3.5$

8.5 Integration

$$\int_a^b x^n dx = \frac{x^{n+1}}{n+1} = \frac{b^{n+1} - a^{n+1}}{n+1}$$

$$\int_a^b \frac{1}{x} dx = \ln\left(\frac{b}{a}\right)$$

$$\int_1^2 x^2 dx = \frac{x^3}{3} = \frac{2^3 - 1^3}{3}$$

$$\int_1^2 x^3 dx = \frac{x^4}{4} = \frac{2^4 - 1^4}{4}$$

$$\int_1^2 x^4 dx = \frac{x^5}{5} = \frac{2^5 - 1^5}{5}$$

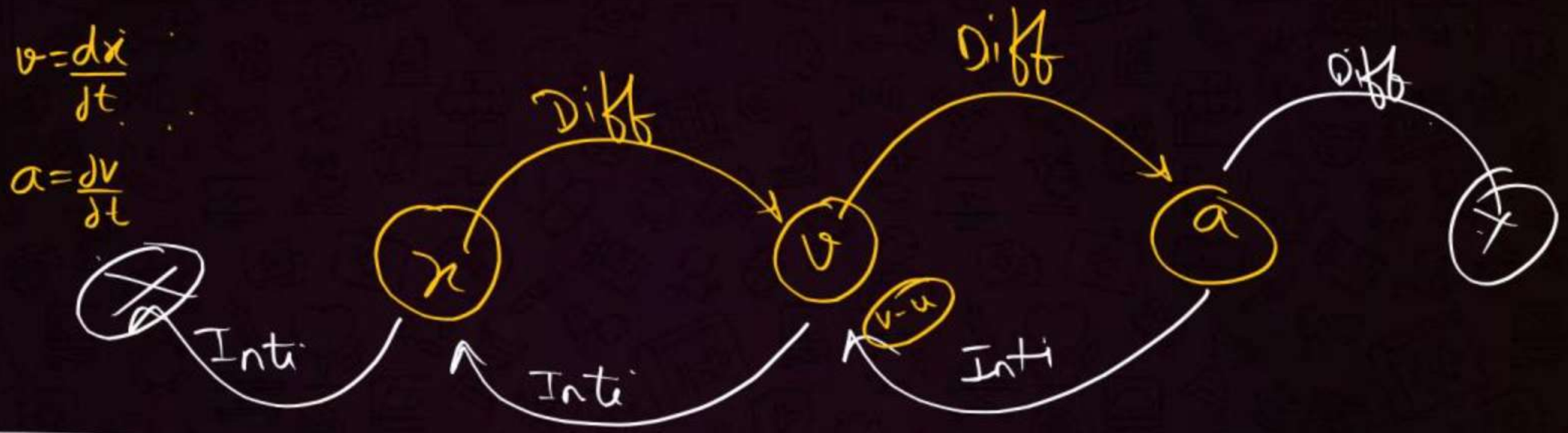
$$\int_1^2 x^{10} dx = \frac{x^{11}}{11} = \frac{2^{11} - 1^{11}}{11}$$

Puppy 14 – Integrate

Difficulty Level : Easy

$\int 1 \, dx$

8.6 Integration Type 1 – Pure



$$\int a\,dt = v-u$$

$$\int v\,dt = x$$

Difficulty Level : Hard

QUESTION-83

Conc

The acceleration of a particle is increasing linearly with time t as bt. The particle starts from origin with an initial velocity v_0 The distance travelled by the particle in time t will be: [1995]

(1) $v_0 t + \frac{1}{3} bt^2$

(2) $v_0 t + \frac{1}{2} bt^2$

(3) $v_0 t + \frac{1}{6} bt^3$

(4) $v_0 t + \frac{1}{3} bt^3$

$a = bt$

$a = \frac{bt}{1}$

$v - u = \frac{bt^2}{2}$

$v = u + \frac{bt^2}{2}$

$x = ut + \frac{bt^3}{2 \times 3}$

$x = ut + \frac{bt^3}{6}$

x v-u a

Difficulty Level : Hard

QUESTION-84

If the velocity of a particle is $v = At + Bt^2$, where A and B are constants, then the distance travelled by it between 1 s and 2 s is: [2016-I]

(1) $\frac{3}{2}A + 4B$

(2) $3A + 7B$

(3) $\frac{3}{2}A + \frac{7}{3}B$

(4) $\frac{A}{2} + \frac{B}{3}$

$v = At + Bt^2$

$x = \left(\frac{At^2}{2} + \frac{Bt^3}{3}\right)_1^2$

$\frac{A}{2}(2^2 - 1^2) + \frac{B}{3}(2^3 - 1^3)$

$= \frac{3A}{2} + \frac{7B}{3}$

Difficulty Level : Hard

QUESTION-85

The initial velocity of a particle is u (at $t = 0$) and the acceleration is given by $f = at$. Which of the following relations is valid?

1. $2v = u + at^2$
2. $v = 2u + at$
3. $v = u + \frac{at^2}{2}$
4. None of these

$$f = at$$

$$v - u = \frac{at^2}{2}$$

$$v = u + \frac{at^2}{2}$$

8.7 Integration Type 2 – Impure

Difficulty Level : Hard

QUESTION-86

A particle moving along x-axis has acceleration f, at time t, given by, $f = f_0\left(1-\frac{t}{T}\right)$ where f_0 and T are constants. The particle at $t = 0$ has zero velocity. In the time interval between $t = 0$ and the instant when $f = 0$ the particle's velocity (v_x) is: [2007]

$a = f\left(1-\frac{t}{T}\right)$

$a = f - \frac{ft}{T} = 0$

$f = \frac{ft}{T}$

$(t = T)$

condition $\rightsquigarrow$ $t = T$

(1) $\frac{1}{2}f_0T^2$

(2) f_0T^2

(3) $\frac{1}{2}f_0T$

(4) f_0T

$$a = f - \frac{ft}{T}$$

v at $t = T$

$$v - \cancel{u}_{0} = ft - \frac{ft^2}{2T}$$

$$v = fT - \frac{fT^2}{2T}$$

$$v = \frac{fT}{2}$$

Difficulty Level : YODHA

QUESTION-87

Starting from origin, a body moves along x-axis. its velocity at any time is given by $v = 4t^3 - 2t$ meter/sec. Acceleration of the particle when it is 2 m away from the origin is

[NCERT Based]

1. $28\ ms^{-2}$
2. $12\ ms^{-2}$
3. $22\ ms^{-2}$ ✓
4. $14\ ms^{-2}$

$x = \frac{4t^4}{4} - \frac{2t^2}{2}$

$x = t^4 - t^2 = 2$

$V = 4t^3 - 2t$

$a = 12t^2 - 2$

$a = 12 \times 2 - 2$
$= 24 - 2$
$= 22m$

$t^4 - t^2 = 2$ $\quad t^2 = p$

$p^2 - p = 2$

$(p-1) = 2$

$p = 2$

$t^2 = 2$

$t = \sqrt{2}$

$x = \frac{4t^4}{4} - \frac{2t^2}{2}$

$x = t^4 - t^2 = 2$

$v = 4t^3 - 2t$

$t = \sqrt{2}$

$a = 12t^2 - 2$

$a = 12 \times 2 - 2$

$= 24 - 2$

$= 22 m$

Difficulty Level : YODHA

QUESTION-87

Starting from origin, a body moves along x-axis. its velocity at any time is given by $v = 4t^3 - 2t$ meter/sec. Acceleration of the particle when it is 2 m away from the origin is

[NCERT Based]

1. $28\ ms^{-2}$
2. $12\ ms^{-2}$
3. $22\ ms^{-2}$
4. $14\ ms^{-2}$

$x = t^4 - t^2 = 2$

$v = 4t^3 - 2t$

$a = 12t^2 - 2$

$28 + 2 = 12t^2 \quad t = \sqrt{\frac{30}{12}}$

$12 + 2 = 12t^2 \quad t = \sqrt{\frac{14}{12}}$

$2 + 2 = 12t^2$

$14 + 2 = 12t^2 \quad t = \sqrt{\frac{24}{12}} = \sqrt{2}$

$t = \sqrt{16/12}$

$\sqrt{2}\sqrt{2}\sqrt{2}\sqrt{2} - \sqrt{2}\sqrt{2} = 2$

$4 - 2 = 2$

QUESTION-88

Difficulty Level : YODHA

A particle starts from point A moves along a straight line path with an acceleration given by $a = p - qx$ where p, q are constants and x is distance from point t. The particle stops at point B. The maximum velocity of the particle is

[NCERT Based]

$a = p - qx$

$m/s^2 \quad m/s^2 \quad 1/s^2$

1. p/q
2. $p/\sqrt{q}$
3. q/p
4. $\sqrt{q}/p$

QUESTION-88

Difficulty Level : YODHA

A particle starts from point A moves along a straight line path with an acceleration given by $a = p - qx$ where p, q are constants and x is distance from point t. The particle stops at point B. The maximum velocity of the particle is

[NCERT Based]

1. p/q
2. $p/\sqrt{q}$
3. q/p
4. $\sqrt{q}/p$

$a = p - qx$

$[LT^{-2}] = p = q[L]$

$p = LT^{-2}$ $\quad [T^{-2}] = qx$

$v = m/s = [LT^{-1}] = \frac{p}{\sqrt{q}} \quad \frac{LT^{-2}}{T^{-1}}$

QUESTION-88

Difficulty Level : YODHA

A particle starts from point A moves along a straight line path with an acceleration given by $a = p - qx$ where p, q are constants and x is distance from point t. The particle stops at point B. The maximum velocity of the particle is

[NCERT Based]

1. p/q
2. $p/\sqrt{q}$
3. q/p
4. $\sqrt{q}/p$

$\int v\,dv = \int p - qx\,dx$

$\frac{v^2}{2} = px - \frac{qx^2}{2}$

v_{max} $a = 0$

$a = p - qx$

$x = \frac{p}{q}$

$\rightarrow$ max (I) $\left(-\frac{b}{4a}\right)$

$\frac{v^2}{2} = 2q\left(\frac{p}{2q}\right)\left(\frac{p}{q}\right) - \frac{q}{2}\left(\frac{p^2}{q^2}\right)$

$\frac{v^2}{2} = \frac{2p^2q - qp^2}{2q^2} = \frac{qp^2}{2q^2}$

$\left(v = \sqrt{\frac{p^2}{q}} = \frac{p}{\sqrt{q}}\right)$

QUESTION-89

Unit & Dimension

Difficulty Level : YODHA+

Challenge

The relation between time t and distance x is $t = \alpha x^2 + \beta x$, where α and β are constant. The retardation is

[JEE Main 31st Jan 1st Shift 2024]

[Main 25th July 2nd Shift 2021]

1. $2\alpha v^2$
2. $2\alpha v^3$
3. $2\alpha\beta v^3$
4. $2\beta^2 v^3$

Ans (2)

QUESTION-79

Difficulty Level : YODHA

The motion of a body is given by the equation $\frac{dv}{dt} = 6 - 3v$ where v is the speed in ms^{-1} and t is time in s. The body is at rest at $t = 0$. The speed varies with time as.

[NCERT Based]

1. $v = (1 - e^{-3t})$
2. $v = 2(1 - e^{-3t})$
3. $v = (1 + e^{-2t})$
4. $v = 2(1 - e^{-2t})$

$$\frac{dv}{dt} = 3(2 - v)$$

$$\frac{dv}{2 - v} = 3\,dt$$

$$\ln\left(\frac{2 - v}{2 - 0}\right) = 3t$$

$$\frac{2 - v}{2} = e^{3t}$$

$$v = 2 - 2e^{3t}$$

$$v = 2(1 - e^{3t})$$

8.8 Proportionality

$x = t^5$

$v = t^{(4)}$

$a = t^{(3)}$

Concept

$x \propto t^n$ $\quad t \propto a^{\frac{1}{n}}$

$v \propto t^{n-1}$ $\quad t \propto v^{\frac{1}{n-1}}$

$a \propto t^{n-2}$ $\quad t \propto a^{\frac{1}{n-2}}$

$x \propto t^8$

$a \propto x^{(?)}$

$= \quad =$

$a^{\frac{1}{6}} \propto x^{\frac{1}{8}}$

$a \propto x^{6/8}$

$\boxed{a \propto x^{3/4}}$

$x \propto t^8$ $\quad t \propto x^{1/8}$

$v \propto t^7$ $\quad t \propto v^{1/7}$

$a \propto t^6$ $\quad t \propto a^{1/6}$

$x \propto t^{10}$

$a \propto v^{(?)}$

$x \propto t^{-1}$ → Pkp

$a \propto x^{(1)}$

$a \propto v^{(?)}$

Q) $x \propto t^{10}$

$v \propto t^{9}$ $\quad t \propto v^{1/9}$

$a \propto t^{8}$ $\quad t \propto a^{1/8}$

$a^{1/8} \propto v^{1/9}$

$a \propto v^{8/9}$

$x \propto t^{-1}$ $\quad t \propto x^{-1}$

$v \propto t^{-2}$ $\quad t \propto v^{-1/2}$

$a \propto t^{-3}$ $\quad t \propto a^{-1/3}$

$a^{-1/3} \propto v^{+1/2}$

$a \propto v^{3/2}$

$a \propto x^{3}$

Puppy 15 – Non uniform Proportionality

Difficulty Level : HARD

$x \propto t^4$	$v \propto t$	$a \propto t$	$v \propto x$	$a \propto x$	$a \propto v$
$x \propto t^{-1}$	$v \propto t$	$a \propto t$	$v \propto x$	$a \propto x$	$a \propto v$
$x \propto t^2$	$v \propto t$	$a \propto t$	$v \propto x$	$a \propto x$	$a \propto v$
$x \propto t^3$	$v \propto t$	$a \propto t$	$v \propto x$	$a \propto x$	$a \propto v$
$x \propto t^1$	$v \propto t$	$a \propto t$	$v \propto x$	$a \propto x$	$a \propto v$
$x \propto t^{3/2}$	$v \propto t$	$a \propto t$	$v \propto x$	$a \propto x$	$a \propto v$

QUESTION-90

Difficulty Level : YODHA

A particle moves a distance x in time t according to equation $x = (t + 5)^{-1}$. The acceleration of particle is proportional to:

[2010 Pre]

1. (Velocity)$^{2/3}$
2. (Velocity)$^{3/2}$ ✓
3. (Distance)^{2}
4. (Distance)$^{-2}$

$v = \frac{dx}{dt} = -\frac{1}{(t+5)^2}$

$a = \frac{dv}{dt} = \frac{2}{(t+5)^3}$

$\left(v = -\frac{1}{x^2}\right)$ ✗

$a = \frac{2}{x^3}$

$x = \frac{1}{t+5}$

$x \propto \frac{1}{t}$

$x \propto t^{-1}$

$a \propto x^3$

$a \propto v^{3/2}$

8.9 Time average and Distance Average

Average

$$\frac{\int y\,dx}{\int dx}$$

velocity – time average	velocity – space average	velocity ganji average
$= \frac{\int v\,dt}{\int dt}$	$= \frac{\int v\,dx}{\int dx}$	$\frac{\int v\,dg}{\int dg}$

QUESTION-92

Difficulty Level : YODHA

A particle starts from rest with constant acceleration. The ratio of average-space velocity to the time average velocity is: [1999]

1. 1/2
2. 3/4
3. 4/3
4. 3/2

$\frac{\int v\,dx}{\int dx}$ / $\frac{\int v\,dt}{\int dt}$

$v^2 = u^2 + 2ax$

$v = u + at$

$\frac{\int \sqrt{2ax}\,dx}{\int dx}$ / $\frac{\int at\,dt}{\int dt}$

Good

PUPPY POINTS-2

$\frac{dx^n}{dx} = nx^{n-1}$

$\frac{d(x^{-n})}{dx} = \frac{-n}{x^{n+1}}$

$\frac{d}{dx}\sqrt{x} = \frac{1}{2\sqrt{x}}$

$\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$

$\frac{dk}{dx} = 0$

$\int_a^b x^n dx = \frac{b^{n+1} - a^{n+1}}{n+1}$

$\int_a^b k\,dx = k(b-a)$

$\int_a^b \frac{1}{x} dx = \ln\left(\frac{b}{a}\right)$

$v = \frac{dx}{dt}$

$a = \frac{dv}{dt} = \frac{d^2x}{dt^2} = v\frac{dv}{dx}$

$\int v\,dt = \vec{x}$

$\int a\,dt = \Delta\vec{v} = \vec{v} - \vec{u}$

$v = A\sqrt{Bx + C}$

$\vec{a} = \frac{A^2 B}{2}$

$x \propto t^n \quad t \propto x^{\frac{1}{n}}$

$v \propto t^{n-1} \quad t \propto v^{\frac{1}{n-1}}$

$a \propto t^{n-2} \quad t \propto a^{\frac{1}{n-2}}$

$a \propto v^{\frac{n-2}{n-1}}$

$a \propto x^{\frac{n-2}{n}}$

$v \propto x^{\frac{n-1}{n}}$

time at $v_{max/min}$ $a = 0$

$t = \alpha x^2 + \beta x \rightarrow a = 2\alpha v^3$

$\frac{\text{Vavg distance}}{\text{Vavg time}} = \frac{4}{3}$

Part 9 – Uniform acceleration

Uniform Motion

$a = 0$

Hint: v is constant

Speed & direction same

1sec	2sec	3sec	4sec
2m	2m	2m	2m

$a = 0$

$v = k$

$x = At + B$

Linear.

Uniformly accelerated motion

$a = k \rightarrow$ constant

$v = At + B \rightarrow$ Linear

$x = At^2 + Bt + C \rightarrow$ quadratic

$v = A\sqrt{Bx + C} \rightarrow v \propto \sqrt{x}$.

1sec	2nd sec	3rd sec	4th sec	5th sec
10m	13m	16m	19m	22m.

→ AP

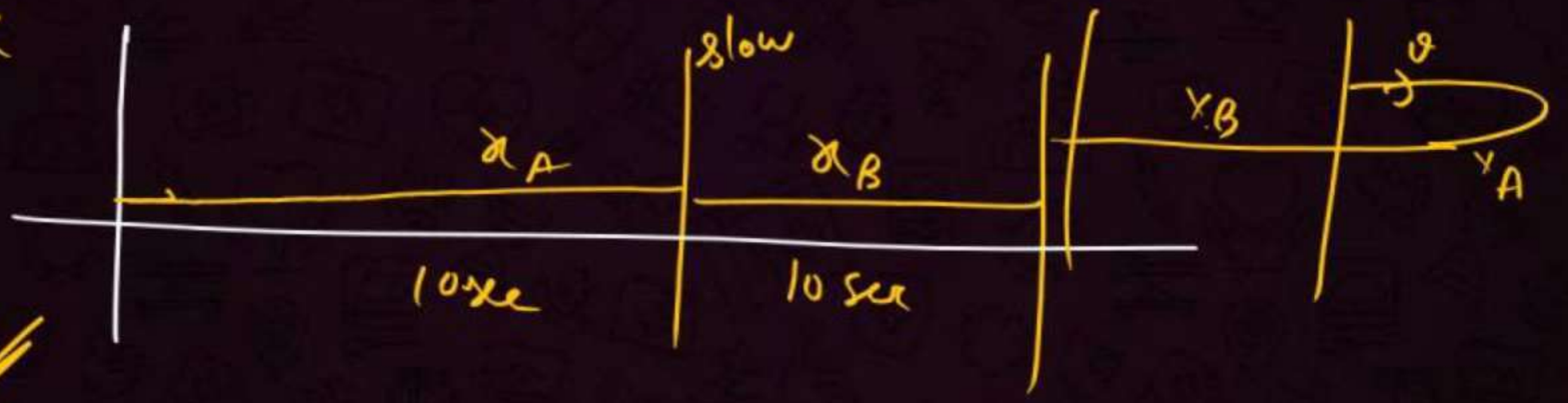
QUESTION-93

Difficulty Level : Easy

A particle has a velocity u towards east at $t = 0$ Its acceleration is towards west and is constant. Let x_A and x_B be the magnitude of displacements in the first 10 seconds and the next 10 seconds

[HCV Objective I]

1. $x_A < x_B$
2. $x_A = x_B$
3. $x_A > x_B$
4. the information is insufficient to decide the relation of x_A with x_B



Difficulty Level : Easy

QUESTION-94

[NCERT Based]

Free fall of an object in vacuum is a case of motion with

1. Uniform velocity
2. Uniform acceleration
3. Variable acceleration
4. Uniform speed

Difficulty Level : Easy

QUESTION-95

A player throws a ball vertically upwards with velocity u. At highest point,

[NCERT Based]

1. Both the velocity and acceleration of the ball zero
2. The velocity of the ball is u but its acceleration is zero.
3. The velocity of the ball is zero but its acceleration is g
4. The velocity of the ball is u but its acceleration is g

Difficulty Level : Easy

QUESTION-96

In which of the following acceleration of object is constant

1. $a = kx$
2. $v = 4\sin(2t)$
3. $v = e^{2t}$
4. $v = 4t$

$a = t^2$

$v = t^1$

$a \rightarrow$ constant

$v = \int a$

Difficulty Level : Easy

QUESTION-97

Which one of the following equations represent the motion of a body with finite constant acceleration. In these equations y denotes the position of the body at time t and a, b and c are the constant of the motion

$x = t^2$ max.

1. $y = a/t + bt$
2. $y = at$
3. $y = at + bt^2$ ✓
4. $y = at + bt^2 + ct^3$ ✗

Difficulty Level : Easy

QUESTION-98

The velocity-time relationship is described by equation $v = P + Qt^2$. The body is travelling with

$v = t^1$

1. Zero acceleration ✗
2. Uniform acceleration ✗
3. Uniform retardation ✗
4. Non-uniform acceleration ✓

Difficulty Level : Hard

QUESTION-81

A particle located at $x = 0$ at time $t = 0$, starts moving along the positive x-direction with a velocity 'v' which varies as $v = \alpha\sqrt{x}$, then velocity of particle varies with time as: (α is a constant).

→ Constant acc

$v = t^1$

1. $v \propto t$
2. $v \propto t^2$
3. $v \propto \sqrt{t}$
4. v = constant

9.1 Direct use of ~~4~~ 3 equations

$$v = u + at$$
$$s = ut + \frac{1}{2}at^2$$
$$v^2 = u^2 + 2as$$

$v \rightarrow$ final velocity
$u \rightarrow$ initial velocity
$a \rightarrow$ acceleration
$s \longrightarrow$ displacement
$t \longrightarrow$ time

$$v_{avg} = \frac{u+v}{2}$$

$$s = \left(\frac{u+v}{2}\right)t$$

4th eq

Difficulty Level : Easy

QUESTION-99

Which of the following equations does not represent the kinematic equations of motion?

[NCERT Based]

1. $v = u + at$
2. $S = ut + \frac{1}{2}at^2$
3. $S = vt + \frac{1}{2}at^2$
4. $v^2 - u^2 = 2as$

× $S = vt - \frac{1}{2}at^2$

$v = u + at$

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

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

$S = (u + v)\, t/2$

Difficulty Level : Easy

QUESTION-100

A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 ms^{-1} to 20 ms^{-1} while passing through a distance 135 m in to second. The value of t is [2008]

1. 12
2. 9
3. 10
4. 1.8

$$135 = \left(\frac{10+20}{2}\right) t$$

$$27\,\phi = 3\,\phi\, t$$

$$t = 9$$

$v = u + at$

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

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

$S = (u + v)\, t/2$

Difficulty Level : Easy

QUESTION-101

If a car at rest accelerates uniformly to a speed of 144 km/h in 20 sec, it covers a distance of: [1997]

(1) 1440 cm

(2) 2980 cm

(3) 20 m

(4) 400 m ✓

$u = 0$

v t

$144\ \frac{km}{hr} \times \frac{5}{18} = 40\ \frac{m}{s}$

$S = \left(\frac{u+v}{2}\right) t$

$S = \left(\frac{0+40}{2}\right) 20 \mid 0$

$v = u + at$

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

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

$S = (u + v)\, t/2$

Difficulty Level : Easy

QUESTION-102

The velocity of train increases uniformly from 20 km/h to 60 km/h in 4 hours. The distance travelled by the train during this period, is: [1994]

1. 160 km
2. 180 km
3. 100 km
4. 120 km

$v = u + at$

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

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

$S = (u + v)\, t/2$

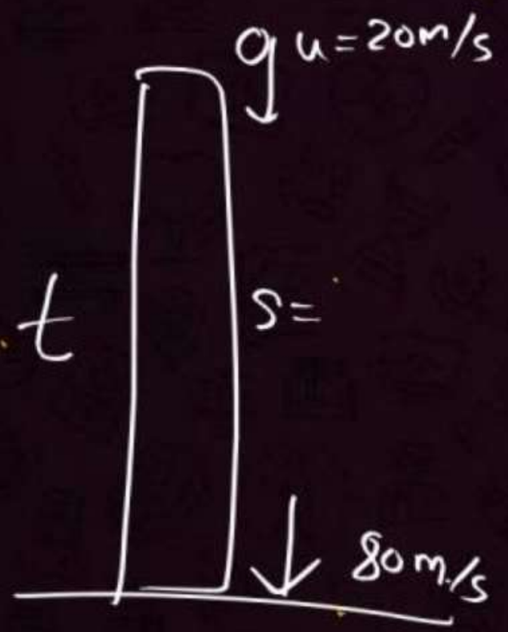
Difficulty Level : Easy

QUESTION-103

A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is: ($g = 10\ m/s^2$)

[2020]

1. 340 m
2. 320 m
3. 300 m
4. 360 m



$a = \downarrow 10$

$v^2 = u^2 + 2as$

$80^2 = 20^2 + 2 \times 10 s$

$6400 = 400 + 20s$

$6000 = 21s$

$s = 300m$

$v = u + at$

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

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

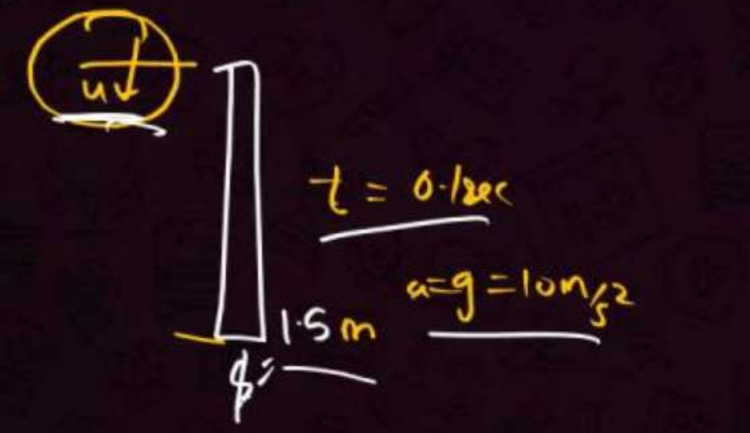
$S = (u + v)\, t/2$

QUESTION-104

Difficulty Level : ~~Easy~~ Moderate

A person sitting in the ground floor of a building notices through the window, of height 1.5 m, a ball dropped from the roof of the building crosses the window in 0.1 s. What is the velocity of the ball when it is at the **topmost point** of the window? ($g = 10\ m/s^2$) [202

1. 14.5 m/s
2. 4.5 m/s
3. 20 m/s
4. 15.5 m/s



$1.5 = u\,0.1 + \frac{1}{2} \times 10 \times 0.1 \times 0.1$

$15 = u + \frac{1}{2}$

$15 = u + 0.5$

$u = 14.5$

$v = u + at$

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

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

$S = (u + v)\,t/2$

Difficulty Level : Easy

QUESTION-105

An auto travelling along a straight road increases its speed from 30.0 ms^{-1} to 50 ms^{-1} in a distance of 180 m. If the acceleration is constant, how much time elapses while the auto moves this distance?

[NCERT Based]

1. 6.0 s
2. 4.5 s
3. 3.6 s
4. 7.0 s

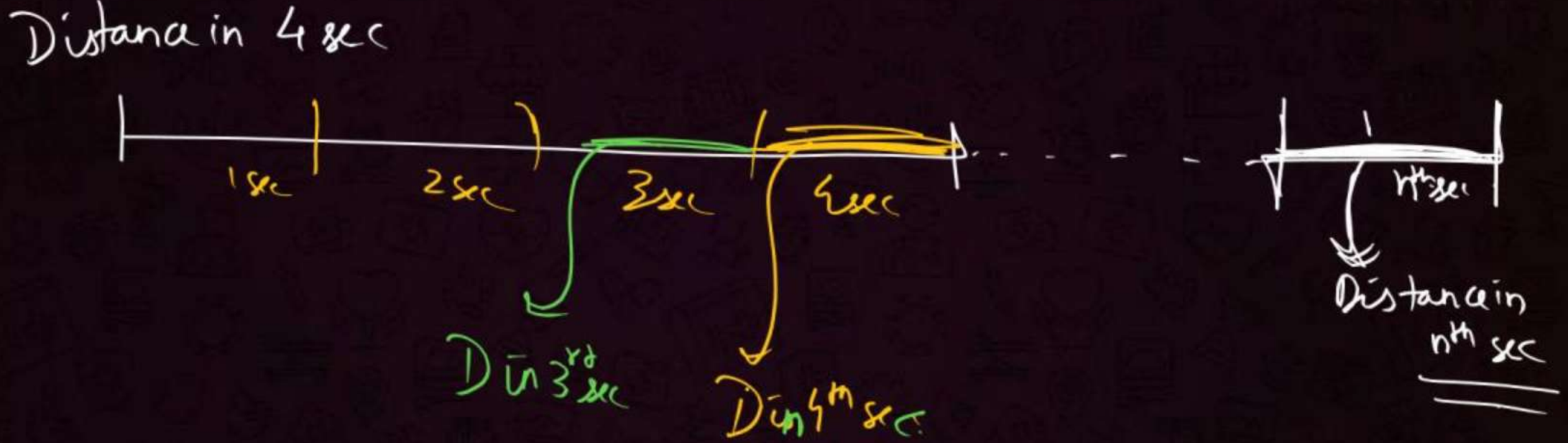
$$v = u + at$$

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

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

$$S = (u + v)\, t/2$$

9.2 n^{th} second ki baate



$u = 0$

$a = 10\ m/s^2$

$S_1 = \frac{1}{2}at^2 = \frac{1}{2} \times 10 t^2 = 5 \times 1^2 = 5m$

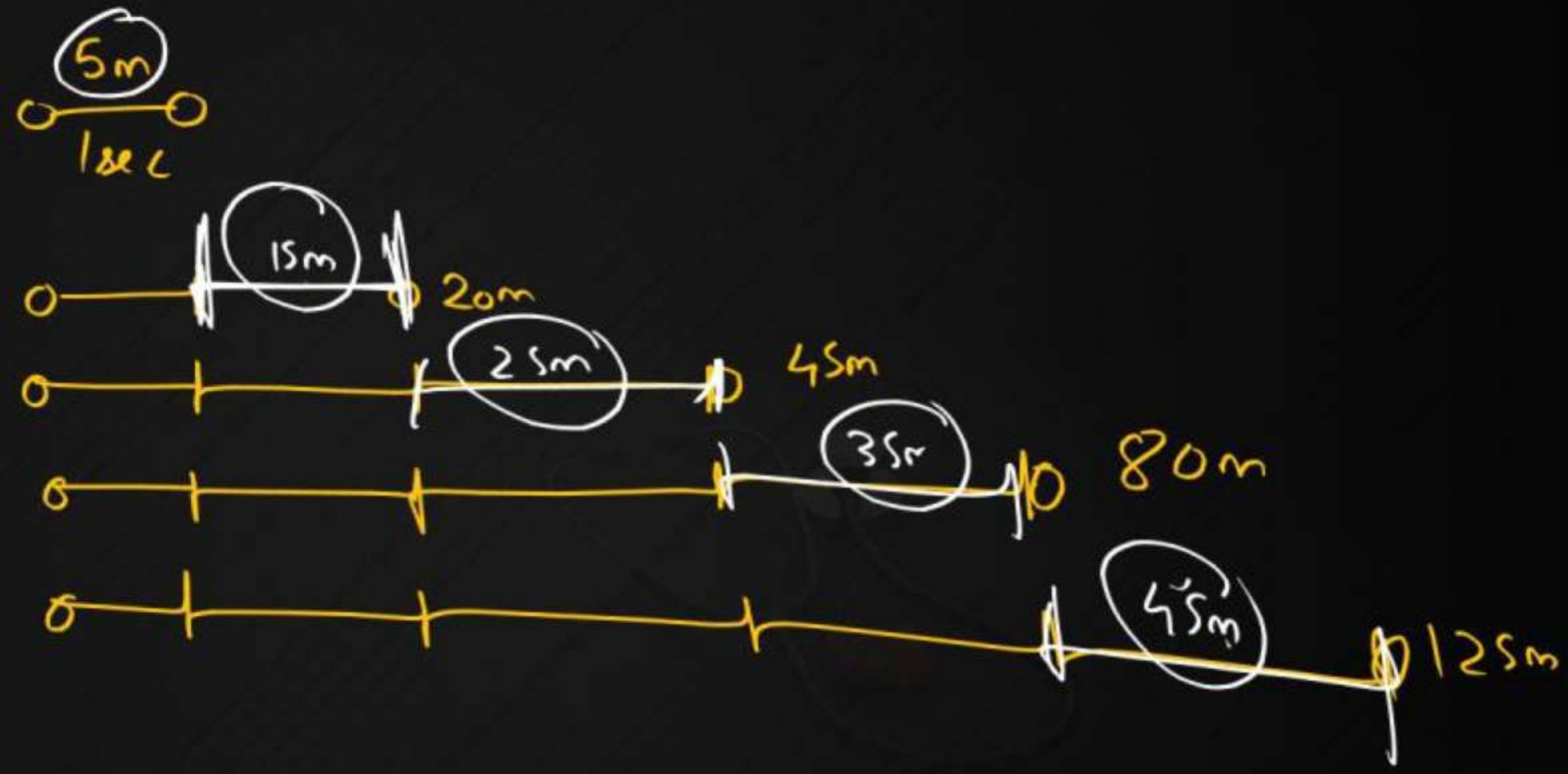
$S_2 =$ ——————— $= 20m$

$S_3 = 45m$

$S_4 = 80m$

$S_5 = 125m$

$S_6 = 180m$



$$S_{n^{th}} = u + (2n-1)\frac{a}{2}$$ ✓ → odd

$$S_{n+1^{th}} = u + (2n+1)\frac{a}{2}$$

$$S_{n+2^{th}} = u + (2n+3)\frac{a}{2}$$

$$S_{(n+3)^{th}} = u + (2n+5)\frac{a}{2}$$

$$S_{(n-1)^{th}} = u + (2n-3)\frac{a}{2}$$

$$S_{(n-2)^{th}} = u + (2n-5)\frac{a}{2}$$

Odd Number

$1, 3, 5, 7, - - - 2n-5, 2n-3, 2n-1, 2n+1, 2n+3, 2n+5, - -$

Difficulty Level : Easy

QUESTION-106

$u = 0$

The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}$ ms^{-2} in the third second is [2008]

3rd sec

(1) $\frac{10}{3}$ m

(2) $\frac{19}{3}$ m

(3) 6 m

(4) 4 m

$$S_{3rd} = u + (2\times3 - 1)\frac{a}{2}$$

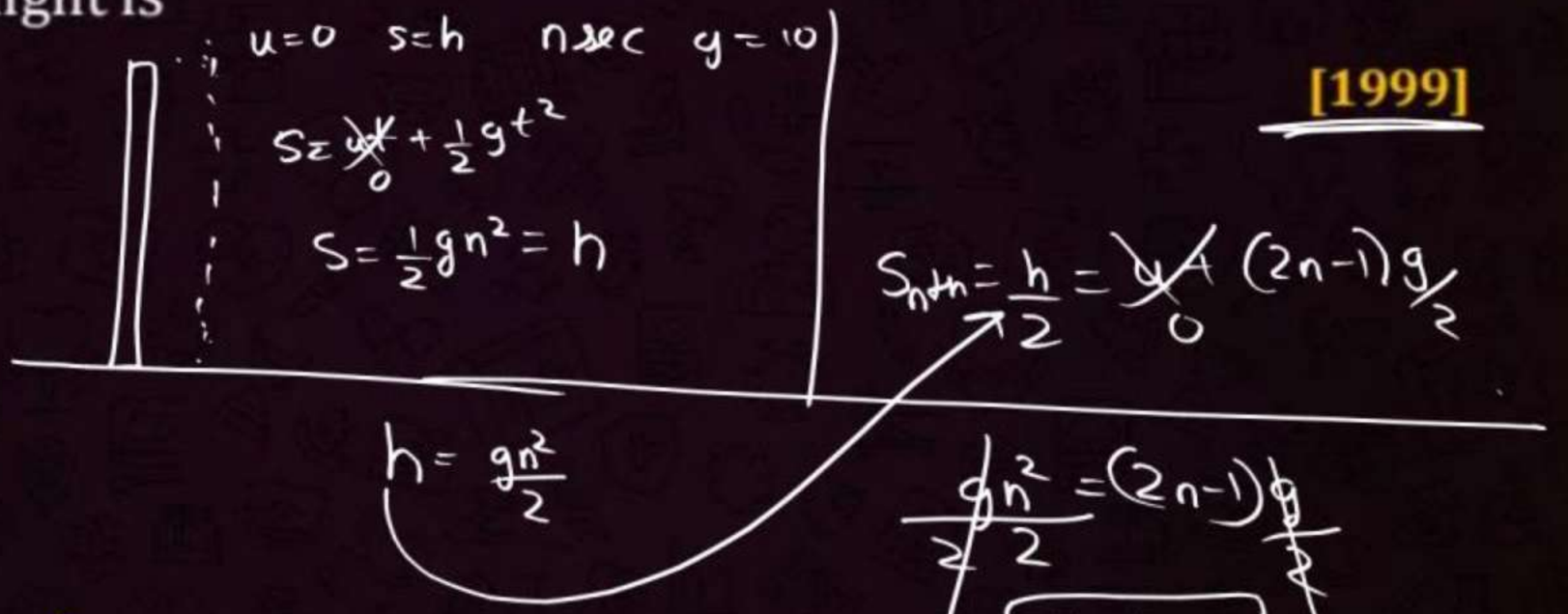
$$= (6-1)\frac{4}{3\times2} = \frac{5\times4^2}{3\times2} = \frac{10}{3}$$

Difficulty Level : Hard

QUESTION-107

A body starts falling from height 'h' and travels distance $h/2$ during last second of motion then time of flight is (in second):

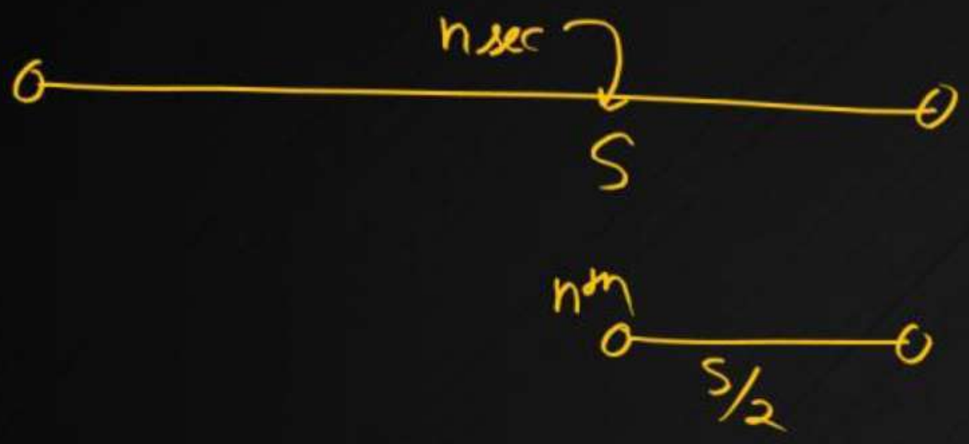
[1999]



$n^2 - 4n + 2 = 0$

$n = \frac{4 \pm \sqrt{16-8}}{2} = 2 \pm \sqrt{2}$

1. $\sqrt{2} - 1$
2. $2 + \sqrt{2}$
3. $\sqrt{2} + \sqrt{2}$
4. $\sqrt{3} + 2$



$$S = \frac{1}{2}an^2$$

$$S_{nth} = \frac{S}{2} = (2n-1)\frac{a}{2}$$

$$\frac{1}{2}an^2 = (2n-1)\frac{a}{2}$$

$$n^2 = 4n-2$$

$$n^2 - 4n + 2 = 0$$

$$n = 2 \pm \sqrt{2}$$

QUESTION-108

Difficulty Level : Medium

AP

A body covers 20 m, 22 m, 24 m, in 8^{th}, 9^{th} and 10^{th} seconds respectively. The body starts.

[NCERT Based]

1 2 3 4 5 6 7 8 9 10
6 8 10 12 14 16 18 20 22 24

1. From rest and moves with uniform velocity
2. From rest and moves with uniform acceleration
3. With an initial velocity and moves with uniform acceleration ✓
4. With an initial velocity and moves with uniform velocity.

$S_{nth} = u + \frac{(2n-1)a}{2}$ AP

$S_{8th} = u + (2\times8-1)\frac{a}{2} = 20$

$S_{9th} = 22$

$S_{10th} = 24$

u, a

QUESTION-109

Difficulty Level : Hard

A body covers a distance of 4 m in 3rd second and 12 m in 5th second. if the motion is uniformly accelerated, how far will it travel in the next 3 seconds [NCERT Based]

1. 10 m
2. 30 m
3. 40 m
4. 60 m

$\frac{3^{rd}}{4}$ $\frac{4^{th}}{8}$ $\frac{5^{th}}{12}$ 6^{th} 7^{th} 8^{th}

$16 + 20 + 24$

Difficulty Level : Medium

QUESTION-110

$2n-1 \rightarrow$ odd

A body A starts from rest with an acceleration a_1. After 2 seconds, another body B starts from rest with an acceleration a_2. If they travel equal distances in the 5^{th} second after the start of A, then the ratio $a_1 : a_2$ is equal to [NCERT Based]

1. 5 : 9
2. 5 : 7
3. 9 : 5
4. 9 : 7

$S_{n^{th}} = u + (2n-1)\frac{a}{2}$

$S_{1st} = u + \frac{a}{2}$

$S_{2nd} = u + 3a/2$

$S_{3rd} = u + 5a/2$

$S_{4th} = u + 7a/2$

$u + \frac{9a_1}{2} = u + \frac{5a_2}{2}$

$\frac{a_1}{a_2} = \frac{5}{9}$

QUESTION-111

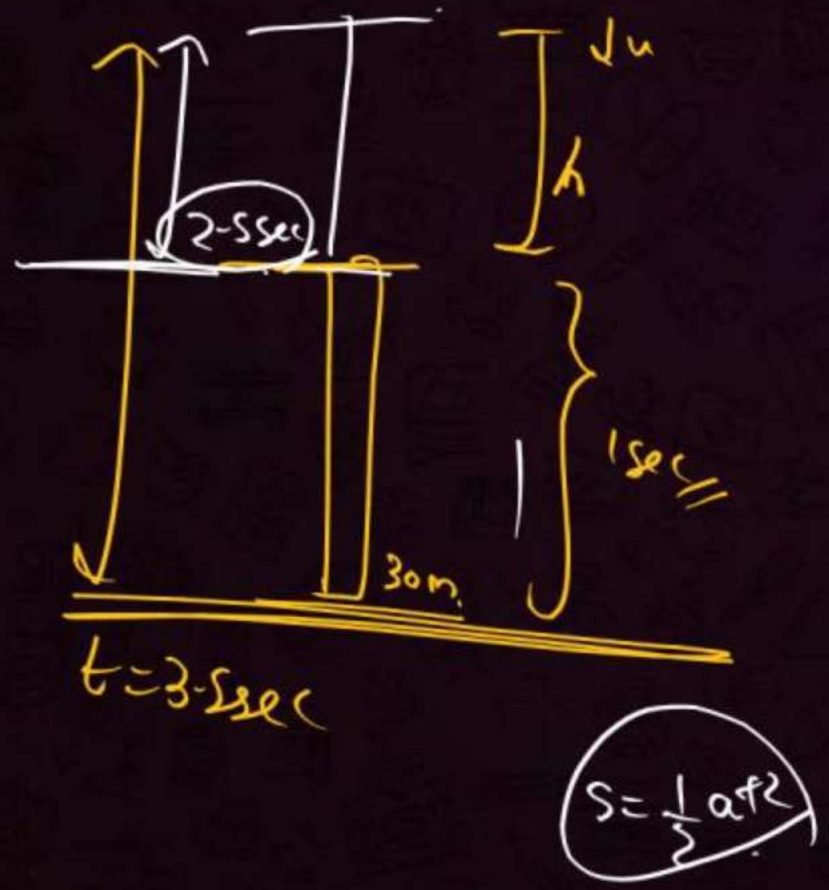
Difficulty Level : Hard

$g = 10$

A body falling freely under gravity passes two points 30 m apart in 1s. From what point above the upper point it began to fall? (Take $g = 9.8\ ms^{-2}$)

[NCERT Based]

1. 32.1 m
2. 16.0 m
3. 8.6 m
4. 4.0 m



$30 = (2n-1)\frac{10}{2}$

$2n-1 = 6$

$2n = 7$

$n = 7/2 = 3.5$

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

QUESTION-111

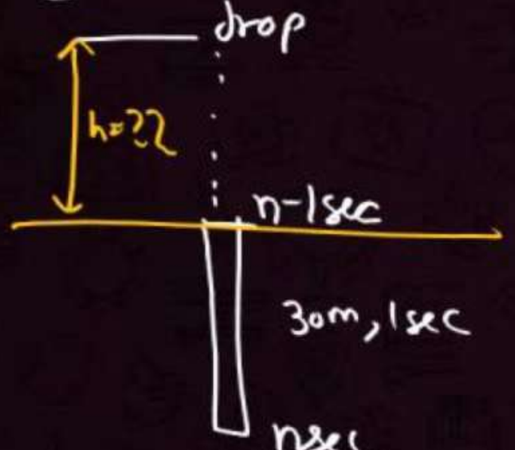
Difficulty Level : Hard

A body falling freely under gravity passes two points 30 m apart in 1s. From what point above the upper point it began to fall? (Take g = 9.8 ms^{-2})

[NCERT Based]

1. 32.1 m
2. 16.0 m
3. 8.6 m
4. 4.0 m

(I) Diagram



$S_{nth} = (2n-1)\frac{a}{2}$

$30 = (2\times n-1)\frac{9.8}{2}$

$6 = 2n-1$

$7 = 2n$

$n = \frac{7}{2} = 3.5$

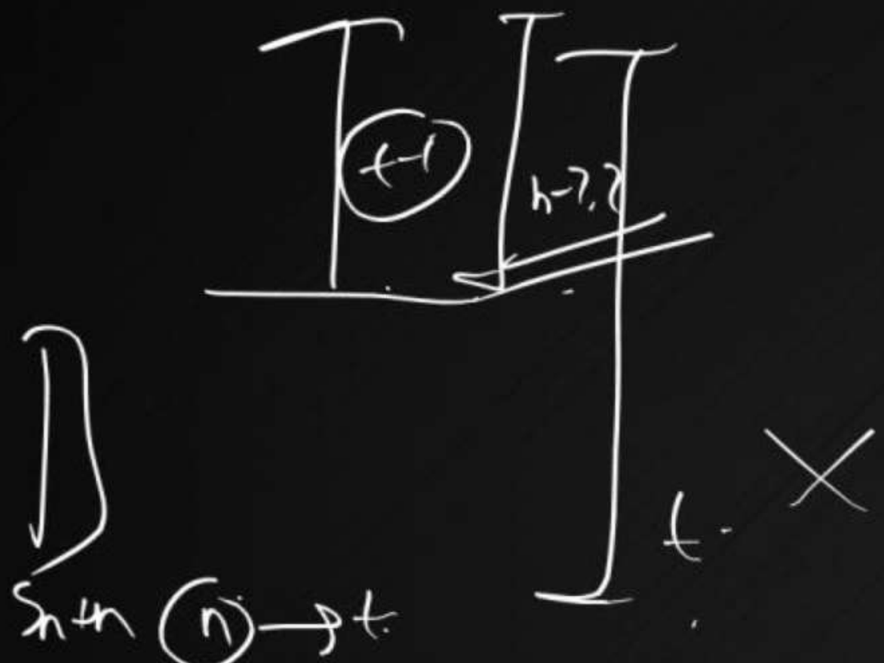
$t = n-1 = 2.5$ sec

drop + 2.5 sec = t

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

$= \frac{1}{2}\times 10\times\frac{5}{2}\times\frac{5}{2}$

$= \frac{125}{4} = 31.$



Difficulty Level : Hard

QUESTION-112

A body initially at rest is moving with uniform acceleration a. its velocity after n seconds is v. The displacement of the body in last 2s is [NCERT Based]

1. $\frac{2v(n-1)}{n}$
2. $\frac{v(n-1)}{n}$
3. $\frac{v(n+1)}{n}$
4. $\frac{2v(n+1)}{n}$

$u=0$, a, n, v

$v = u + at$

$v = an$

add

$S_{nth} = (2n-1)\frac{a}{2}$

$S_{(n-1)th} = (2n-3)\frac{a}{2}$

$S_{last\,2} = \frac{a}{2}(4n-4)$

$2 \times \frac{a}{2}(n-1)$

$= \frac{2v(n-1)}{n}$

QUESTION-113

Difficulty Level : Hard

A particle starts from rest and moves with uniform acceleration. Then the ratio of distance covered in nth second to n second is

1. $\frac{n^2}{2n-1}$
2. $\frac{2}{n}-\frac{1}{n^2}$
3. $\frac{n^2}{n+1}$
4. $\frac{2n+1}{n^2}$

$$\frac{S_{nth}}{S_n}=\frac{(2n-1)\frac{a}{2}}{\frac{1}{2}an^2}$$

QUESTION-114

Difficulty Level : Medium

A small block slides without friction down an inclined plane starting from rest. Let S_n be the distance travelled from time $t = n - 1$ to $t = n$. Then $\frac{S_n}{S_{n-1}}$ =

1. $\frac{2n-1}{2n}$
2. $\frac{2n+1}{2n-1}$
3. $\frac{2n-1}{2n-3}$
4. $\frac{2n}{2n+1}$

Puppy 16 – 1st equation of motion

Difficulty Level : Easy

1. Find acceleration of truck if its speed increases from 40 m/s to 200 m/s in 10 seconds.

2. Find acceleration of truck if its speed increases from 20 m/s to 50 m/s in 10 seconds.

3. 61. A car moving with velocity of 10 m/s accelerates with 8 m/s^2 for 10 sec. Calculate its final velocity.

4. A girl moving with 18 km/h speed is accelerated with 3 m/s^2. What will be her speed after four seconds, 10 seconds and 17 seconds.

5. A rickshaw moving with 30 m/s and -2 m/s^2 for 3 s. Calculate its final Velocity.

9.3 PUPPY Analysis

Rest start $v = u + at$

	1 sec	2 sec	3 sec	4 sec	- - - -
v	a	2a	3a	4a	

Q An object starts from rest with $a = 8\ m/s^2$. Velocity after 8 sec is 64 m/s

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

	1 sec	2 sec	3 sec	7 sec
S	$\left(\frac{a}{2}\right)$	$4\left(\frac{a}{2}\right)$	$9\left(\frac{a}{2}\right)$	$49\left(\frac{a}{2}\right)$

Q rest $a = 8\ m/s^2$. S covered in (6 sec) $= 36 \times 4 =$ 144 m

$S_{nth} = \cancel{x} + (2n-1)\frac{a}{2}$

Rest

1st	2nd	3rd	4th
$\frac{a}{2}$	$\frac{3a}{2}$	$\frac{5a}{2}$	$\frac{7a}{2}$

Gravity $a = g = 10$

	v
1sec	10m/s
2sec	20m/s
3sec	30m/s
4sec	40m/s
5sec	50m/s
6sec	60m/s

$S = h$

$5 \times 1^2 = 5m$

$5 \times 2^2 = 20m$

$5 \times 3^2 = 45m$

$5 \times 4^2 = 80m$

$5 \times 5^2 = 125m$

$5 \times 6^2 = 180m$

S_{nth}

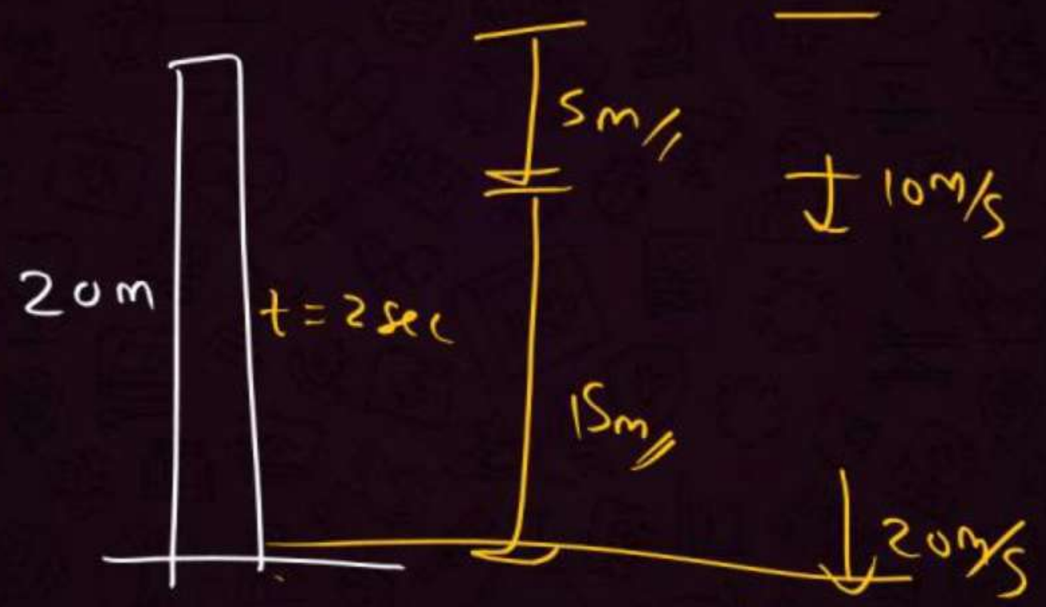
1st	5m	5m
2nd	3×5	15m
3rd	5×5	25m
4th	7×5	35m
5th	9×5	45m
6th	11×5	55m

QUESTION-116

Difficulty Level : Easy

A boy standing at the top of a tower of 20 m height drops a stone. Assuming $g = 10 m/s^2$ the velocity with which it hits the ground is: [2011 Pre]

1. 10.0 m/s
2. 20.0 m/s
3. 40.0 m/s
4. 5.0 m/s



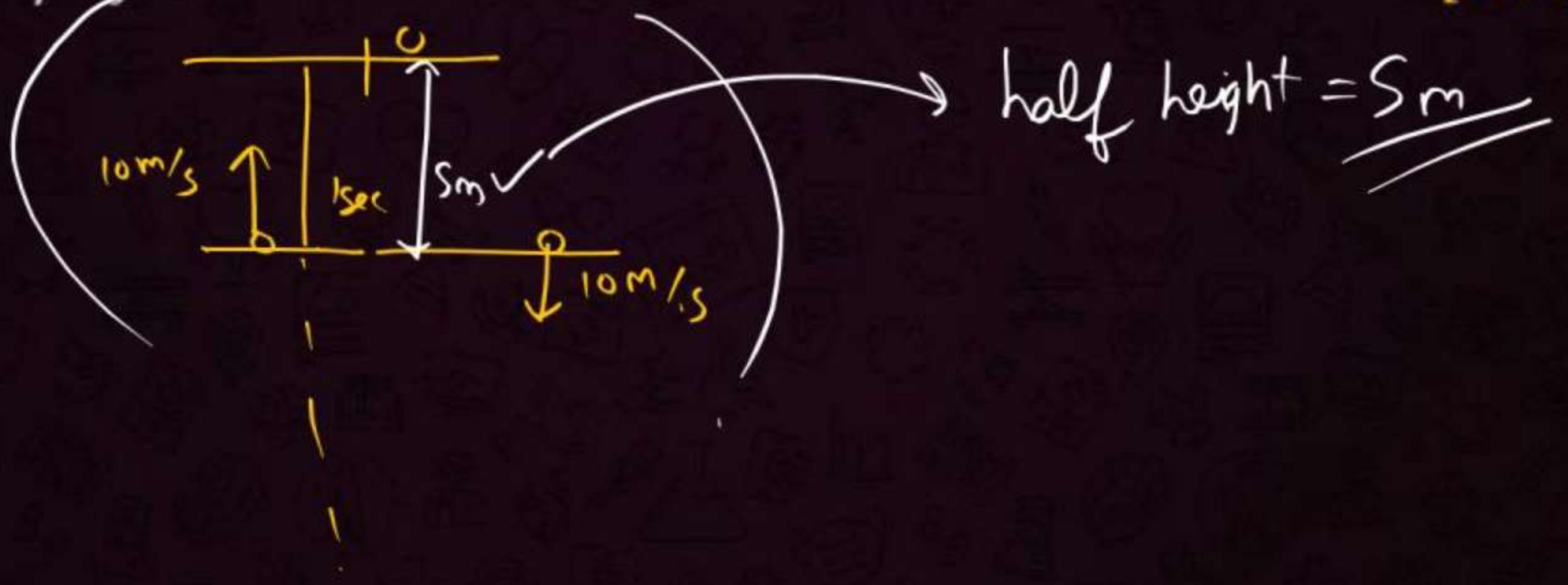
Difficulty Level : Easy

QUESTION-117

A ball is thrown vertically upward. It has a speed of 10 m/s when it has reached one half of its maximum height. How high does the ball rise?

(Taking 'g' = 10 m/s^2)

[2005]



1. 6 m
2. 10 m
3. 14 m
4. 18 m

Difficulty Level : Hard

QUESTION-118

A particle is thrown vertically upward. Its velocity at half of the height is 10 m/s then the maximum height attained by it:

($g = 10\ m/s^2$)

[2001]

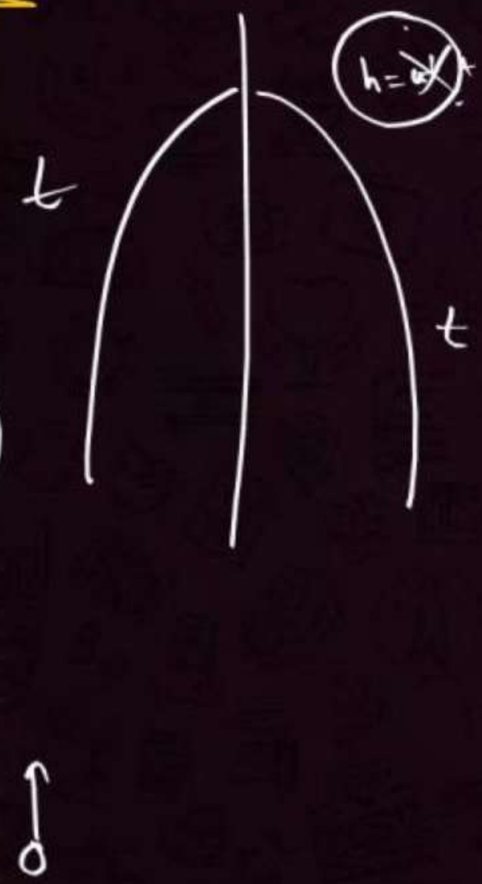
1. 8 m
2. 20 m
3. 10 m
4. 16 m

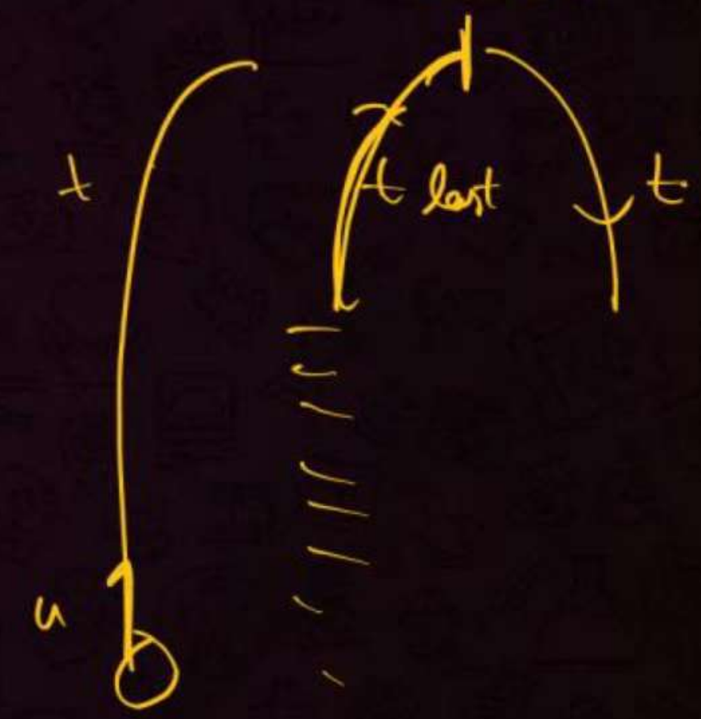
Difficulty Level : Hard

QUESTION-119

If a ball is thrown vertically upwards with speed u, the distance covered during the last 't' seconds of its ascent is: [2003]

1. ut
2. $\frac{1}{2}gt^2$
3. $ut - \frac{1}{2}gt^2$
4. $(u + gt)t$

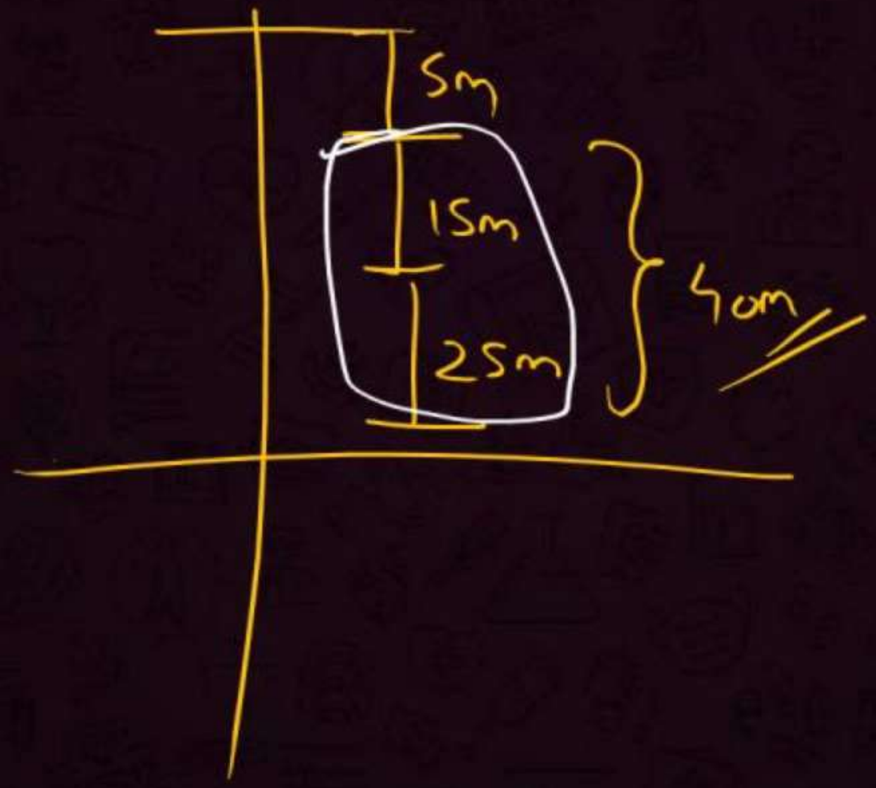




Difficulty Level : Hard

QUESTION-120

A body dropped from top of a tower fall through 40 m during the last two seconds of its fall. The height of tower is ($g = 10\ m/s^2$): [1992]



1. 60 m
2. 45 m
3. 80 m
4. 50 m

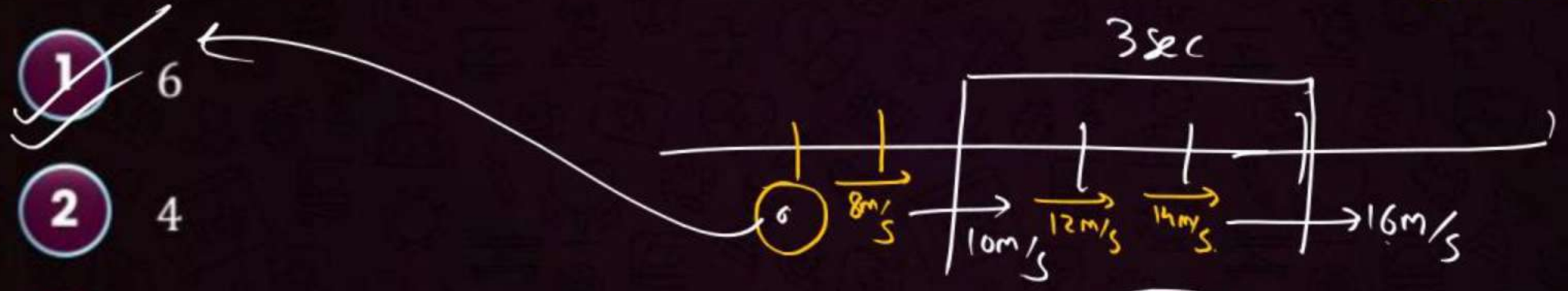
Difficulty Level : Medium

QUESTION-121

The velocity of a particle at an instant is 10 ms^{-1}. After 3s its velocity will become 16 ms^{-1}. The velocity (in ms^{-1}) at 2s, before the given instant will be

[NCERT Based]

1. 6
2. 4
3. 2
4. 1



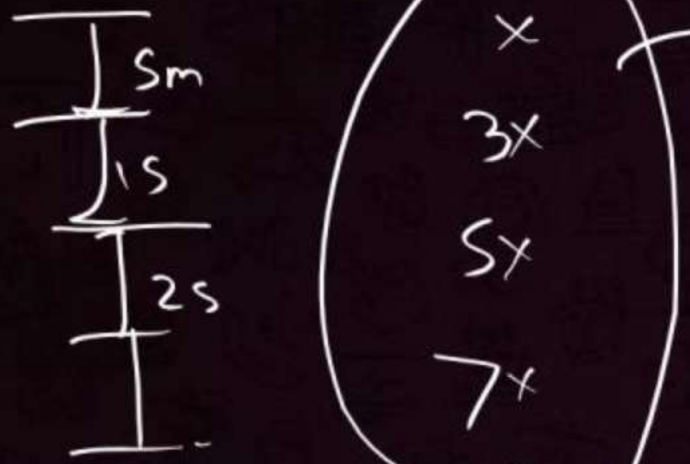
$16 = 10 + at$

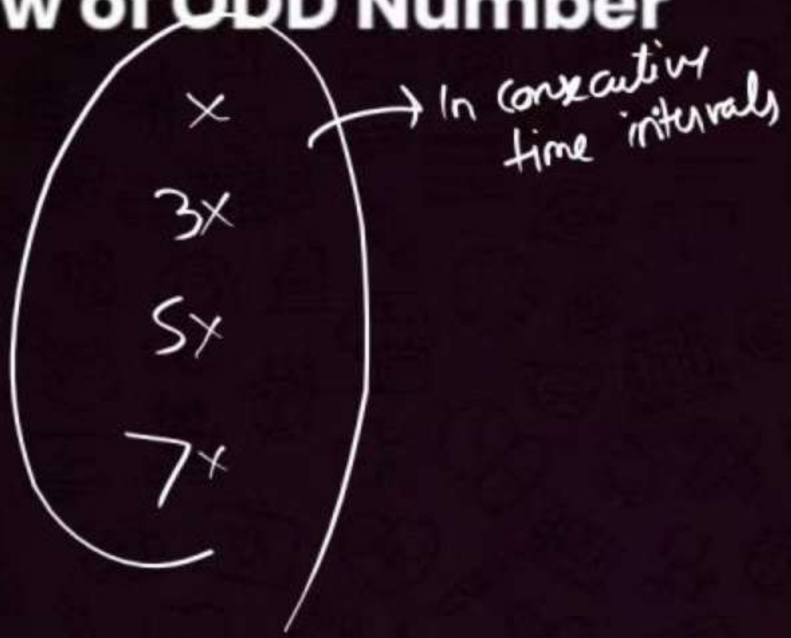
$6 = a3$

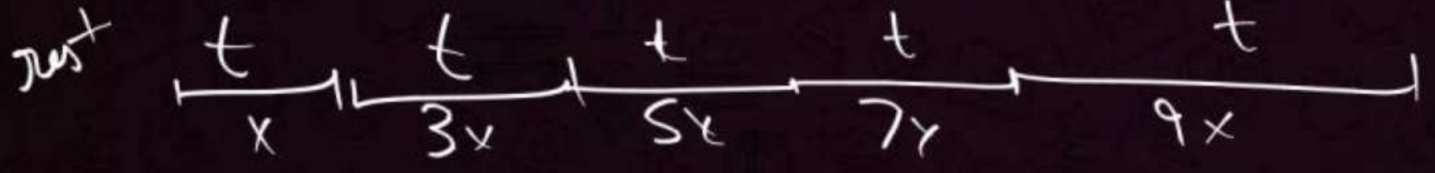
$a = 2 m/s^2$

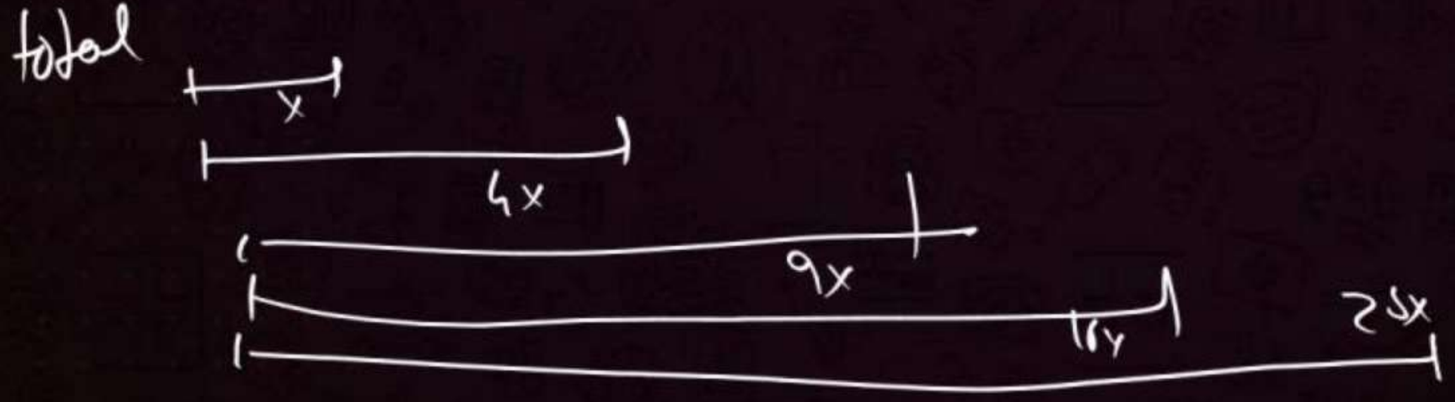
$a = \frac{\Delta v}{t} = \frac{6}{3} = 2 m/s^2$

9.4 Galileo Law of ODD Number









Puppy 20 – Galileo ki JAY

Difficulty Level : Easy

1. A girl starts running from rest with acceleration of 2 m/s². Find her a velocity after 1s, 2s, 3s, 4s, 5s and 10s.

2. A girl starts running from rest with acceleration of 2 m/s². Find her a displacement after 1s, 2s, 3s, 4s, 5s and 10s.

3. A girl starts running from rest with acceleration of 2 m/s². Find her a displacement in 1st, 2nd, 3rd, 4th, 5th and 10th second.

Puppy 21 – Galileo ki JAY

Difficulty Level : Easy

1. Ball is released from tower. What will be it's speed after
1s , 2s , 3s , 4s , 5s , 6s , 7s , 8s , 9s and 10s.

2. A ball is released from a tower. What will be distance covered after
1s , 2s , 3s , 4s , 5s , 6s , 7s , 8s , 9s and 10s.

3. A ball is released from a tower. What will be distance covered in
1^{st} , 2^{nd} , 3^{rd} , 4^{th} , 5^{th} , 6^{th} , 7^{th} , 8^{th} , 9^{th} and 10^{th} second.

Difficulty Level : Easy

QUESTION-122

A particle starts its motion from rest under the action of a constant force. If the distance covered in first 10 seconds is S_1 and that covered in the first 20 seconds is S_2 then: [2009]

1. $S_2 = 3S_1$
2. $S_2 = 4S_1$
3. $S_2 = S_1$
4. $S_2 = 2S_1$

Difficulty Level : Easy

QUESTION-123

A body starts from rest, what is the ratio of the distance travelled by the body during the 4^{th} and 3^{rd} second? [1993]

1. 7/5
2. 5/7
3. 7/3
4. 3/7

$\frac{7}{5}$

Difficulty Level : Easy

QUESTION-124

The ratio of the distance traveled by a freely falling body in the 1^{st}, 2^{nd}, 3^{rd} and 4^{th} second: [2022]

1. 1 : 1 : 1 : 1
2. 1 : 2 : 3 : 4
3. 1 : 4 : 9 : 16
4. 1 : 3 : 5 : 7

Difficulty Level : Medium

QUESTION-125

hw

A stone falls freely under gravity. It covers distances h_1 h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1 h_2 and h_3 is: [2013]

1. $h_1 = h_2 = h_3$
2. $h_1 = 2h_2 = h_3$
3. $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$
4. $h_2 = 3h_1$ and $h_3 = 3h_2$

Difficulty Level : Easy

QUESTION-126

What will be the ratio of the distance moved by a freely falling body from rest in 4^{th} and 5^{th} seconds of journey? [1989]

1. 4 : 5
2. 7 : 9
3. 16 : 25
4. 1 : 1

Difficulty Level : Easy

QUESTION-127

HW

A body starts from rest and moves with constant acceleration for t s. It travels a distance x_1 in first half of time and x_2 in next half of time, then. [NCERT Based]

1. $x_2 = 3x_1$
2. $x_2 = x_1$
3. $x_2 = 4x_1$
4. $x_2 = 2x_1$

Difficulty Level : Medium

QUESTION-128

The distances covered by a freely falling body in its first, second, third, ... n^{th} seconds of its motion.

[NCERT Based]

1. Forms an arithmetic progression
2. Forms a geometric progression
3. Do not form any well defined series
4. Form a series corresponding to the difference of square root of the successive natural numbers

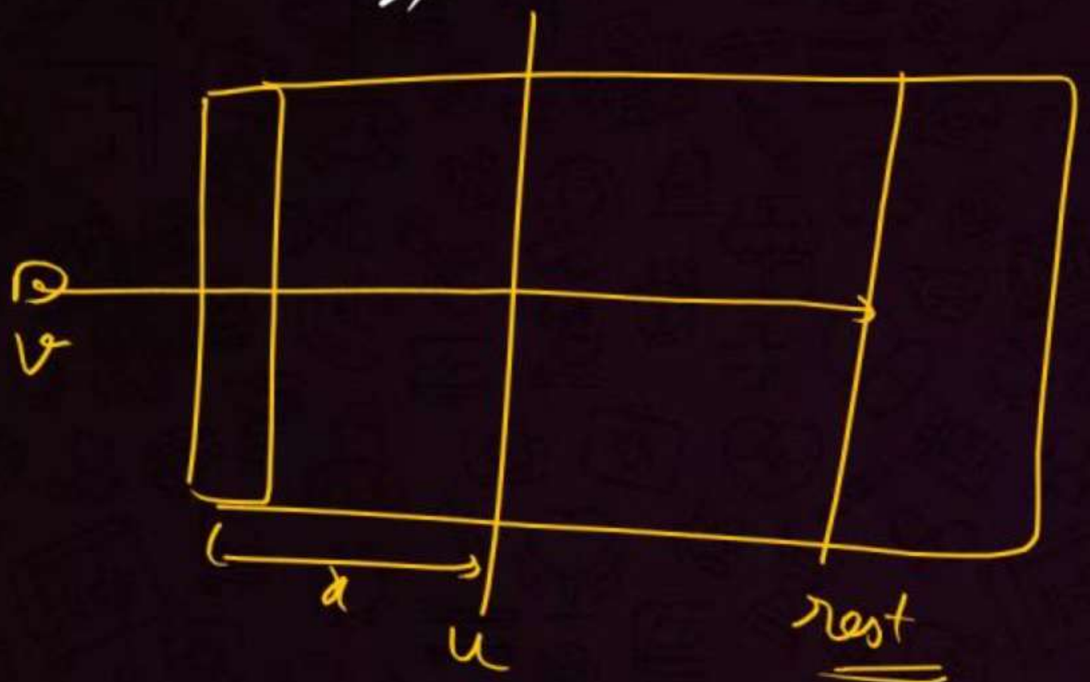
Difficulty Level : Hard

QUESTION-129

A body sliding on a smooth inclined plane requires 4 seconds to reach the bottom, starting from rest at the top, How much time does it take to cover one-fourth the distance starting from rest at the top? [NCERT Based]

1. 1 s
2. 4 s
3. 2 s
4. 16 s

9.5 Bullet Plank



a is constant

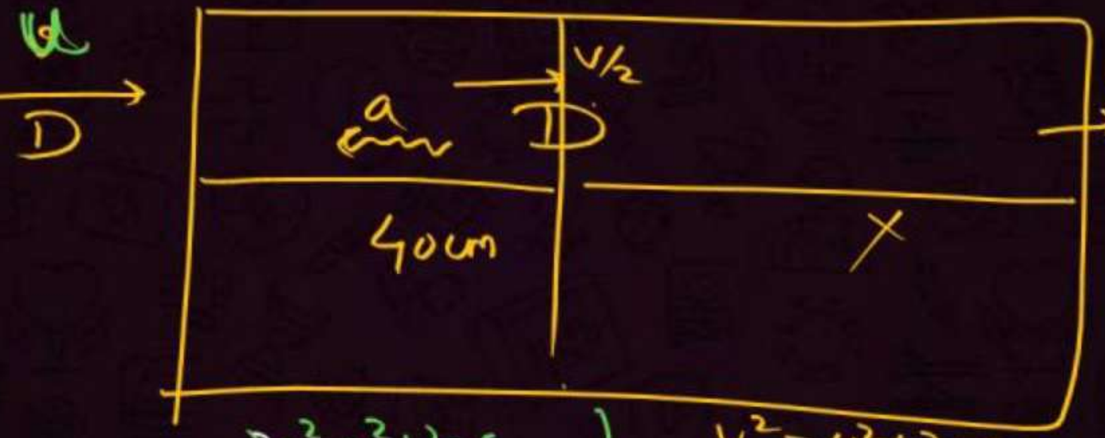
QUESTION-130

❤ If bullet looses half it's velocity in distance x, then it stops in distance x/3 ✓

Difficulty Level : Hard

A bullet fired into a wooden block losses half of its velocity after penetrating 40 cm. it comes to rest after penetrating a further distance of **[NCERT Based]**

1. 22/3 cm
2. 40/3 cm
3. 20/3 cm
4. 22/5 cm



$v^2 = u^2 + 2as$

$\left(\frac{v}{2}\right)^2 = u^2 + 2as$

$\frac{v^2}{4} - v^2 = 2as$

$\frac{-3v^2}{4} = 2a40$

$v^2 = u^2 + 2as$

$0 = \left(\frac{v}{2}\right)^2 + 2as$

$-\frac{v^2}{4} = 2as$

$3(2as) = 2a40$

$s = \frac{40}{3}$

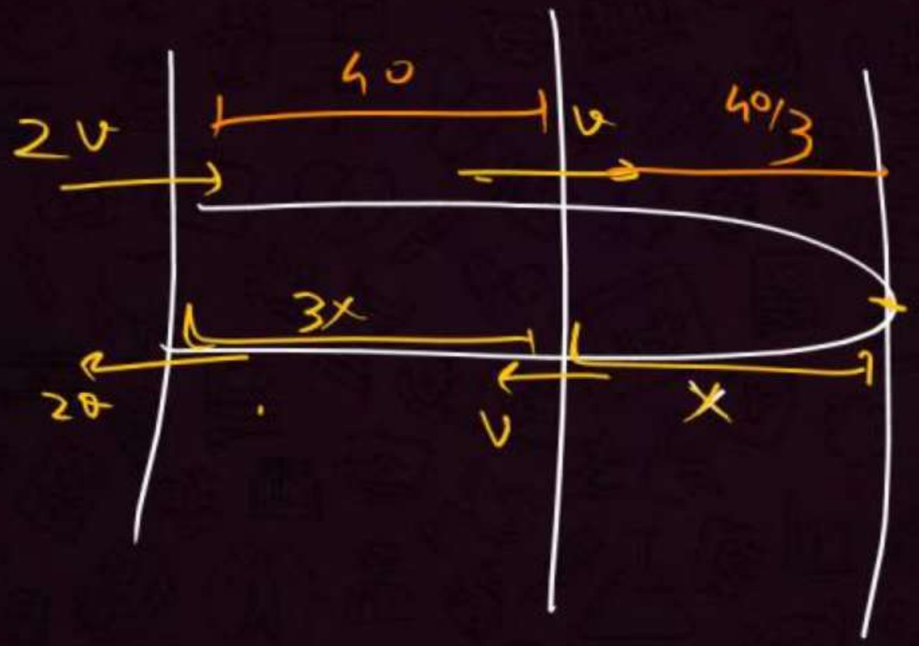
QUESTION-130

❤ If bullet looses half it's velocity in distance x, then it stops in distance x/3

Difficulty Level : Hard

A bullet fired into a wooden block losses half of its velocity after penetrating 40 cm. it comes to rest after penetrating a further distance of [NCERT Based]

1. 22/3 cm
2. 40/3 cm
3. 20/3 cm
4. 22/5 cm



Difficulty Level : Easy

QUESTION-131

The velocity of a bullet is reduced by 200 m/s while travelling through a wooden block in 10 sec. The retardation, assuming it to be uniform, will be:

1. $10\ m/s^2$
2. $12\ m/s^2$
3. $20\ m/s^2$
4. $15\ m/s^2$

Difficulty Level : YODHA

QUESTION-132

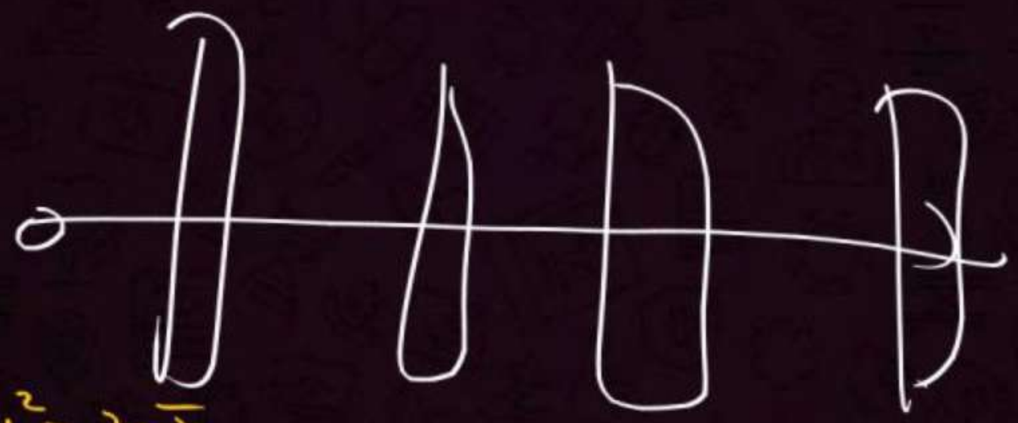
$v_f = \frac{19v}{20}$

❤ Number of plank $= \frac{v^2}{v^2-u^2}$ → whole Number

7.2 → 8

A bullet loses 1/20 of its velocity passing through a plank. The least number of planks required to stop the bullet is (All planks offers same retardation)

1. 10
2. 11
3. 12
4. 23



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

$v^2 = \frac{1}{2aNx}$

$N = \frac{v^2}{v^2 - u^2}$

$N = \frac{v^2}{v^2 - \left(\frac{19v}{20}\right)^2} = \frac{1}{1 - \frac{361}{400}}$

$N = \frac{400}{39} = 10.1$

11

Difficulty Level : Easy

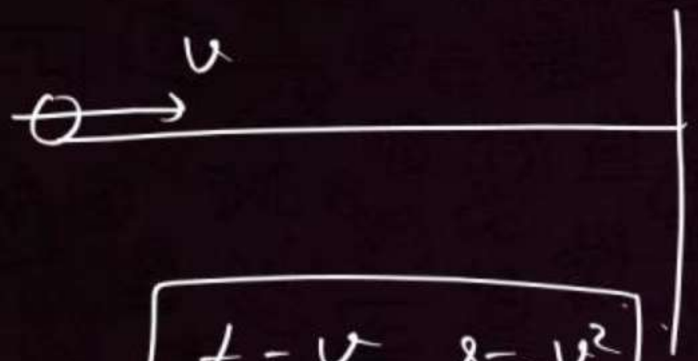
QUESTION-133

HW

Two bodies, A (of mass 1 kg) and B (of mass 3 kg) are dropped from heights of 16 m and 25 m, respectively. The ratio of the time taken by them to reach the ground is: [2006]

1. 5/4
2. 8/5
3. 5/8
4. 4/5

9.7 Stopping Distance



$$t = \frac{u}{a} \qquad s = \frac{u^2}{2a}$$

$v = u + at$

$v^2 = u^2 + 2as$

Difficulty Level : Medium

QUESTION-134

A car moving along a straight road with speed of 144 km h^{-1} is brought to a stop within a distance of 200 m. How long does it take for the car to stop?

[NCERT Based]

1. 5 s
2. 10 s ✓
3. 15 s
4. 20 s

$u = 144$ km/h $\rightarrow 40$ m/s $v = 0$

$s = \frac{u+v}{2} t$

$200 = \frac{40}{2} t$

I choose $\frac{1^{th}}{20}$ of v

$$v - \frac{v}{20} = \frac{19v}{20} = a$$

Difficulty Level : Easy

QUESTION-135

Stopping distance of a moving vehicle is directly proportional to [NCERT Based]

1. Square of the initial velocity ✓

$$S = \frac{u^2}{2a}$$

2. Square of the initial acceleration
3. The initial velocity
4. The initial acceleration

Difficulty Level : Medium

QUESTION-136

A car moving with a speed of 50 km h^{-1} can be stopped by applying brakes after moving at least 6m. If the same car is moving at a speed of 100 km h^{-1}, the minimum stopping distance is.

[NCERT Based]

$S \propto u^2$

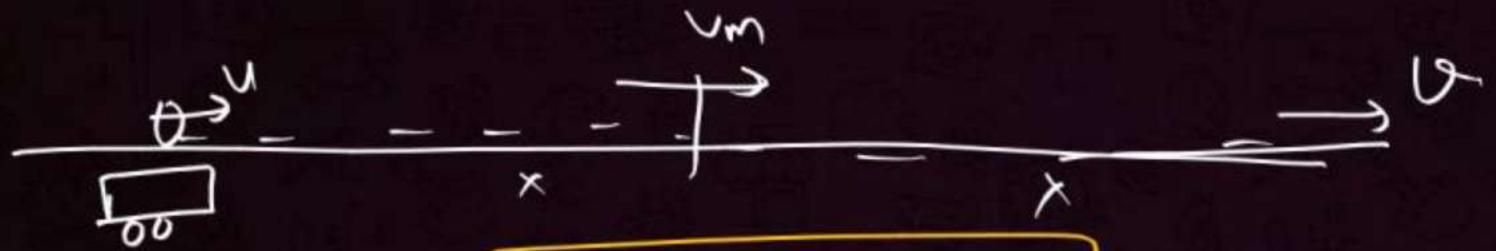
2^2

4 times

1. 6 m
2. 12 m
3. 18 m
4. 24 m

9.8 Speed at Mid Jounery

Const. a



$$v_m = \sqrt{\frac{u^2+v^2}{2}}$$

Difficulty Level : Easy

QUESTION-137

A car is moving along a straight road with a uniform acceleration. It passes through two points P and Q separated by a distance with velocity 30 km/h and 40 km/h respectively. The velocity of the car midway between P and Q is: [1998]

1. 33.3 km/h
2. $20\sqrt{2}$ km / h
3. $25\sqrt{2}$ Km / h
4. 5 km/h

$$V_m = \sqrt{\frac{u^2+v^2}{2}}$$

$$= \sqrt{\frac{30^2+40^2}{2}} = \frac{50}{\sqrt{2}} = 25\sqrt{2}$$

9.9 Ahhhaaa Ratio

time for same distance

$$t : (\sqrt{2}-1)t : (\sqrt{3}-\sqrt{2})t : (\sqrt{4}-\sqrt{3})t : (\sqrt{5}-\sqrt{4})t$$

Difficulty Level : Hard

QUESTION-138

A particle is released from rest from a tower of height $3h$. the ratio of the intervals of time to cover three equal heights h is

[NCERT Based]

1. $t_1 : t_2 : t_3 = 3 : 2 : 1$
2. $t_1 : t_2 : t_3 = 1 : (\sqrt{2}-1) : (\sqrt{3}-2)$
3. $t_1 : t_2 : t_3 = \sqrt{3} : \sqrt{2} : 1$
4. $t_1 : t_2 : t_3 = 1 : (\sqrt{2}-1) : (\sqrt{3}-\sqrt{2})$

QUESTION-139

Difficulty Level : Medium

If a body starts from rest, the time in which it covers a particular displacement with uniform acceleration is:

1. Inversely proportional to the square root of the displacement
2. Inversely proportional to the displacement
3. Directly proportional to the displacement
4. Directly proportional to the square root of the displacement

9.10 U TURN

S → displacement

(S ≠ Distance)

QUESTION-140

Difficulty Level : YODHA

A particle is moving with initial velocity of 20m/s with a constant deceleration of 20 m/s^2 . What will be its distance after 2 seconds

$a = -20$ $\quad$ s $\quad$ t

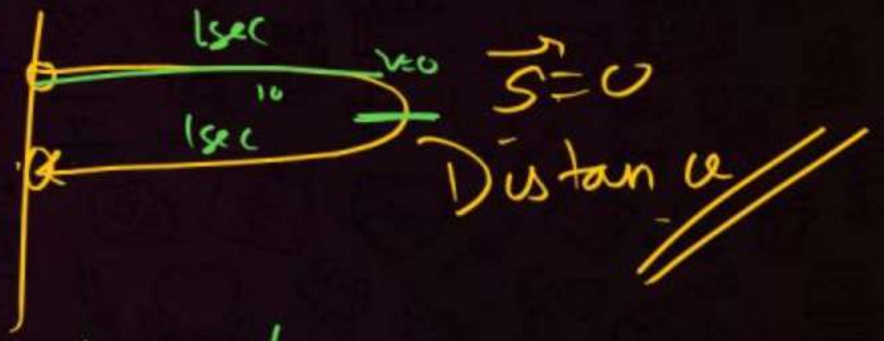
1. 0 m
2. 10 m
3. 20 m
4. 40 m

$$s = ut - \frac{1}{2}at^2$$

$$= 20 \times 2 - \frac{1}{2} \times 20 \times 2 \times 2$$

$$= 40 - 40$$

$$= 0\ m$$



$v = u + at$

$0 = 20 - 20t$ $\quad$ $t = 1\ sec$

$$S = ut - \frac{1}{2}at^2 = 20 \times 1 - \frac{1}{2}\frac{20}{10} \times 1 \times 1$$

$$= 20 - 10 = 10m$$

S_1
S_2
S
S_1+S_2
Distance

PUPPY POINTS-3

$v = u + at$
$S = ut + \frac{1}{2}at^2$
$v^2 = u^2 + 2as$
$S = \left(\frac{u+v}{2}\right)t$
$S_{nth} = u + \frac{(2n-1)a}{2}$

$v = u + gt$
$h = ut + \frac{1}{2}gt^2$
$v^2 = u^2 + 2gh$
$h = \left(\frac{u+v}{2}\right)t$
$h_{nth} = u + \frac{(2n-1)g}{2}$

$v = u - gt$
$h = ut - \frac{1}{2}gt^2$
$v^2 = u^2 - 2gh$
$h = \left(\frac{u+v}{2}\right)t$
$h_{nth} = u - \frac{(2n-1)g}{2}$

Rest $t = \frac{u}{a}$ $t = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2h}{g}}$ $v = \sqrt{2as}$ $v = \sqrt{2gh}$

Stopping Distance $S = \frac{u^2}{2a}$
time $= u/a$

$u = 0$
$v \propto t \propto \sqrt{s}$
$s \propto t^2 \propto v^2$

$u = 0 \rightarrow S_{nth} = \frac{(2n-1)a}{2}$
$S_{n+1^{th}} = \frac{(2n+1)a}{2}$
$S_{n-1^{th}} = \frac{(2n-3)a}{2}$

$a = \frac{\Delta v}{t}$ Change in velocity per second

Rest — Galileo Ratio

			(drop) v
nsec	n^{th} sec	5	10
x	x	20	15 20
$4x$	$3x$	45	25 30
$9x$	$5x$	80	35 40
$16x$	$7x$	125	45 50
$25x$	$9x$	180	55 60
per sec $x = a/2$		↓ n	↓ n^{th}

Ahaa.. Rater
Same distance me kitna time

$\sqrt{1}$. $\sqrt{1}$
$\sqrt{2}$. $\sqrt{2}-\sqrt{1}$
$\sqrt{3}$. $\sqrt{3}-\sqrt{2}$
$\sqrt{4}$. $\sqrt{4}-\sqrt{3}$

x x
$2x$ x
$3x$ x

$v_{mid\ journey} = \sqrt{\frac{u^2+v^2}{2}}$

distance in same time are same → uniform

distance in same time are in AP → a constant

Bullet - Plank (a constant)
No of Plank $= N = \frac{V^2}{v^2 - u^2}$ → after / plank

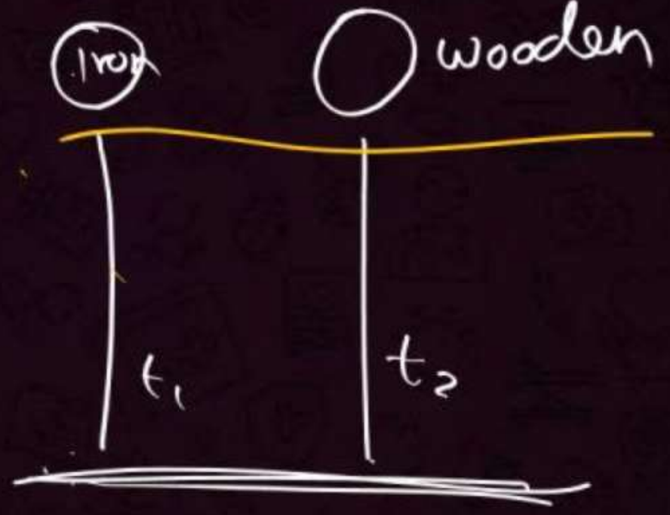
U turn $\overrightarrow{v}$ $\overleftarrow{a}$
Check $v = 0$ at what time
Distance before & after separate calculate

Part 10 – Motion Under Gravity

Difficulty Level : Easy

QUESTION-141

If an iron ball and a wooden ball of same radii are released from a height h in vacuum then time taken by both of them to reach ground will be:



1. Unequal
2. Roughly equal
3. Exactly equal ✓
4. Zero

10.1 Dissection of motion under gravity

$v = u + gt$

$h = ut + \frac{1}{2}gt^2$

$v^2 = u^2 + 2gh$

$v = u - gt$

$h = ut - \frac{1}{2}gt^2$

$v^2 = u^2 - 2gh$

$h = \left(\frac{u+v}{2}\right)t$

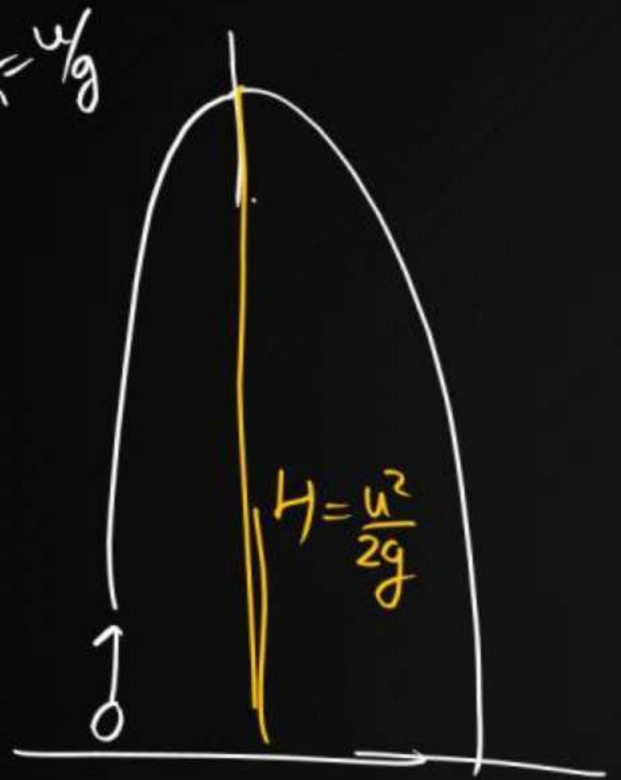
$h_{nth} = u \pm (2n-1)\frac{g}{2}$

Drop $u = 0$

$t = \sqrt{\frac{2h}{g}}$ $\quad v = \sqrt{2gh}$

2 special

$v = u - gt$



$T_f = \frac{2u}{g}$.

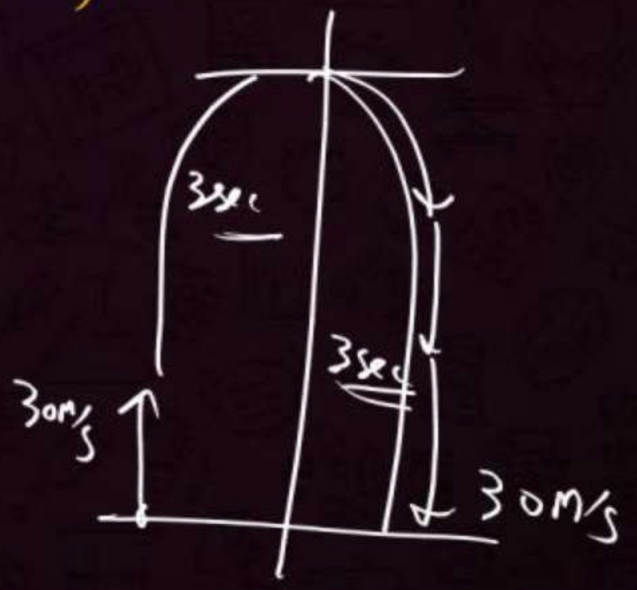
Difficulty Level : Easy

QUESTION-142

A player throws a ball upwards with an initial speed of $30\ ms^{-1}$. How long does the ball take to return to the plyer's hands? (take $g = 10\ ms^{-2}$) [NCERT Based]

1. 3 s
2. 6 s
3. 9 s
4. 12 s

$$T_f = \frac{2u}{g} = \frac{2 \times 30}{10} = 6\ sec.$$



Difficulty Level : Easy

QUESTION-143

hw//

A girl standing on a stationary lift (Open from above) throws a ball upwards with initial speed 50 ms^{-1}. The time taken by the ball to return to her hands is (Take g = 10 ms^{-2})

[NCERT Based]

1. 5 s
2. 10 s
3. 15 s
4. 20 s

Difficulty Level : Hard

QUESTION-144

hw

It is a common observation that rain clouds can be at about 1 km altitude above the ground. if a rain drop falls from such a height freely under gravity, then what will be its speed in km h^{-1}? (Take $g = 10\ ms^{-2}$) [NCERT Based]

1. 510
2. 610
3. 710
4. 910

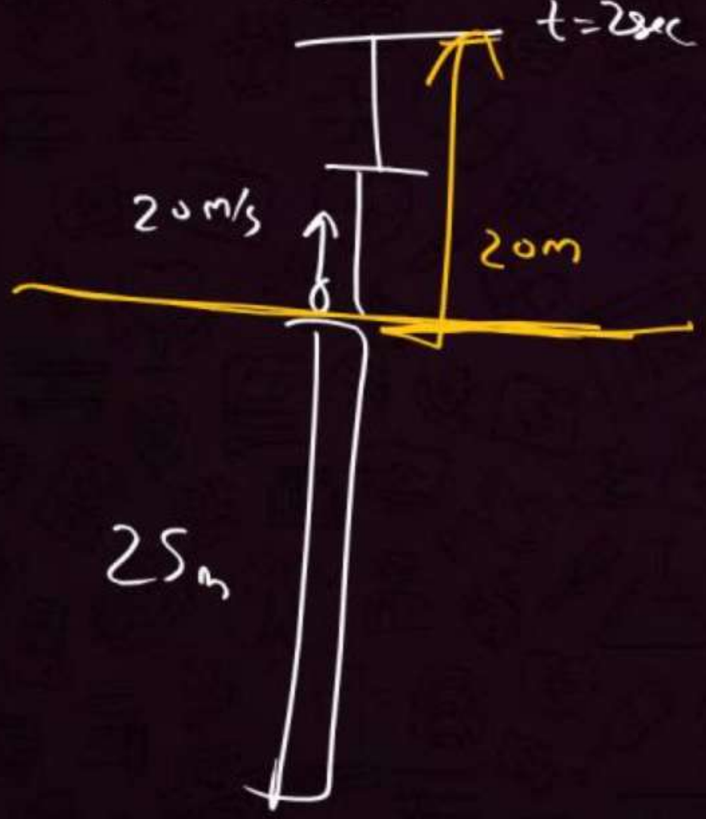
Difficulty Level : Easy

QUESTION-145

A ball is thrown vertically upwards with a velocity of 20 ms^{-1} from the top of a multistorey building of 25 m high. How high will the ball rise?

(Take g = 10 ms^{-2})

[NCERT Based]



1. 10 m
2. 15 m
3. 20 m
4. 25 m

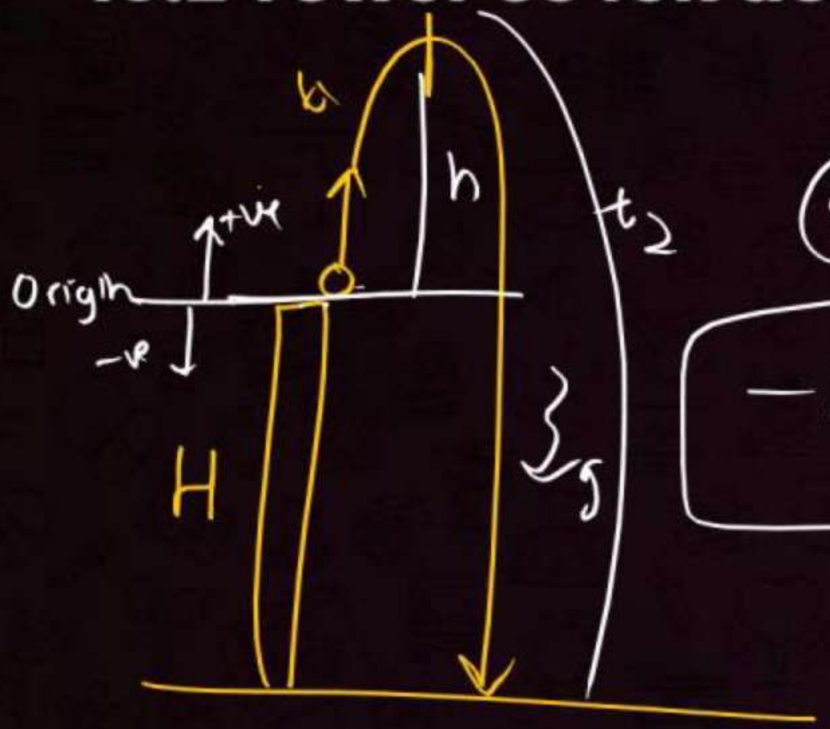
Difficulty Level : Easy

QUESTION-147

An object is thrown vertically with a velocity u. The velocity with which it strikes the ground on its return is [NCERT Based]

1. $u/2$
2. $-u/2$
3. $-u$
4. u

10.2 Tower se fek do



$$S = ut + \frac{1}{2}gt^2 \quad \text{(I)}$$

$$\boxed{-H = ut - \frac{1}{2}gt^2}$$

(II) $t_1 = \frac{u}{g}$

$$h = \frac{u^2}{2g}$$

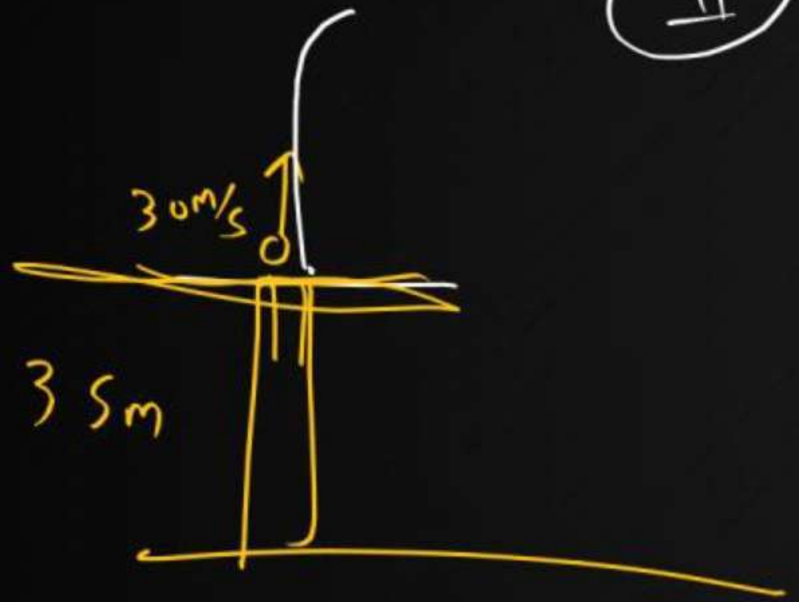
total $H = H + h$

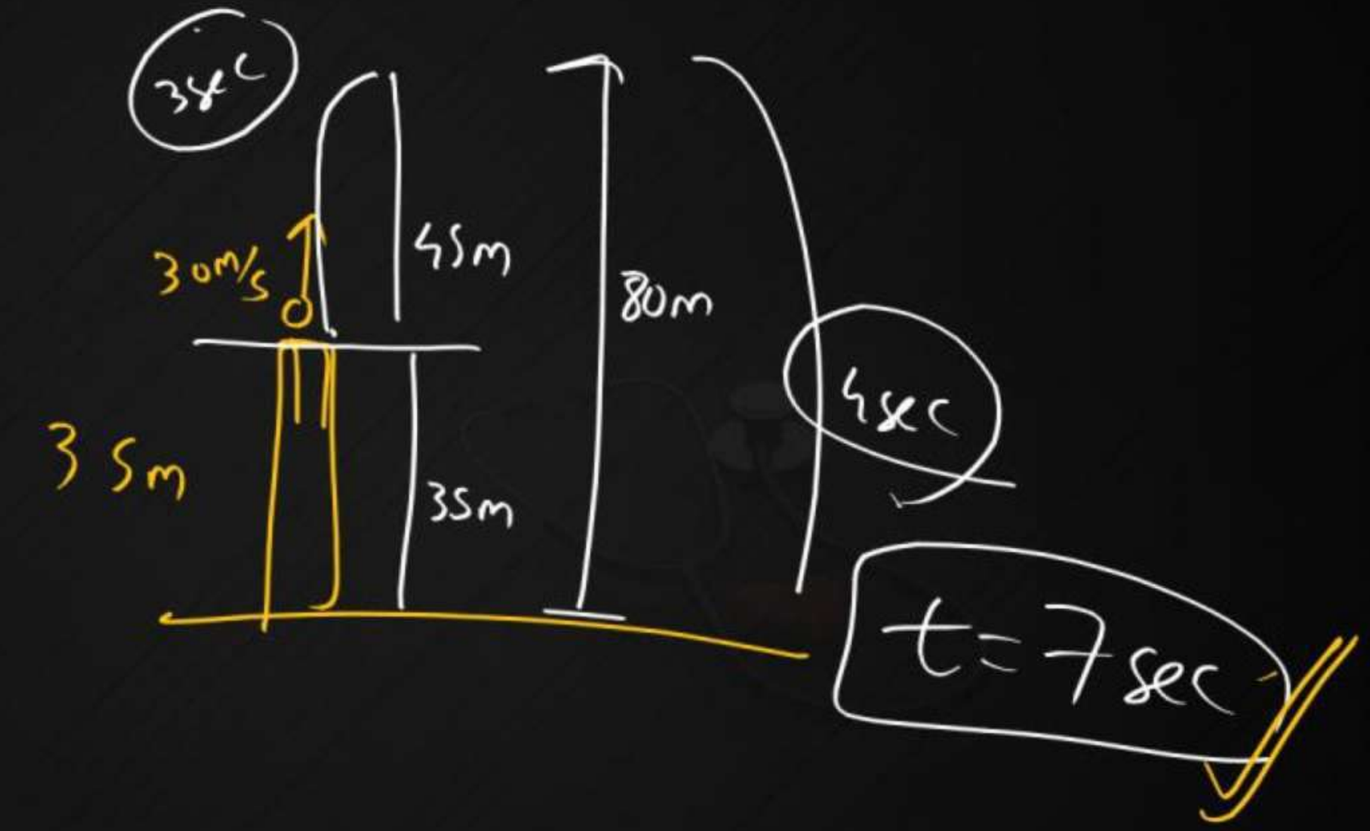
$$t_2 = \sqrt{\frac{2(H+h)}{g}}$$

(I) $-35 = 30t - \frac{1}{2}\times 10 t^2$ Solve

$t =$

(II)





QUESTION-146

Difficulty Level : Medium

A ball is thrown vertically upwards with a velocity of 20 ms^{-1} from the top of a multistorey building of 25 m high. The time taken by the ball to reach the ground is (Take g = 10 ms^{-2}),

[NCERT Based]

1. 2 s
2. 3 s
3. 5 s ✓
4. 7 s

Difficulty Level : Hard

QUESTION-148

HW

A stone thrown upwards with a speed 'u' from the top of the tower reaches the ground with a velocity $3u'$. The height of the tower is:

1. $\frac{4u^2}{g}$
2. $\frac{4u^3}{2g}$
3. $\frac{8u^2}{g}$
4. $\frac{7u^2}{g}$

Difficulty Level : Easy

QUESTION-149

A ball is thrown vertically upwards from the top of a tower at 4.9 ms^{-1}. It strikes the pond near the base of the tower after 3 seconds. The height of the tower is

1. 73.5 m
2. 44.1 m
3. 29.4 m
4. None of these

Ans (3)

Difficulty Level : Easy

QUESTION-150

A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is ($g = 10\ m/s^2$) [NEET 2020]

1. 360 m
2. 340 m
3. 320 m
4. 300 m

QUESTION-151

Difficulty Level : YODHA

Dired

A ball is projected upwards from a height h above the surface of the earth with velocity v. The time at which the ball strikes the ground is

1. $\frac{v}{g}+\frac{2hg}{\sqrt{2}}$
2. $\frac{v}{g}\left[1-\sqrt{1+\frac{2h}{g}}\right]$
3. $\frac{v}{g}\left[1+\sqrt{1+\frac{2gh}{v^2}}\right]$
4. $\frac{v}{g}\left[1+\sqrt{v^2+\frac{2g}{h}}\right]$

$t_1=\frac{v}{g}$ $\quad h=\frac{v^2}{2g}$ $\quad H=\left(h+\frac{v^2}{2g}\right)$

$t_2=\sqrt{\frac{2g}{h}}=\sqrt{\frac{2g}{h+\frac{v^2}{2g}}}$

$T=t_1+t_2=\frac{v}{g}+\sqrt{\frac{(2g)(2g)}{2gh+\frac{v^2}{2g}}}$

Ans (3)

QUESTION-152

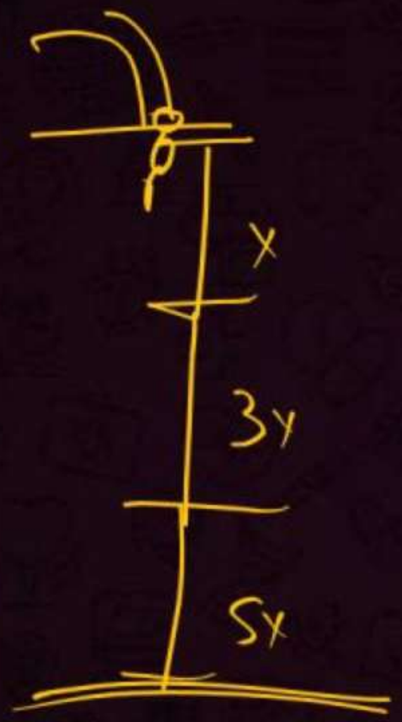
Difficulty Level : YODHA

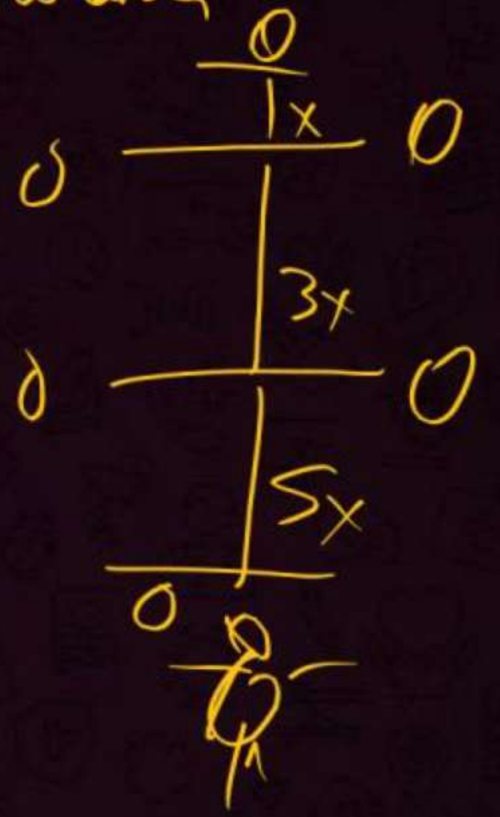
Challenge

From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is n times that taken by it to reach the highest point of its path. The relation between H, u and n is **[Main 2014]**

1. $gH = (n-2)u^2$
2. $2gH = n^2u^2$
3. $gH = (n-2)^2u^2$
4. $2gH = nu^2(n-2)$

10.3 Tip Tip Barsa Pani / Laal tamatar



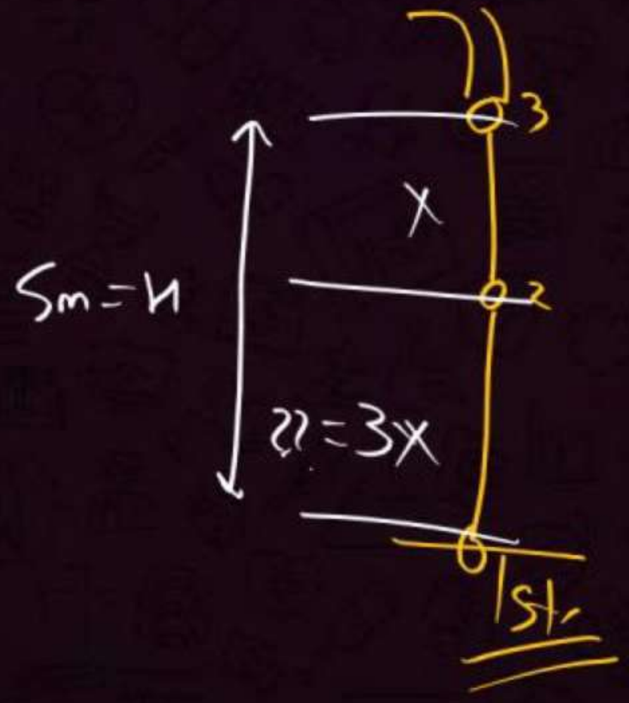


QUESTION-153

Difficulty Level : Hard

The water drop falls at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap at instant the first drop touches the ground. How far above the ground is the second drop at that instant? [1995]

1. 3.75 m
2. 4.00 m
3. 1.25 m
4. 2.50 m



$4x = 5$

$x = \frac{5}{4} = 1.25$

$3x = 3.75$

Difficulty Level : Medium

QUESTION-154

hw

A body dropped from the top of a tower tower is the distance 7X in the last second of its journey, where X is the distance covered in first second. How much time does it take to reach the ground.

1. 1 s
2. 2 s
3. 3 s
4. 4 s

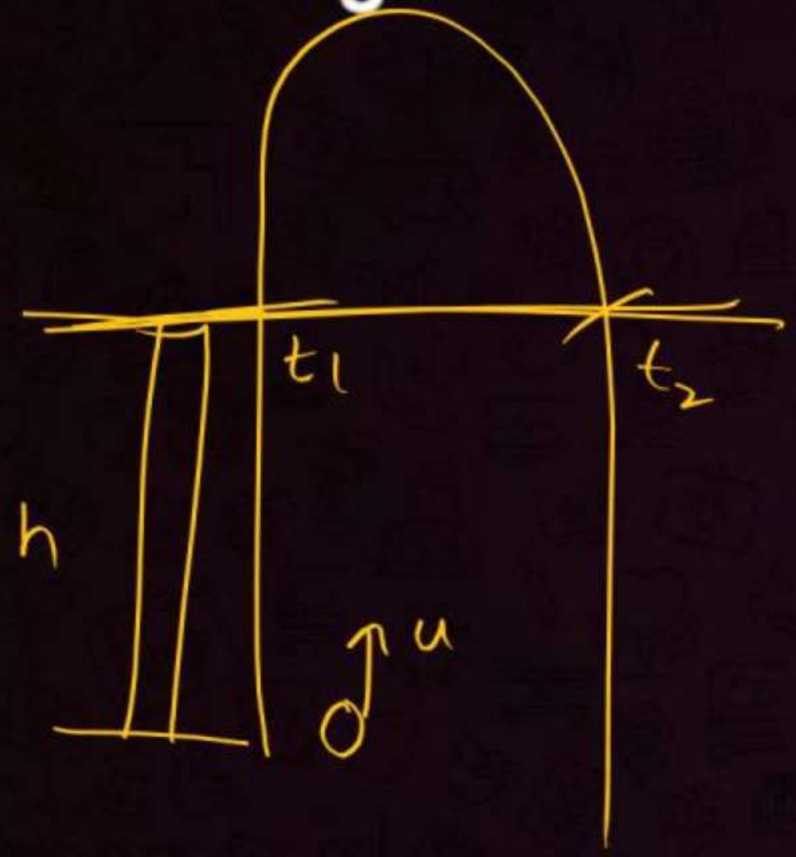
Difficulty Level : MEdium

QUESTION-155

A man throws ball with the same speed vertically upwards one after the other at an interval of 2 seconds. What should be the speed of the throw so that more than two balls are in the sky at any time? (Given $g = 9.8\text{m}/s^2$) [2003]

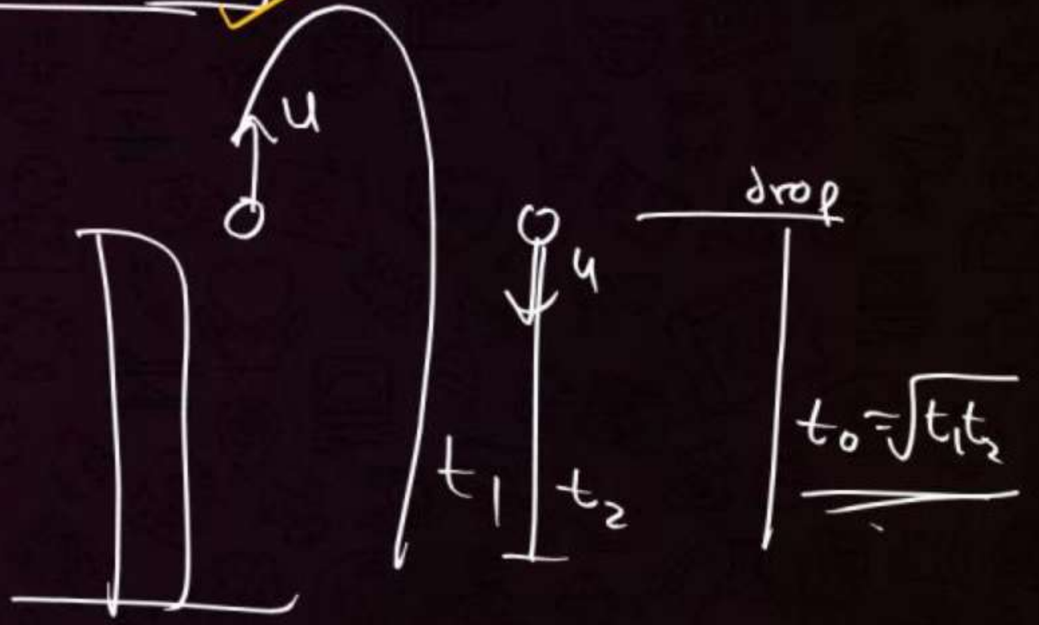
1. More than 19.6 m/s
2. At least 9.8 m/s
3. Any speed less than 19.6 m/s
4. Only with speed 19.6 m/s

10.5 Ek height Do Time



$$u = \frac{1}{2} g (t_1 + t_2)$$

$$h = \frac{1}{2} g (t_1 t_2)$$



Puppy 32 – Ek height Do Time

Difficulty Level : Easy

1. A ball is thrown upwards with velocity u. An observer standing on top of a tower of height sees h the ball two times at 4 seconds and 6 seconds after ball is thrown. Find value of u and h.

2. A ball is thrown upwards with velocity u. An observer standing on top of a tower of height h sees the ball two times at 2 seconds and 8 seconds after the ball is thrown. Find value of u and h.

3. A ball is thrown upwards with velocity u. An observer standing on top of a tower of height h sees the ball two times at 5 seconds and 7 seconds after the ball is thrown. Find value of u and h.

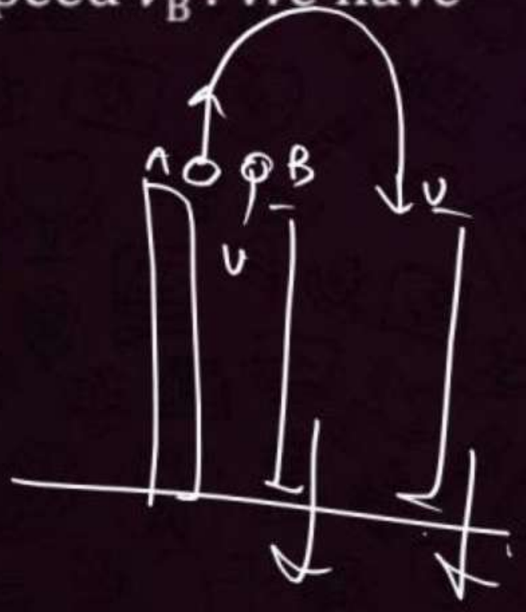
4. A ball is thrown upwards with velocity 30 m/s. An observer standing on top of a tower of height 40 m sees the ball two times after the ball is thrown. Find both values of time when observer sees the ball.

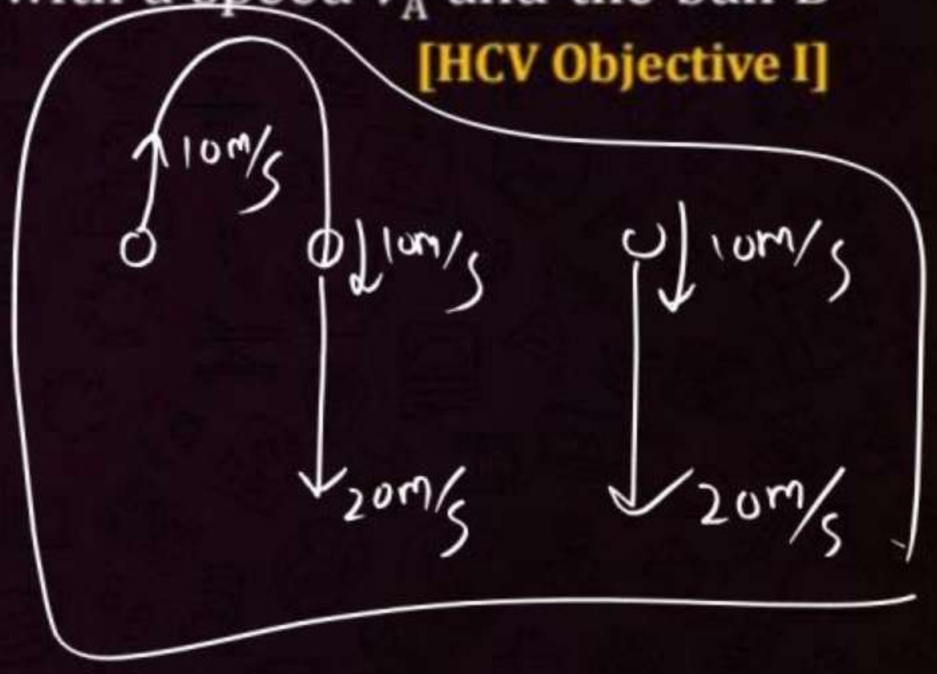
Difficulty Level : Easy

QUESTION-156

A person standing near the edge of the top of a building throws two balls A and B. The ball A is thrown vertically upward and B is thrown vertically downward with the same speed. The ball A hits the ground with a speed v_A and the ball B hits the ground with a speed v_B. We have

[HCV Objective I]





1. $v_A > v_B$
2. $v_A < v_B$
3. $v_A = v_B$
4. the relation between v_A and v_B depends on height of the building above the ground.

Difficulty Level : Easy

QUESTION-157

t_1 t_2

Object is projected up with speed u it is at same height at 4 sec & 6 sec, then find velocity of projection

1. 20 m/s
2. 30 m/s
3. 50 m/s
4. 40 m/s

$$u = \frac{1}{2} g (t_1 + t_2)$$

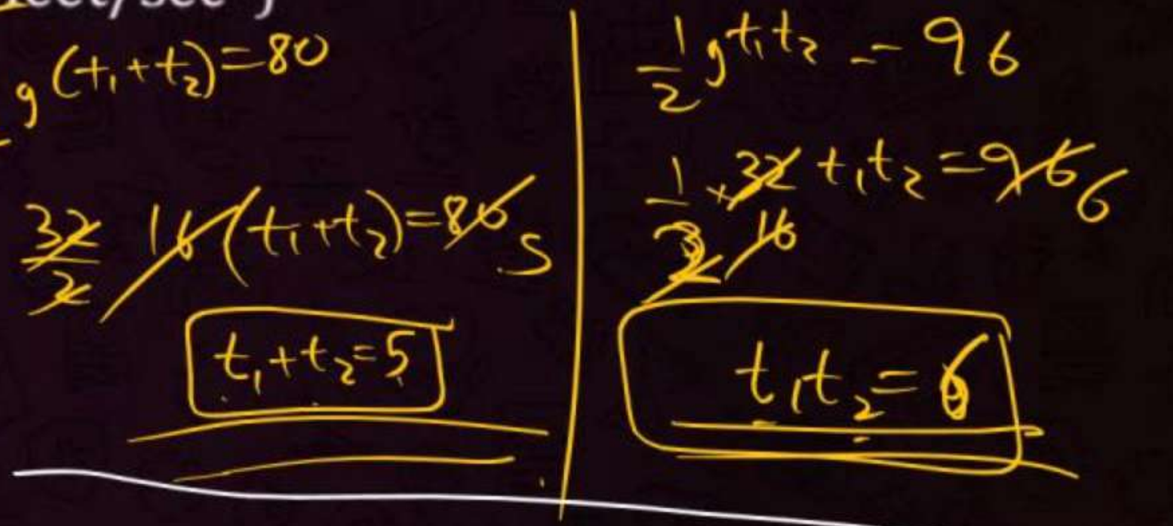
$$= \frac{1}{2} \times 10 (10)$$

QUESTION-158

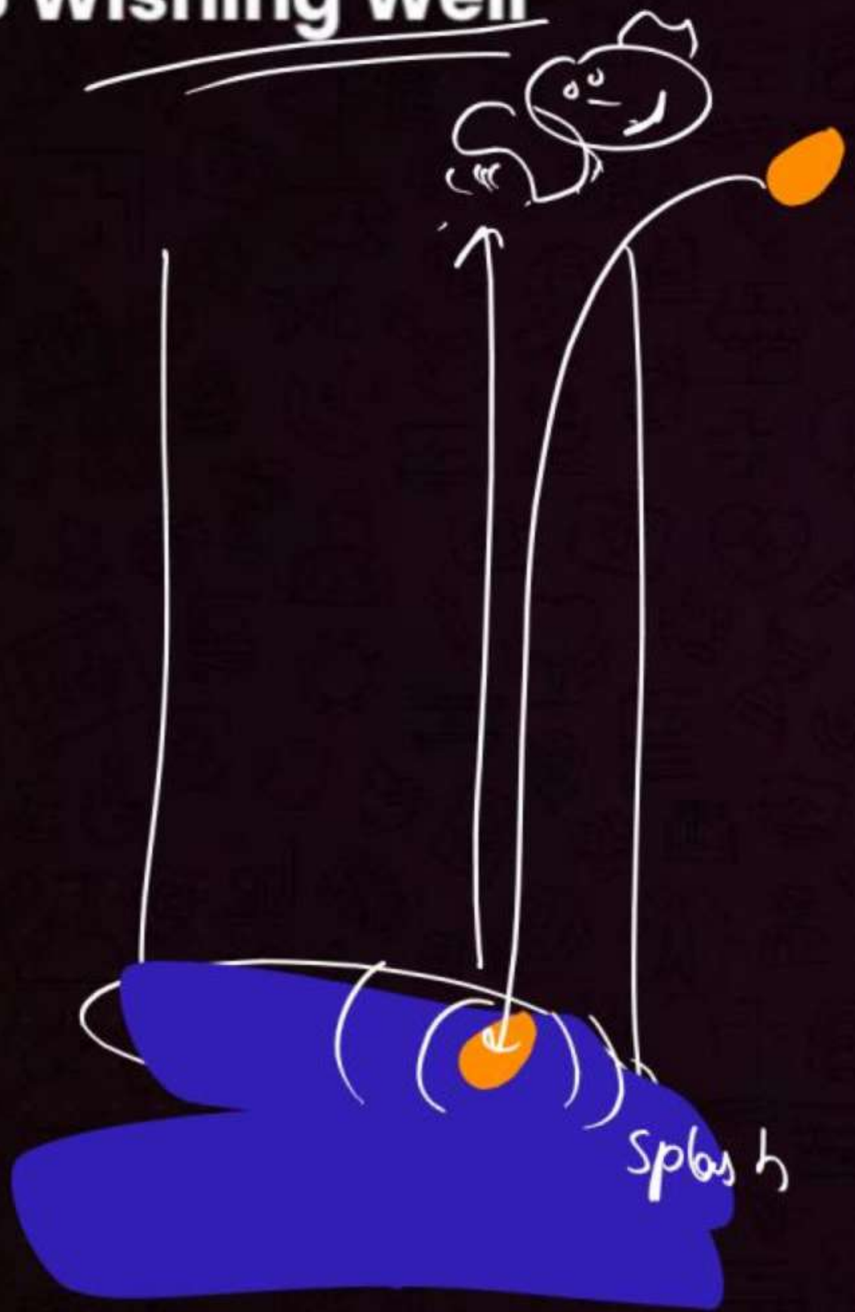
Difficulty Level : MEdium

A particle is projected up with an initial velocity of 80 ft/sec. The ball will be at a height of 96 ft from the ground (Hint g = 32 feet/sec^2)

1. 2.0 and 3.0 sec
2. Only at 3.0 sec
3. Only at 2.0 sec
4. After 1 and 2 sec



10.6 Wishing Well



Total time

= Stone fall + sound upper

$$\sqrt{\frac{2H}{g}} + \left(\frac{H}{V_{sound}}\right)$$

Difficulty Level : Easy

QUESTION-159

A stone is dropped into a well in which the level of water is h below the top of the well. If v is velocity of sound, the time T after which the splash is heard is given by

(1) $T = \frac{3h}{v}$

(2) $T = \sqrt{\frac{h}{4g}} + \frac{2h}{v}$

(3) $T = \sqrt{\frac{6h}{v}} + \frac{h}{2g}$

(4) $T = \sqrt{\frac{2h}{g}} + \frac{h}{v}$ ✓

10.7 Fussy Rocket Fussy Balloon

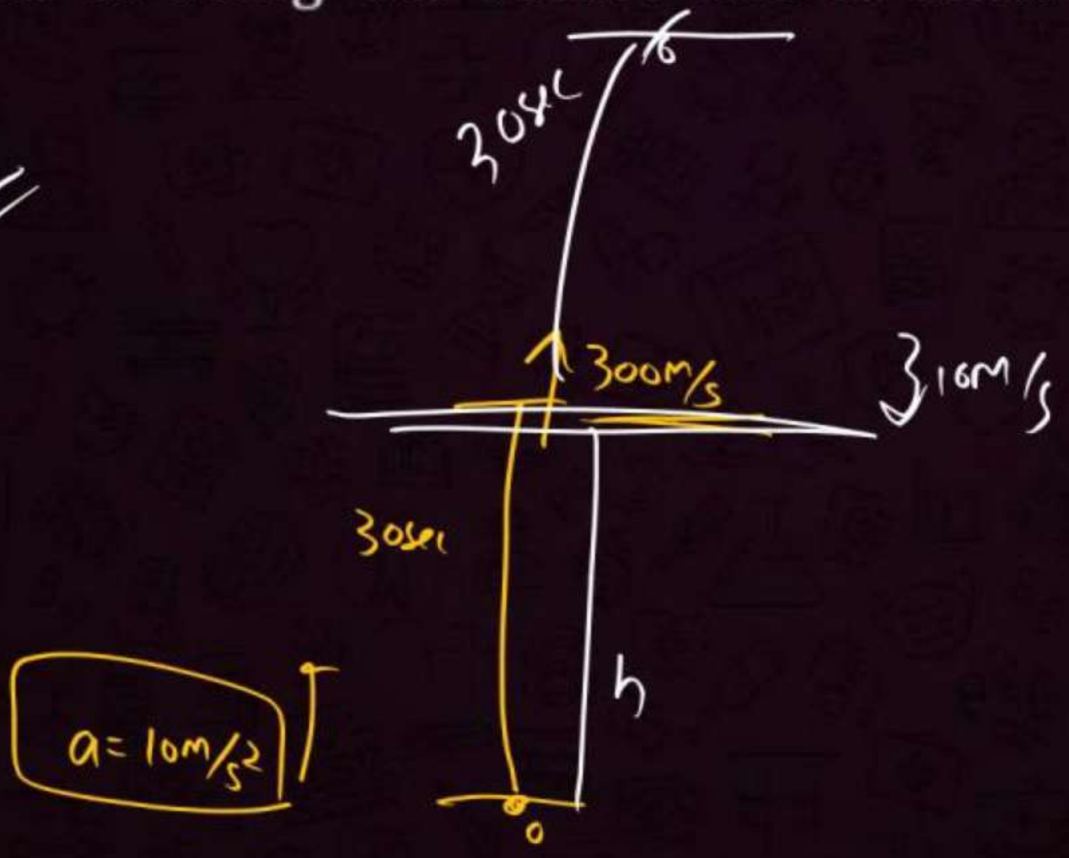
→ Dired PUPPY

Difficulty Level : Hard

QUESTION-161

A rocket is fired vertically from the ground. It moves upwards with a constant acceleration of 10 m/s^2. After 30 seconds the fuel is finished. After what time from the instant of firing the rocket will it attain the maximum height? $g = 10\ m/s^2$:

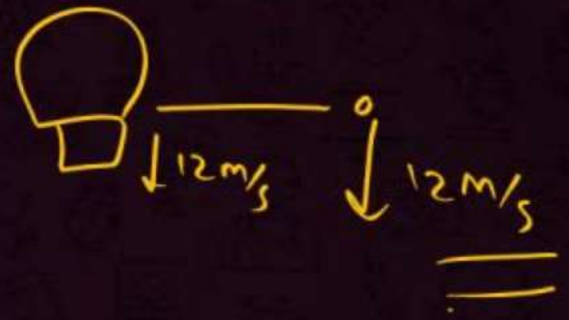
1. 60 s
2. 45 s
3. 90 s
4. 65 s



Difficulty Level : Hard

QUESTION-162

A stone falls from a balloon that is descending at a uniform rate of 12 m/s. The displacement of the stone from the point of release after 10 sec is



1. 490 m
2. 510 m
3. 610 m
4. 725 m

10.8 HAWA ME PAKKADAM PATTI

PUPPY

QUESTION-165

Difficulty Level : MEdium

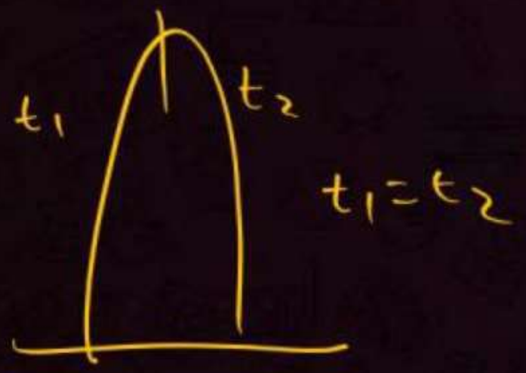
A body dropped from a height h with initial velocity zero, strikes the ground with a velocity 3 m/s. Another body of same mass dropped from the same height h with an initial velocity of 4 m/s. The final velocity of second mass, with which it strikes the ground is: [1996]

1. 5 m/s
2. 12 m/s
3. 3 m/s
4. 4 m/s

10.9 AIR RESISTANCE A GYA

Air resistance, drag force $\propto -v$

No air drag



air drag

$t_1 < t_2$

PUPPY POINTS-3

$v = u + at$ | $v = u + gt$ | $v = u - gt$

$S = ut + \frac{1}{2}at^2$ | $h = ut + \frac{1}{2}gt^2$ | $h = ut - \frac{1}{2}gt^2$

$v^2 = u^2 + 2as$ | $v^2 = u^2 + 2gh$ | $v^2 = u^2 - 2gh$

$S = \left(\frac{u+v}{2}\right)t$ | $h = \left(\frac{u+v}{2}\right)t$ | $h = \left(\frac{u+v}{2}\right)t$

$S_{nth} = u + \frac{(2n-1)a}{2}$ | $h_{nth} = u + \frac{(2n-1)g}{2}$ | $h_{nth} = u - \frac{(2n-1)g}{2}$

Rest $t = \frac{u}{a}$ $t = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2h}{g}}$ $v = \sqrt{2as}$ $v = \sqrt{2gh}$

Stopping Distance $S = \frac{u^2}{2a}$

time $= \frac{u}{a}$

$u = 0$

$v \propto t \propto \sqrt{s}$

$s \propto t^2 \propto v^2$

$u = 0 \rightarrow S_{nth} = \frac{(2n-1)a}{2}$

$S_{n+1^{th}} = \frac{(2n+1)a}{2}$

$S_{n-1^{th}} = \frac{(2n-3)a}{2}$

$a = \frac{\Delta v}{t}$ Change in velocity per second

Rest — Galileo Ratio (Drop) v

nsec	n^{th} sec	5	5	10
x	x	20	15	20
$4x$	$3x$	45	25	30
$9x$	$5x$	80	35	40
$16x$	$7x$	125	45	50
$25x$	$9x$	180	55	60
per sec $x = a/2$		n	n^{th}	

Ahaa.. Rater

Same distance me kitna time

$\sqrt{1} \cdot \sqrt{1}$

$\sqrt{2} \cdot \sqrt{2} - \sqrt{1}$

$\sqrt{3} \cdot \sqrt{3} - \sqrt{2}$

$\sqrt{4} \cdot \sqrt{4} - \sqrt{3}$

$6 \quad \hookrightarrow$

$x \quad x$

$2x \quad x$

$3x \quad x$

Well

$t_{reach} = \sqrt{\frac{2h}{g}} + \frac{h}{v_x}$

Air Resistance

time come down > up

$v_{mid\ journey} = \sqrt{\frac{u^2+v^2}{2}}$

distance in same time are same → uniform

distance in same time are in AP → a constant

Bullet - Plank (a constant)

No of Plank $= N = \frac{v^2}{v^2 - u^2}$ ↳ after 1 plank

U turn $\overrightarrow{v}$ $\overleftarrow{a}$

Check $v = 0$ at what time

Distance before & after separate calculate

Ekhdo time $u = \frac{1}{2}g(t_1 + t_2)$ $h = \frac{1}{2}gt_1t_2$

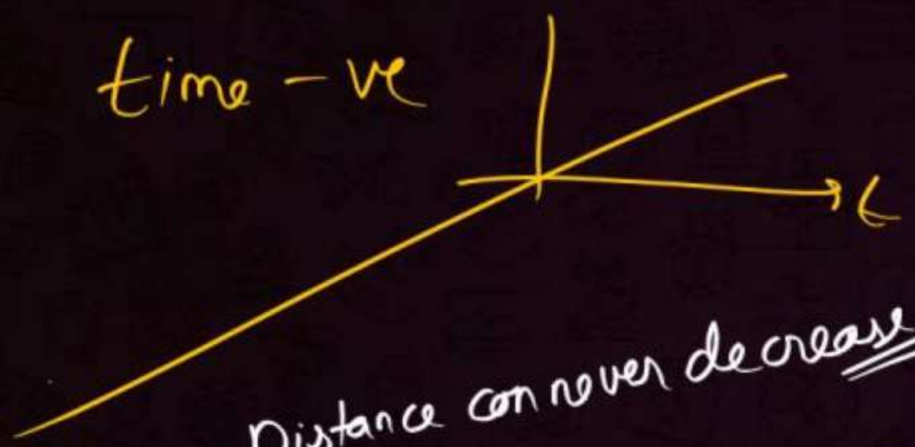
$t_0 = \sqrt{t_1 t_2}$

Thrown from tower

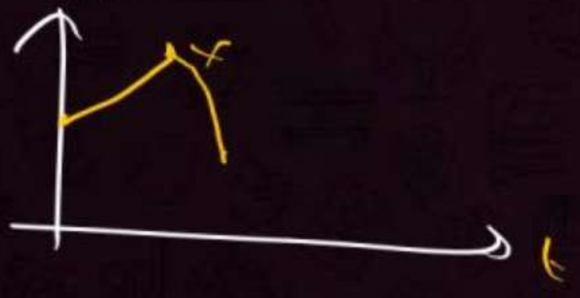
$-h = ut - \frac{1}{2}gt^2 \rightarrow t = \frac{v}{g}\left[1 + \sqrt{1 + \frac{2gh}{v^2}}\right]$

Part 11 – Graphs on Steroids

11.1 IMPOSSIBLE GRAPHS

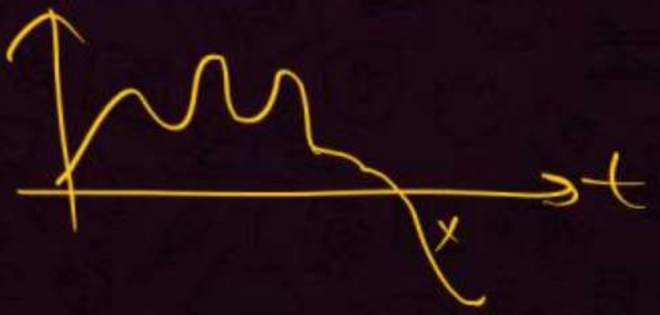


Distance can never decrease



Ek time pe do-do X

Speed cannot be -ve



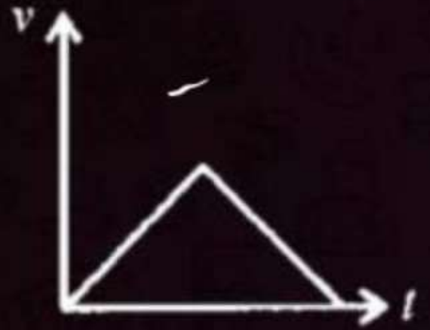
Difficulty Level : Easy

QUESTION-167

Which of the following curve does not represent motion in one dimension?

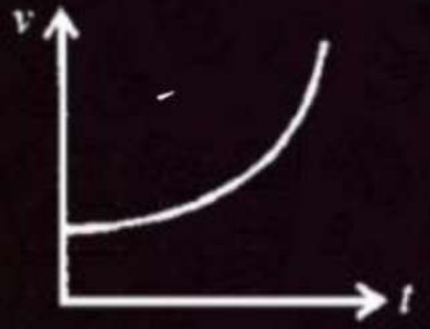
[1992]

1

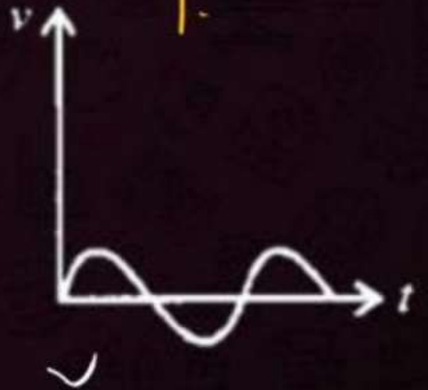


2

3



4



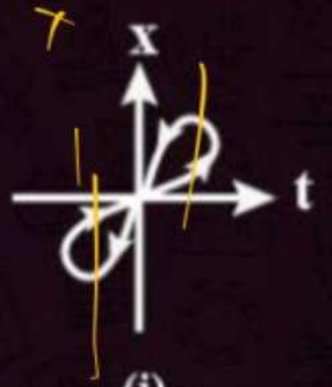
Difficulty Level : Easy

QUESTION-168

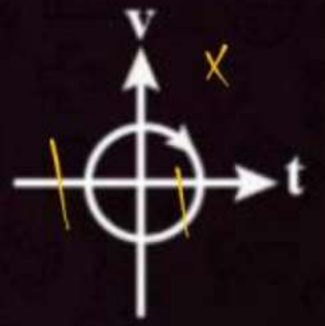
Which of the following graphs cannot possibly represent on dimensional motion of a particle?

[NCERT Based]

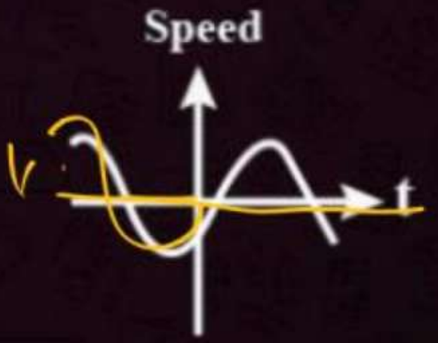
1. (i) and (ii)
2. (ii) and (iii)
3. (i), (ii) and (iii)
4. All four



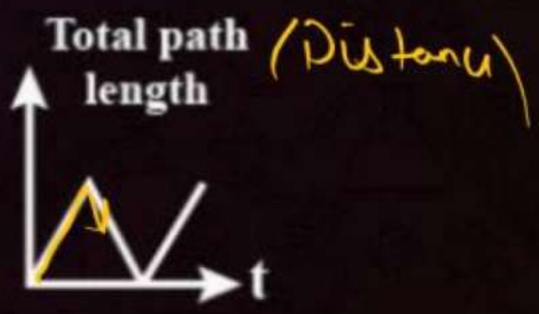
(i)



(ii)



(iii)

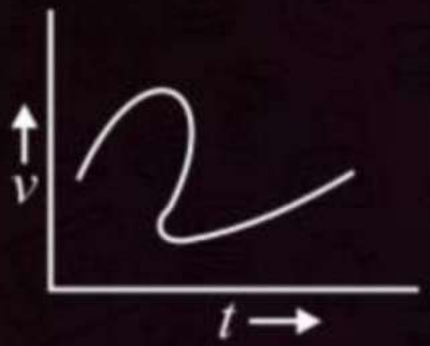


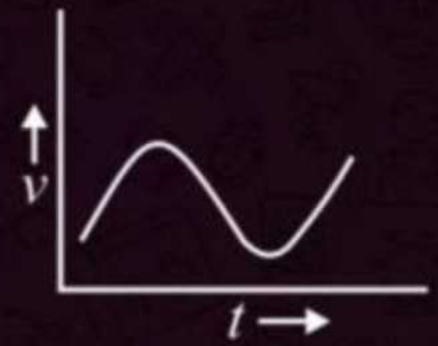
(iv)

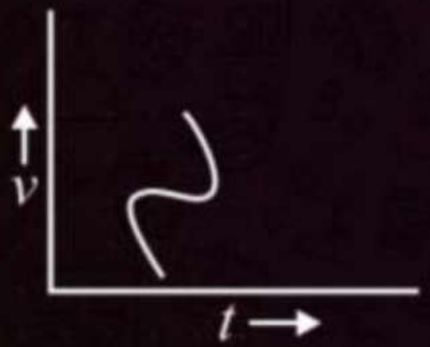
Difficulty Level : Easy

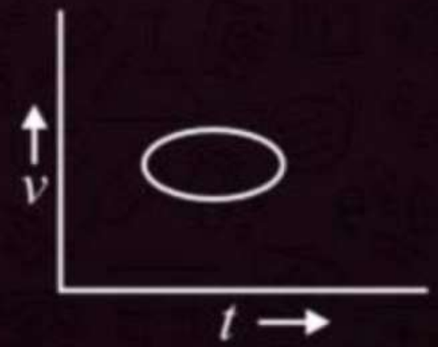
QUESTION-169

Which of the following velocity-time graphs shown a realistic situation for a body in motion?

1. 

2. 

3. 

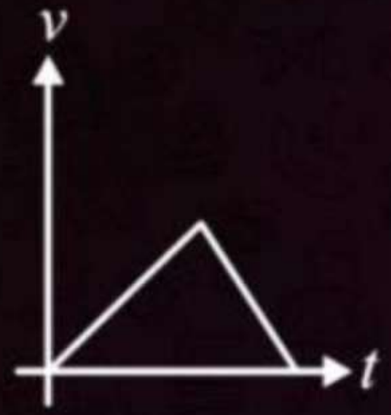
4. 

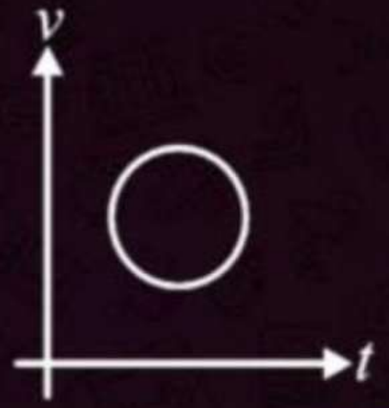
Ans (2)

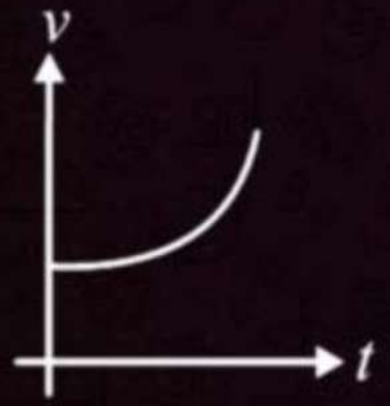
Difficulty Level : Easy

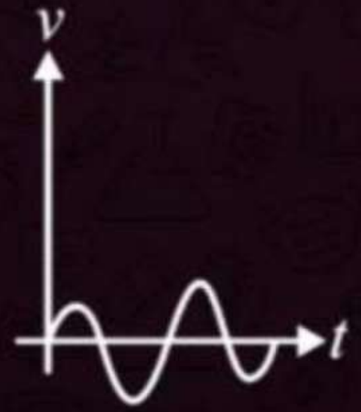
QUESTION-170

Which one of the following curves do not represent motion in one dimension

1. 

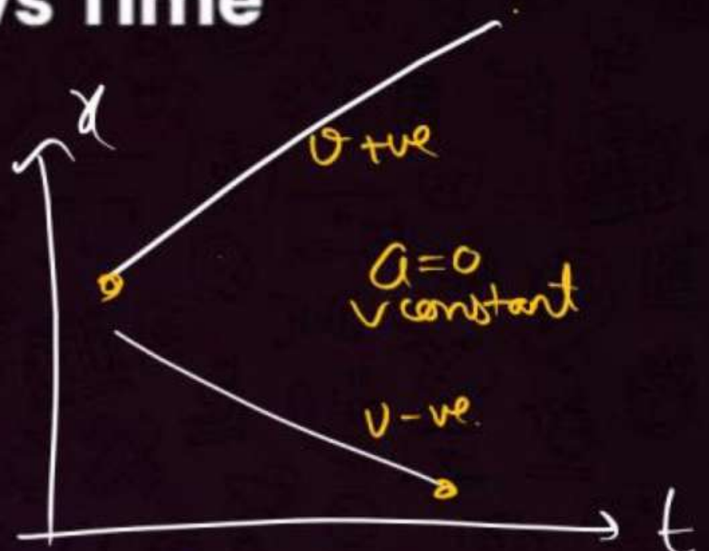
2. 

3. 

4. 

Ans (2)

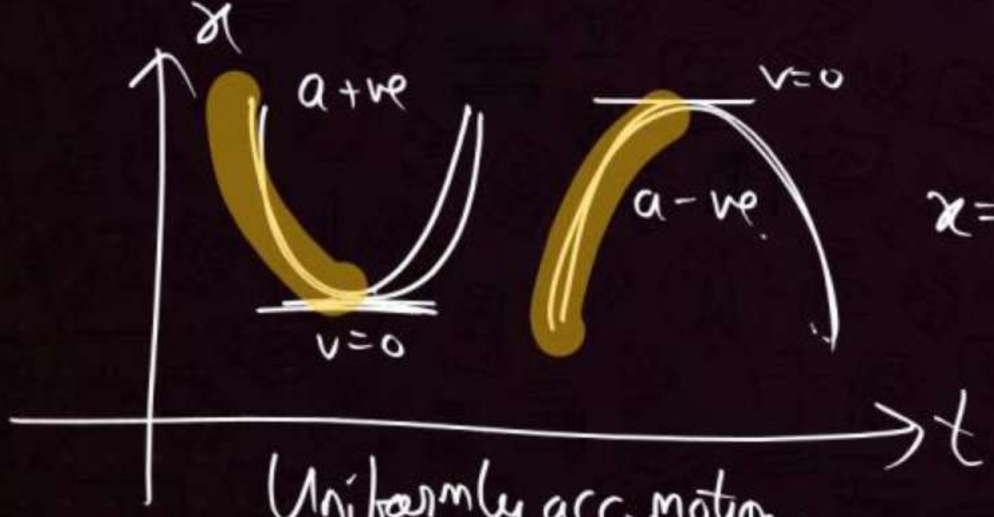
11.2 Distance, Displacement vs Time



$x = vt$

↓ Linear

Uniform motion



Uniformly acc. motion

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

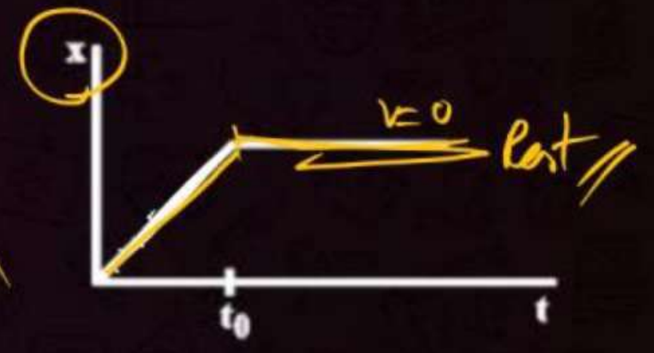
retardation

Difficulty Level : Easy

QUESTION-171

Figure shows the displacement-time graph of a particle moving on the X-axis.

[HCV Objective I]



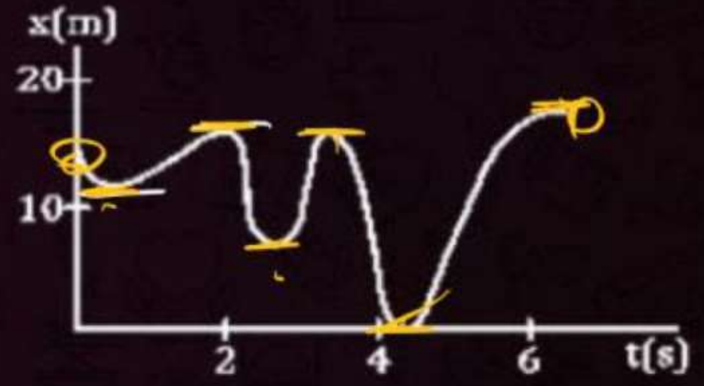
1. the particle is continuously going in positive x direction
2. the particle is at rest
3. the velocity increases up to a time t_0, and then becomes constant
4. the particle moves at a constant velocity up to a time t_0, and then stops.

Difficulty Level : Easy

QUESTION-172

Figure shows the position of a particle moving on the X-axis as a function of time.

[HCV Objective II]



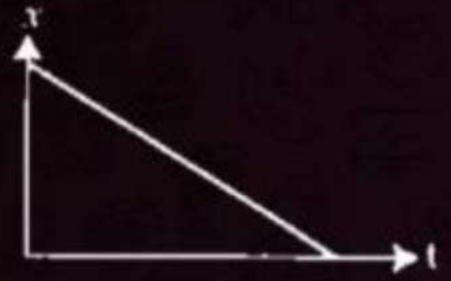
1. The particle has come to rest 6 times.
2. The maximum speed is at $t = 6$ s.
3. The velocity remains positive for $t = 0$ to $t = 6$ s.
4. The average velocity for the total period shown is negative.

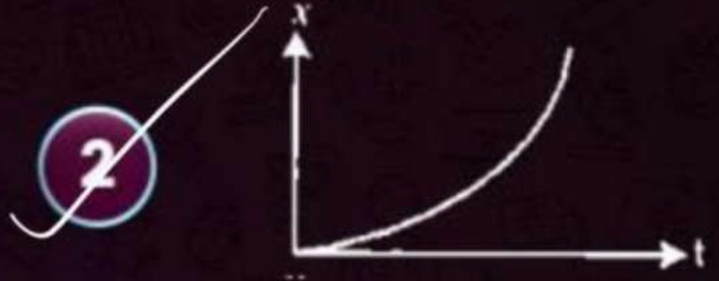
Difficulty Level : Easy

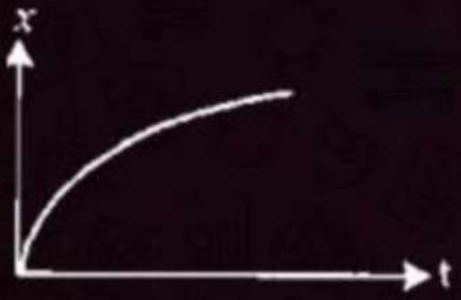
QUESTION-173

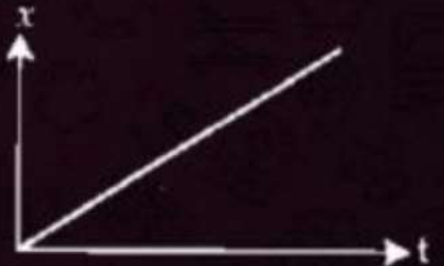
The position-time ($x - t$) graph for positive acceleration is

[2022 Re]

1. 

2. 

3. 

4. 

QUESTION-174

Difficulty Level : MEdium

The displacement time graphs of two moving particle make angles of 30° and 45° with the x-axis as shown in the figure. The ratio of their respective velocity is:

[2022]

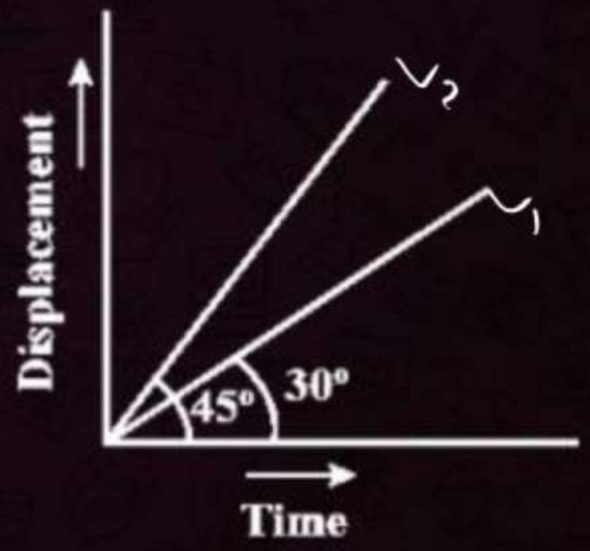
(1) $1:\sqrt{3}$

(2) $\sqrt{3}:1$

(3) $1:1$

(4) $1:2$

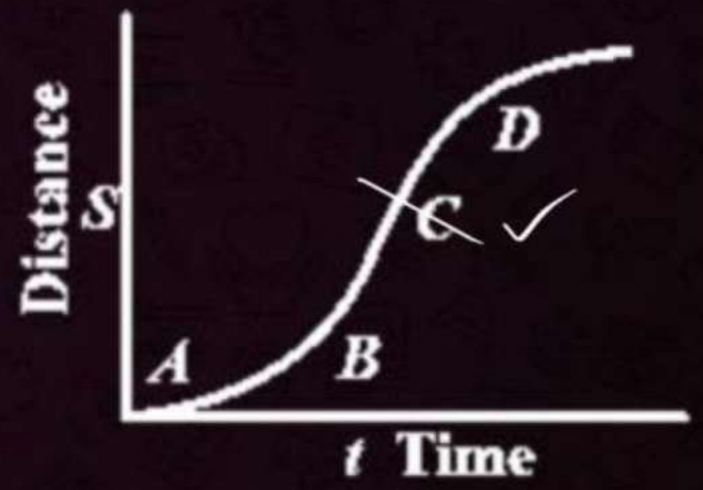
$$\left(\frac{v_1}{v_2}=\frac{\tan 30^\circ}{\tan 45^\circ}\right)$$



Difficulty Level : Easy

QUESTION-175

A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point [2008]

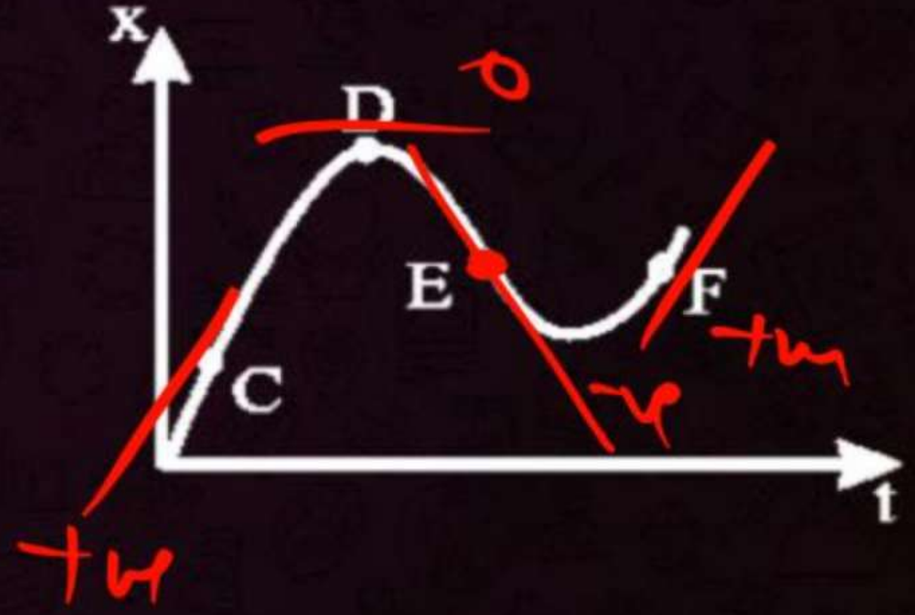


1. D
2. A
3. B
4. C

Difficulty Level : Easy

QUESTION-176

The displacement-time graph of a moving particle is shown below. The instantaneous velocity of the particle is negative at the point: [1994]



1. E
2. F
3. C
4. D

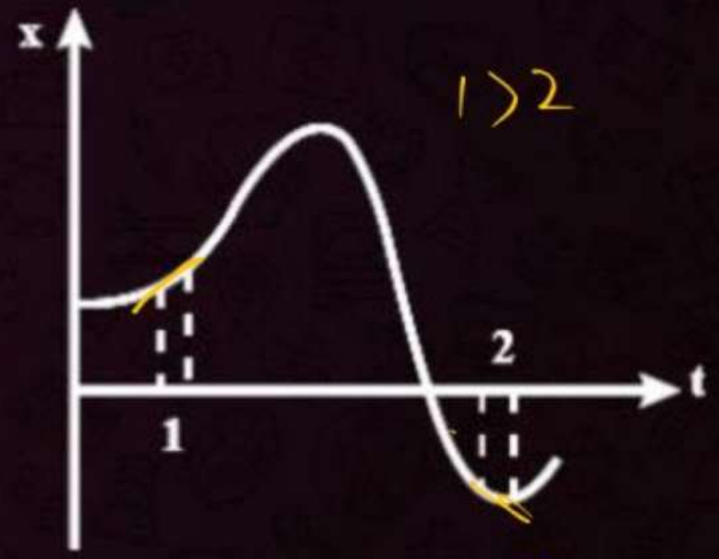
QUESTION-177

Difficulty Level : MEdium

Figure shows the x-t plot of a particle in one-dimensional motion. Two different equal intervals of time are shown. Let v_1 and v_2 be the speed in time intervals 1 and 2 respectively. Then

[NCERT Based]

1. $v_1 > v_2$
2. $v_2 > v_1$
3. $v_1 = v_2$
4. Data is insufficient



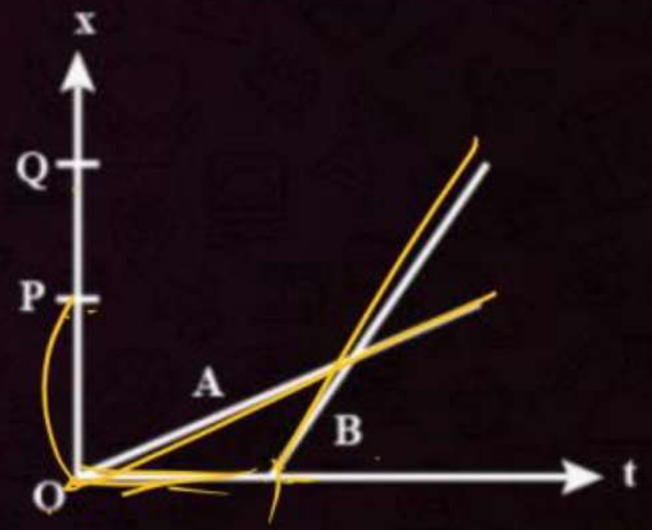
QUESTION-178

Difficulty Level : MEdium

The position-time (x-t) graphs for two children A and B returning from their school O to their homes P and Q respectively are as shown in the figure. Choose the incorrect statement regarding these graph.

[NCERT Based]

1. A lives closer to the school than B.
2. A starts from the school earlier than B
3. A walks faster than B.
4. A and B reach home at the same time.



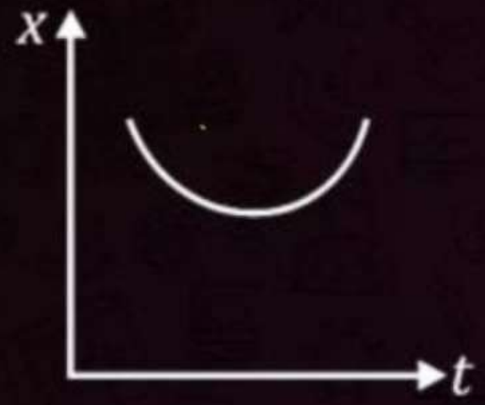
Difficulty Level : Easy

QUESTION-181

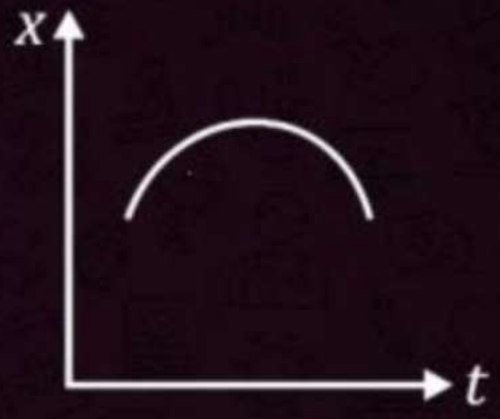
Position-time graph for motion with zero acceleration is

[NCERT Based]

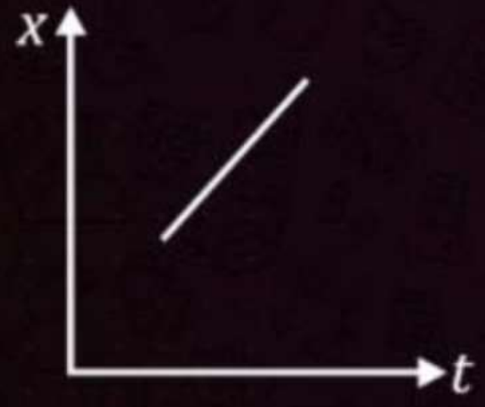
1



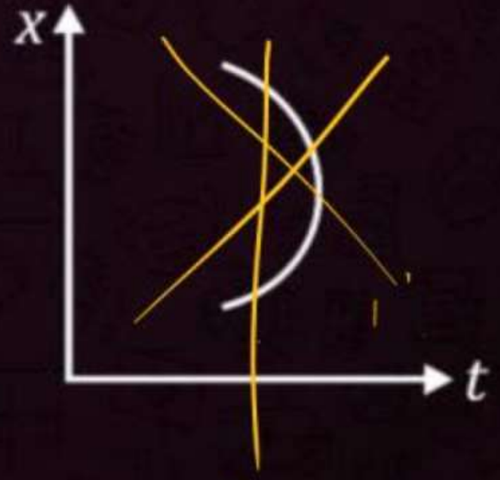
2



3



4



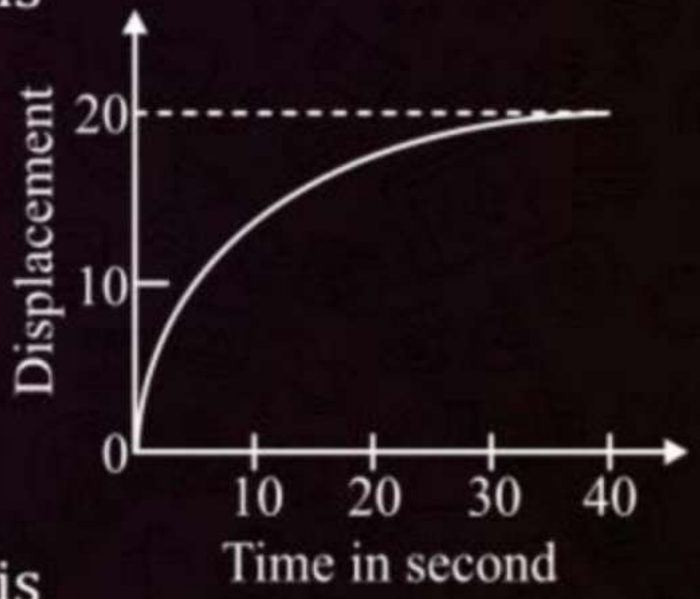
QUESTION-182

Difficulty Level : MEdium

hw

The displacement of a particle as a function of time is shown in the figure. The figure shows that

1. The particle starts with certain velocity but the motion is retarded and finally the particle stops
2. The velocity of the particle is constant throughout
3. The acceleration of the particle is constant throughout.
4. The particle starts with constant velocity, then motion is accelerated and finally the particle moves with another constant velocity



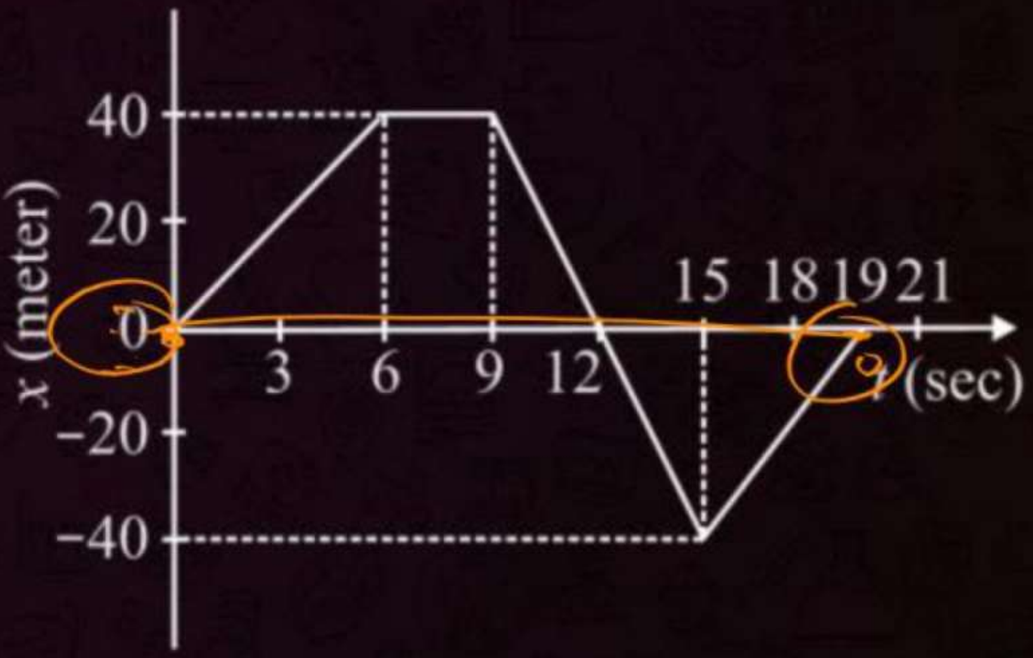
11.3 Distance, Displacement vs Time V_{avg} & a_{avg}

QUESTION-183

Difficulty Level : MEdium

A person walks along an east-west street and a graph of his displacement from home is shown in figure. His average velocity for the whole time interval is

$V_{avg} = \frac{\text{total disp}}{\text{total time}}$



1. 0
2. 23 m/s
3. 8.4 m/s
4. None of these.

Ans (1)

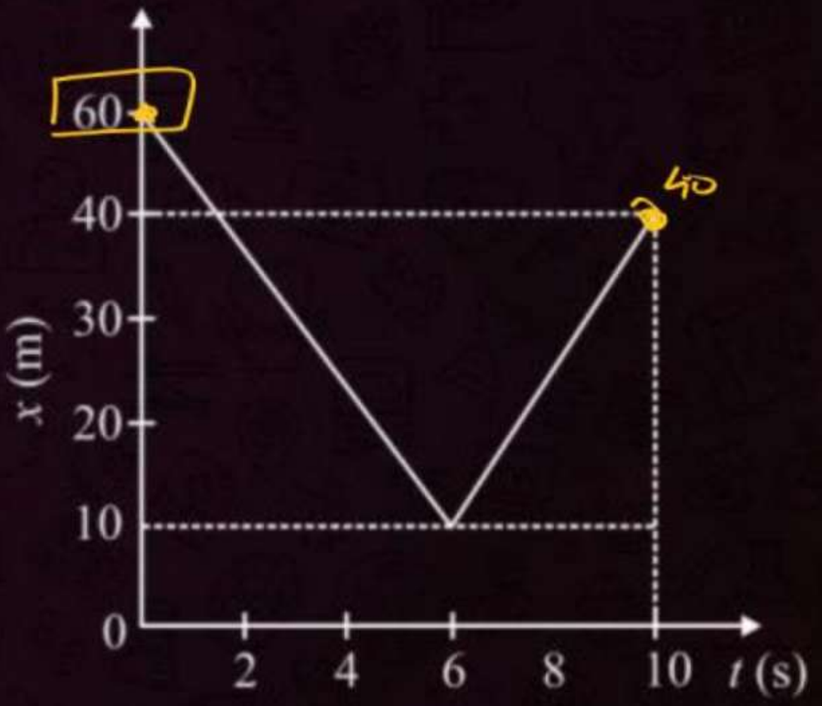
QUESTION-184

Difficulty Level : Hard

The fig. shows the position time graph of a particle moving on a straight line path. What is the magnitude of average velocity of the particle over 10 seconds?

1. 2 m/s
2. 4 m/s
3. 6 m/s
4. 8 m/s

$$V_{avg} = \frac{x}{time} = \frac{-20}{10} = -2\ m/s$$



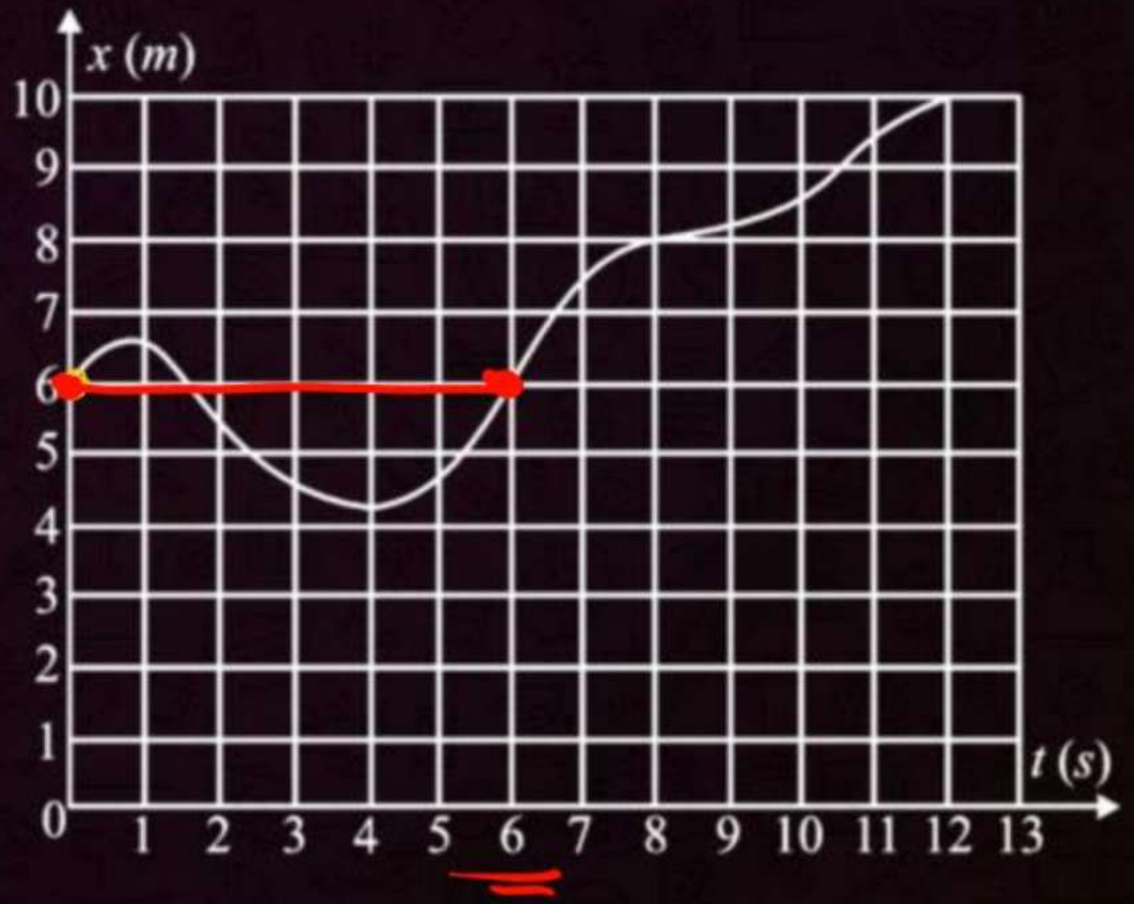
Ans (1)

QUESTION-185

Difficulty Level : MEdium

Position-time graph for a particle is shown in figure. Starting from $t = 0$, at what time t, the average velocity is zero?

1. 1 s
2. 3 s
3. 6 s
4. 7 s



QUESTION-186

Difficulty Level : YODHA

The position (x) of a particle moving along x-axis varies with time (t) as shown in figure. The average acceleration of particle in time interval $t = 0$ to $t = 8$ s is

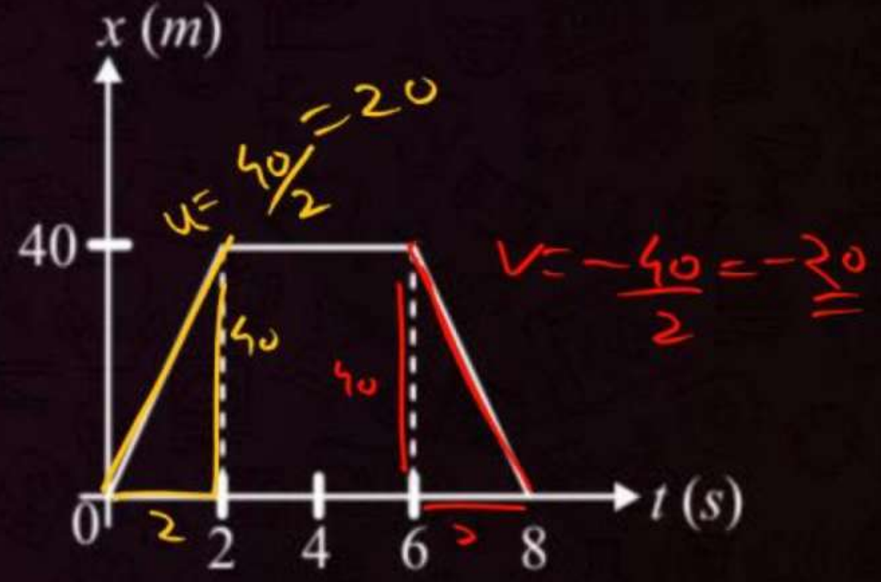
1. $3\ m/s^2$
2. $-5\ m/s^2$
3. $-4\ m/s^2$
4. $2.5\ m/s^2$

$$acc = \frac{\text{Change in velocity}}{\text{time}}$$

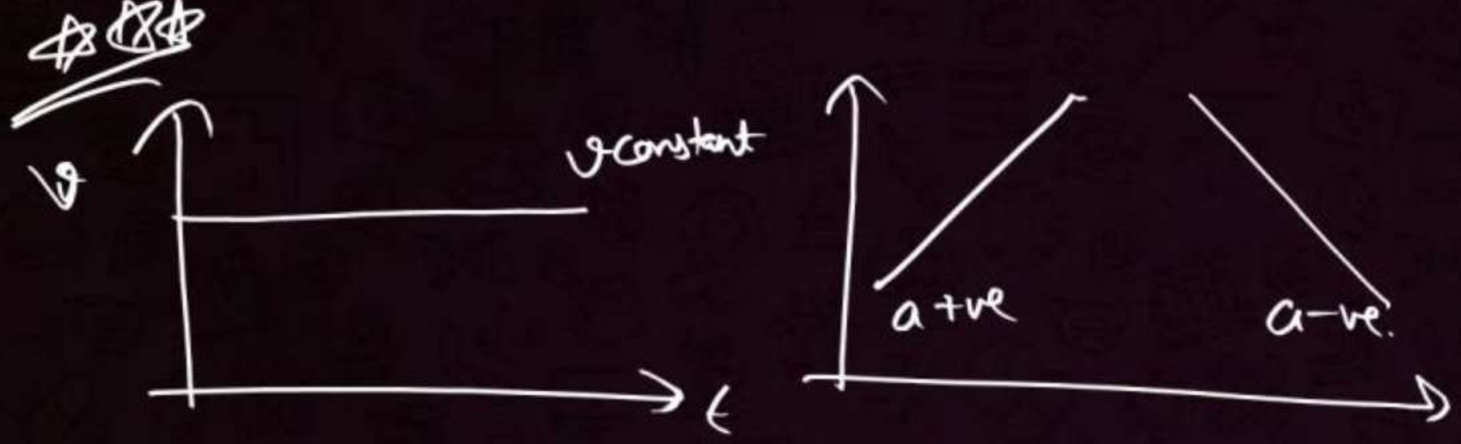
$$a = \frac{v-u}{8} = \frac{-20-20}{8}$$

$$a = -\frac{40}{8}$$

$$\boxed{a = -5\ m/s^2}$$



11.4 Speed Velocity vs Time



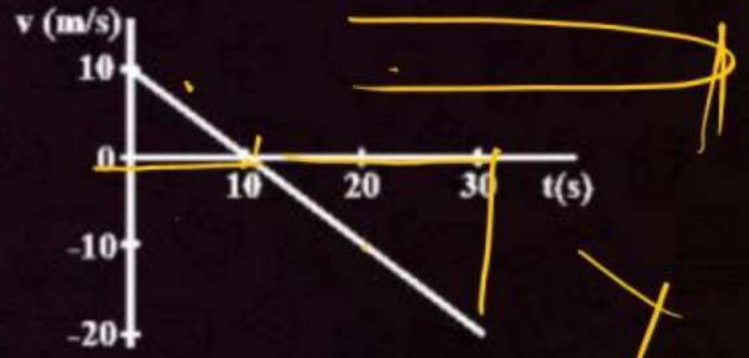
(slope v-t → acc.
Area v-t → displacement)

Difficulty Level : Easy

QUESTION-187

The velocity-time plot for a particle moving on a straight line is shown in the figure.

[HCV Objective II]



1. The particle has a constant acceleration.
2. The particle has never turned around.
3. The particle has zero displacement.
4. The average speed in the interval 0 to 10 *s* is the same as the average speed in the interval 10 *s* to 30 s

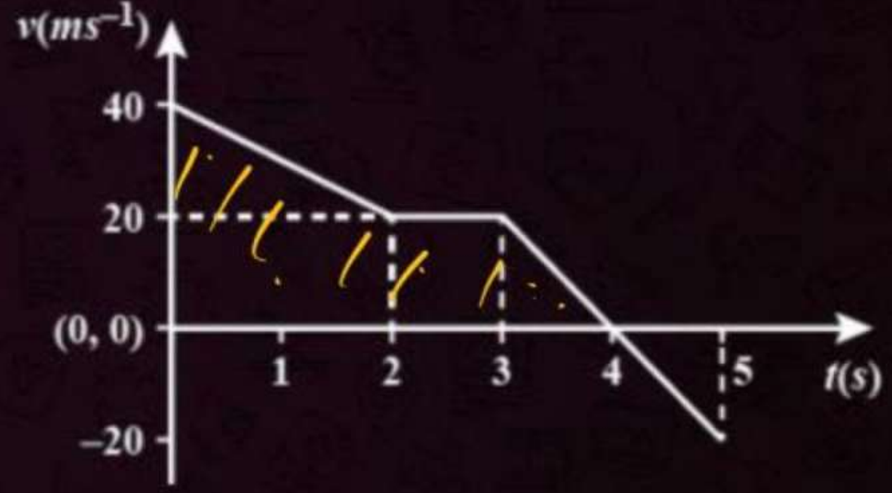
QUESTION-188

Difficulty Level : MEdium

In the given v-t graph the distance travelled by the body in 5 seconds will be.

[NCERT Based]

1. 100 m
2. 80 m
3. 40 m
4. 20 m



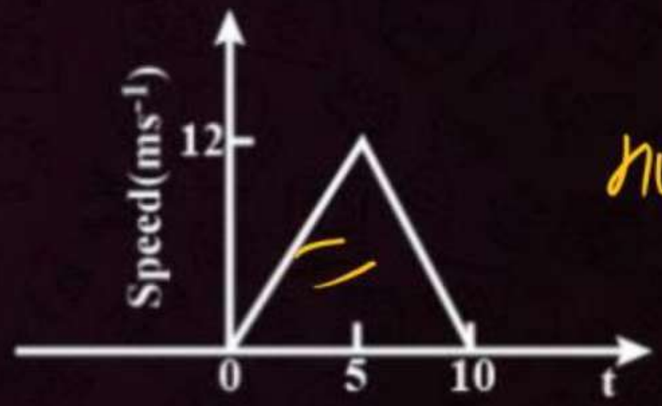
QUESTION-189

Difficulty Level : MEdium

The speed-time graph of a particle moving along a fixed direction is shown in the figure. The distance traversed by the particle between $t = 0s$ to $t = 10s$ is

[NCERT Based]

1. 20 m
2. 40 m
3. 60 m
4. 80 m

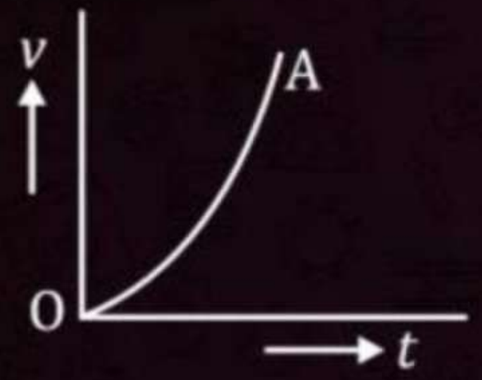


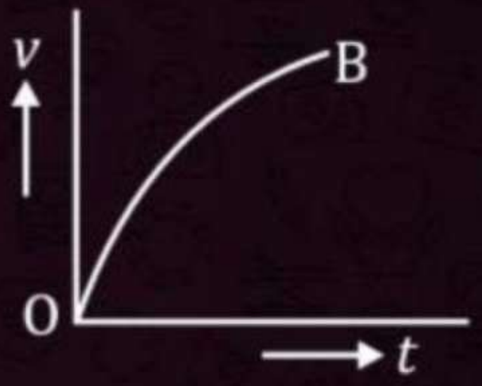
Difficulty Level : Easy

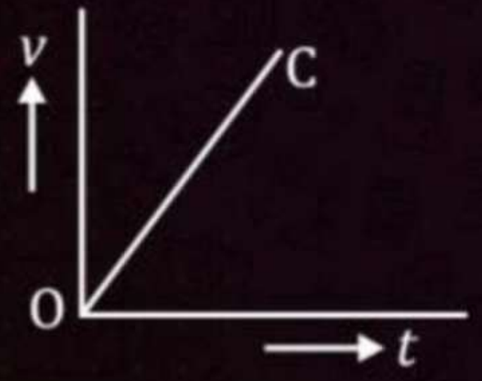
QUESTION-190

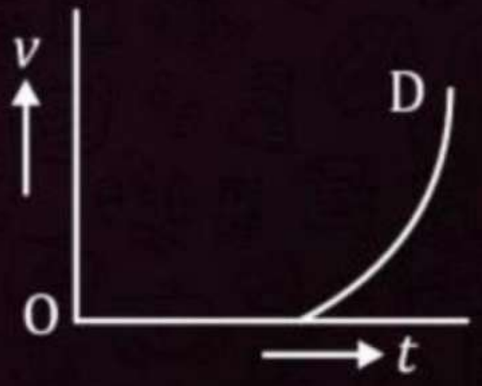
Given below the velocity-time graphs of particles, A, B C and D. The correct graph from the following v-t plots in which the velocity of the particle is a function of t^2 is.

[NCERT Based]

1. 

2. 

3. 

4. 

Difficulty Level : Easy

QUESTION-191

The slope of the tangent drawn on velocity time graph at any instant of time is equal to the instantaneous

[NCERT Based]

1. Acceleration
2. Velocity
3. Impulse
4. Momentum

Difficulty Level : Hard

QUESTION-192

The velocity-time graph of a particle in one-dimensional motion is shown in the figure. Which of the following formulae is correct for describing the motion of the particle over the time interval t_1 to t_2?

[NCERT Based]

1. $x(t_2) = x(t_1) + v(t_1)(t_2 - t_1) + \left(\frac{1}{2}\right) a(t_2 - t_1)^2$

2. $v(t_2) = v(t_1) + a(t_2 - t_1)$

3. $v_{\text{average}} = \dfrac{(x(t_2) + x(t_1))}{(t_2 - t_1)}$

4. $a_{\text{average}} = \dfrac{(v(t_2) - v(t_1))}{(t_2 - t_1)}$

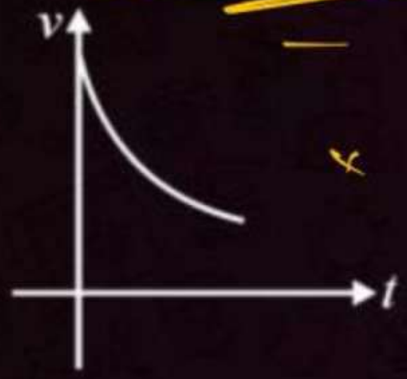
Difficulty Level : Hard

QUESTION-193

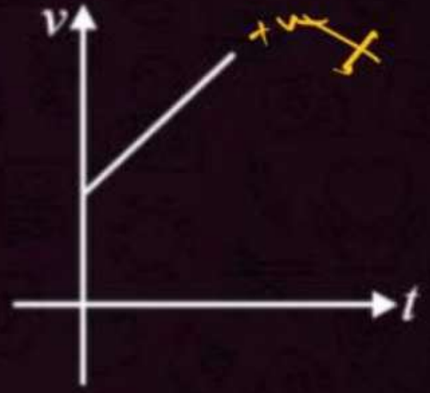
Given below are four curves describing variation of velocity with time of a particle. Which one of these describe the motion of particle initially in positive direction with constant negative acceleration?

[NCERT Based]

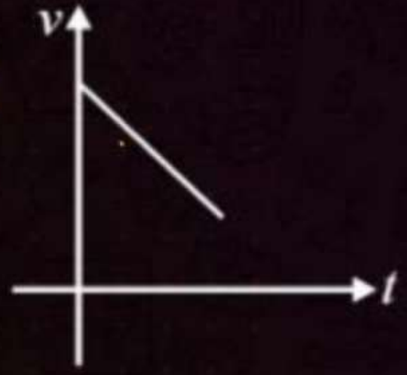
1



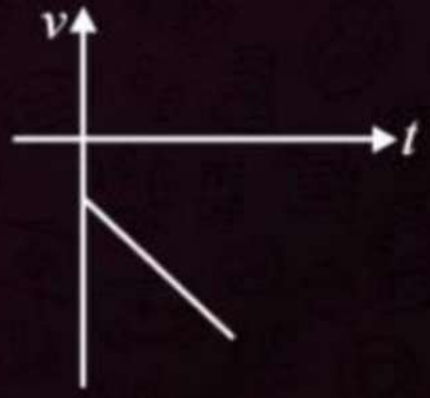
2



3



4

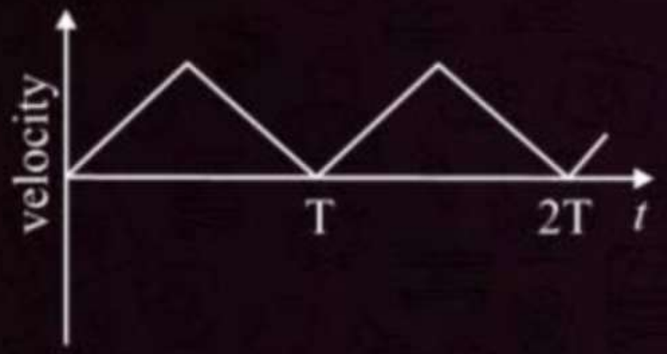


QUESTION-194

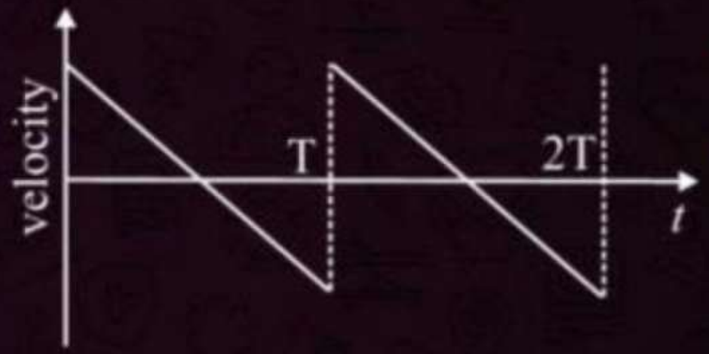
Difficulty Level : Hard

A ball is dropped from the certain height on the surface of glass. It collides elastically and comes back to its initial position. If this process it repeated then the velocity time graph is: (Take downward direction as positive)

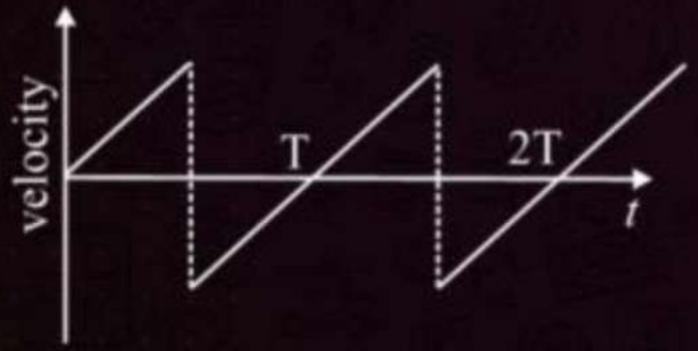
1



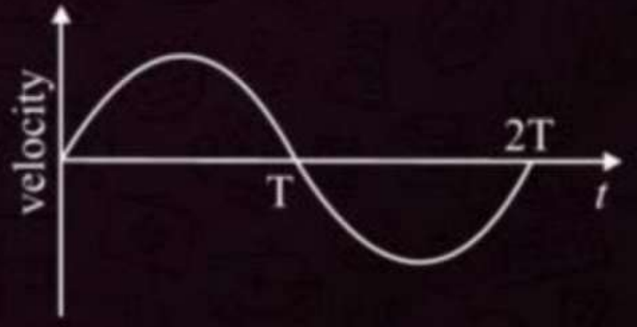
2



3



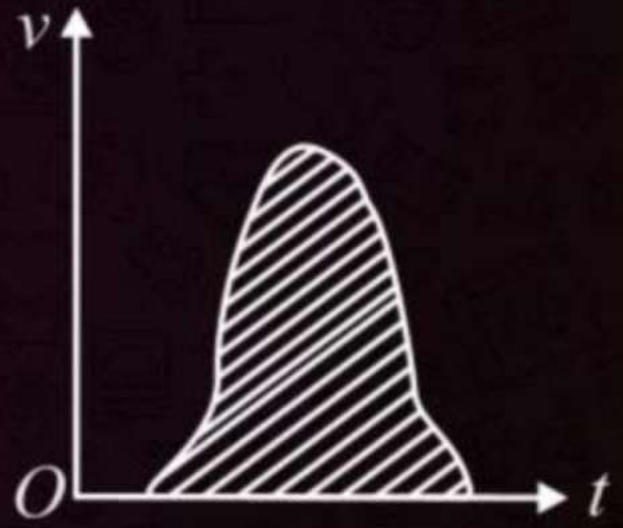
4



Difficulty Level : Easy

QUESTION-195

Figure below shows the velocity-time graph of a one dimensional motion. Which of the following characteristics of the particle is represented by the shaded area?



1. Speed
2. Displacement
3. Acceleration
4. Momentum

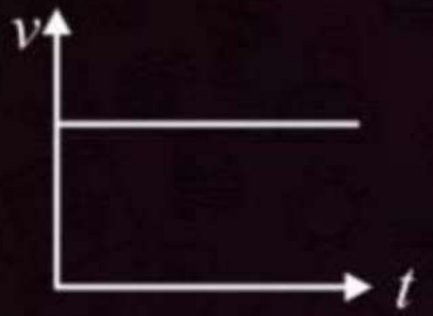
Ans (2)

Difficulty Level : Easy

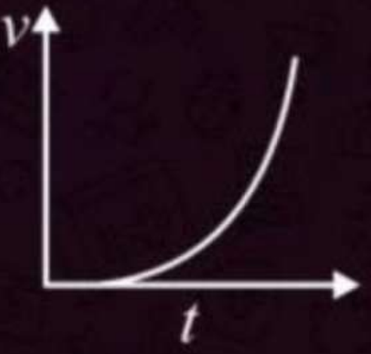
QUESTION-196

Which of the following velocity-time graphs represent uniform motion?

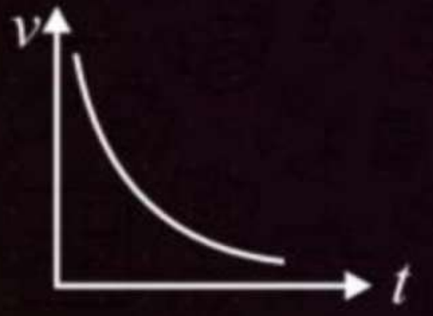
1



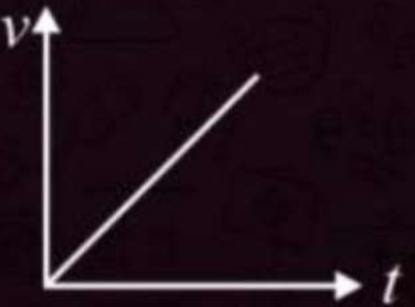
2



3



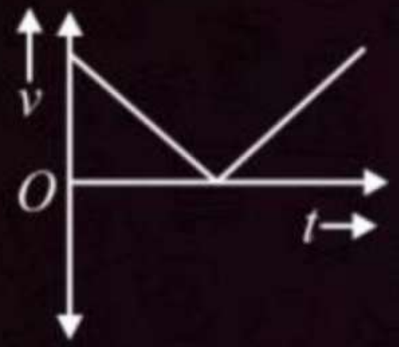
4

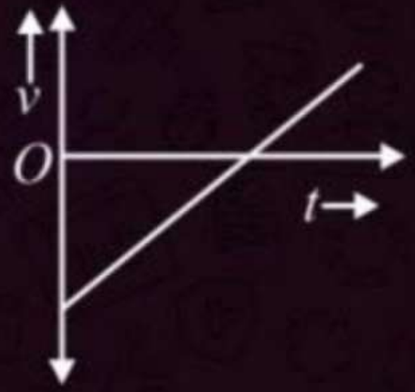


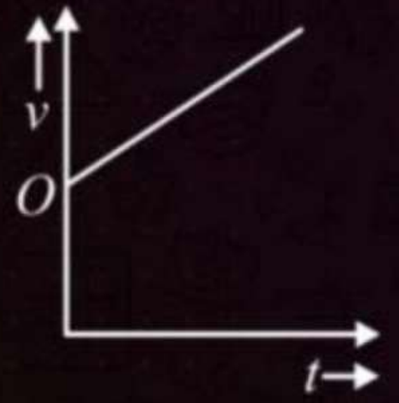
Difficulty Level : Hard

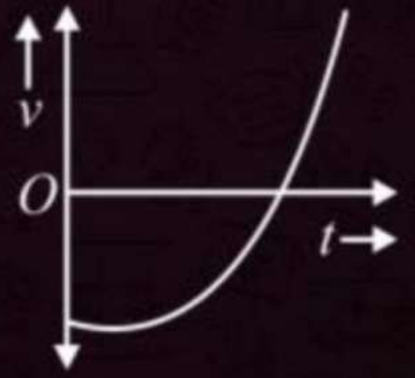
QUESTION-197

A particle moves along x-axis in such a way that its x-co-ordinate varies with time according to the equation $x = 4 - 2t + t^2$. The speed of the particle will vary with time as

1. 

2. 

3. 

4. 

Difficulty Level : Easy

QUESTION-198

Velocity-time curve for a body projected vertically upwards is

1. Parabola
2. Ellipse
3. Hyperbola
4. Straight line

QUESTION-199

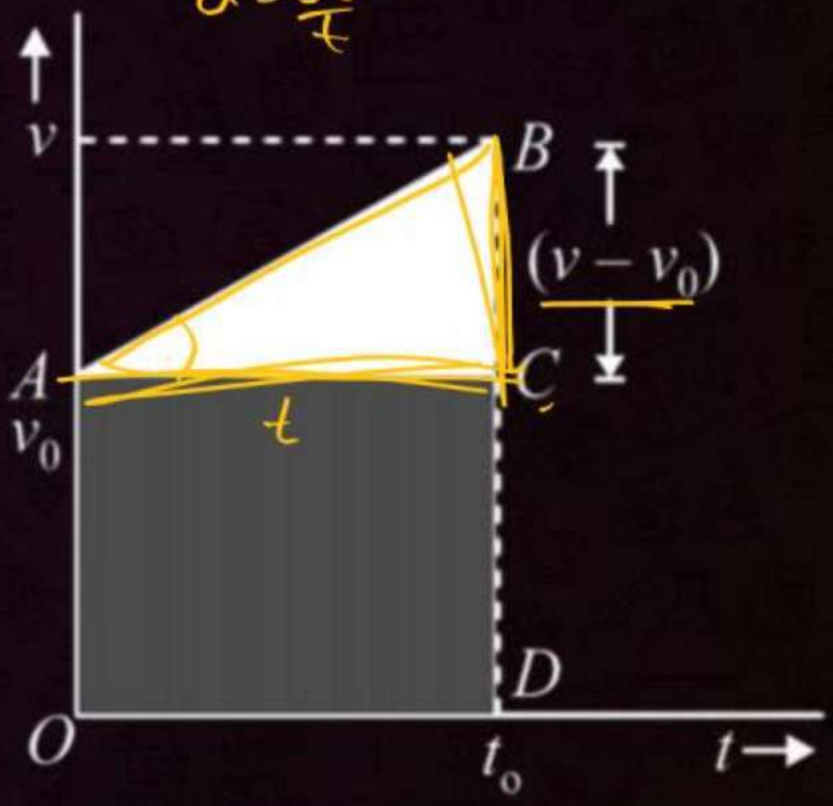
NCERT

Difficulty Level : Hard

The figure shows the velocity-time graph for a particle. What is the acceleration of the particle?

$a = \frac{\Delta v}{t}$

1. $\frac{v-v_0}{t_0}$
2. $\frac{v-2v_0}{t_0}$
3. $\frac{2v-v_0}{t_0}$
4. $\frac{2v-v_0}{2t_0}$



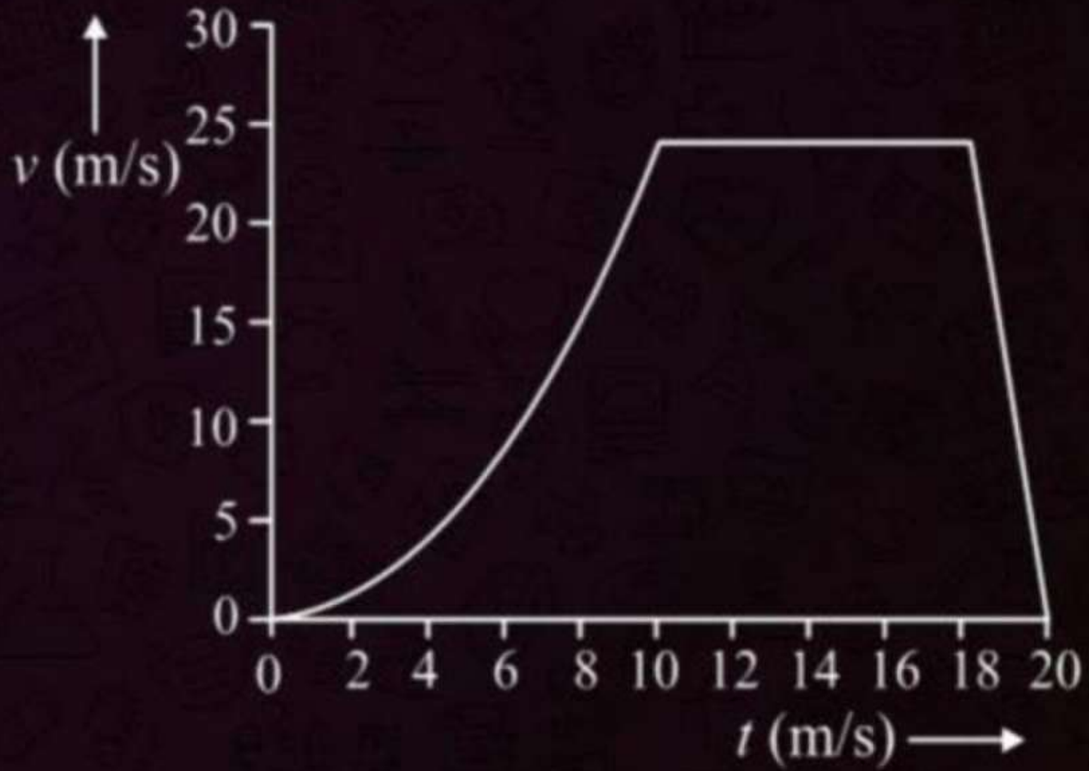
QUESTION-200

Difficulty Level : MEdium

nw

The figure shows the velocity-time graph for a particle. Acceleration in the time interval $t = 0$ to $t = 8$s will be:

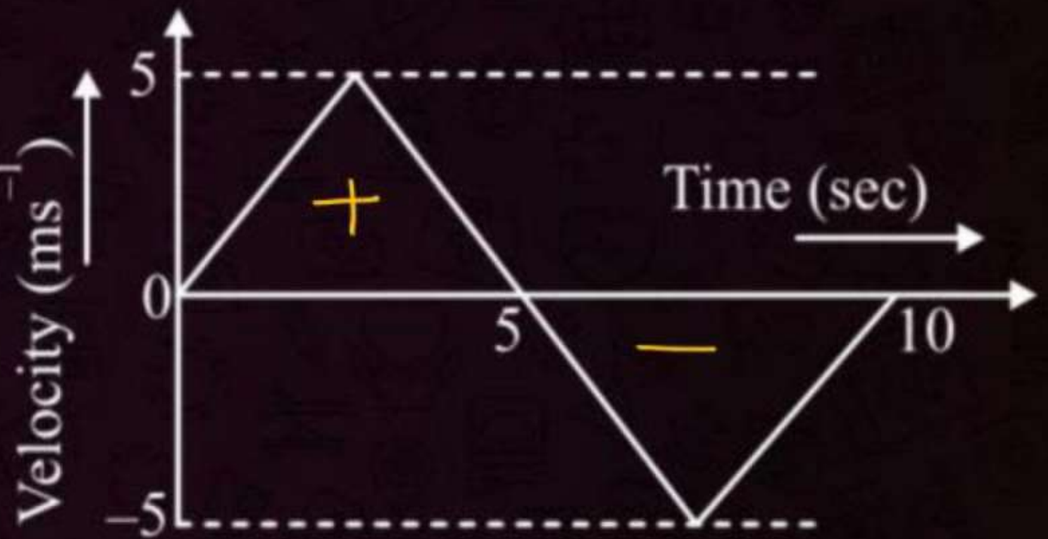
1. Constant
2. Variable and decreasing with time
3. Variable and increasing with time
4. Can't say



QUESTION-201

Difficulty Level : MEdium

The v–t plot of a moving object is shown in the figure. The average velocity of the object during the first 10 seconds is



1. 0
2. 2.5 m/s
3. 5 m/s
4. 2 m/s

$V_{avg} =$

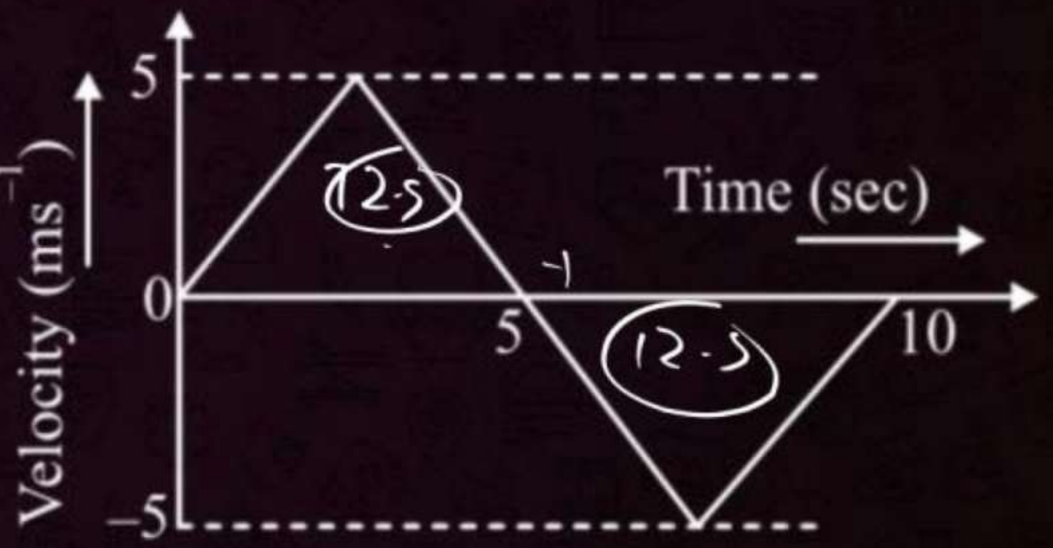
QUESTION-202

Difficulty Level : MEdium

The $v - t$ plot of a moving object is shown in the figure. The average speed of the object during the first 10 seconds is

1. 0
2. 2.5 m/s
3. 5 m/s
4. 2 m/s

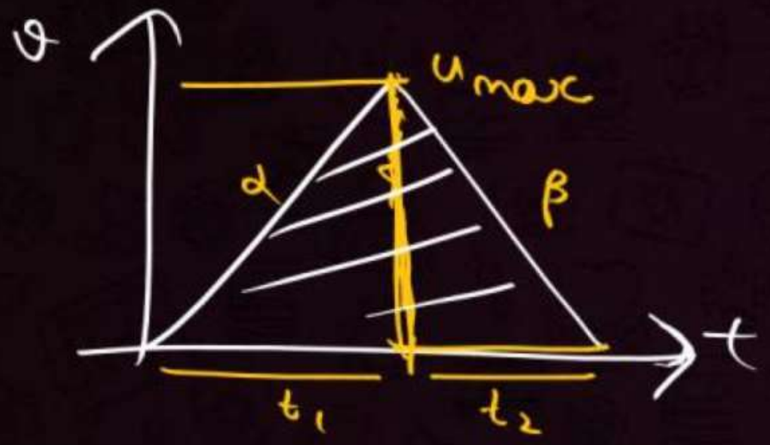
$u_{avg} = \frac{25}{10}$

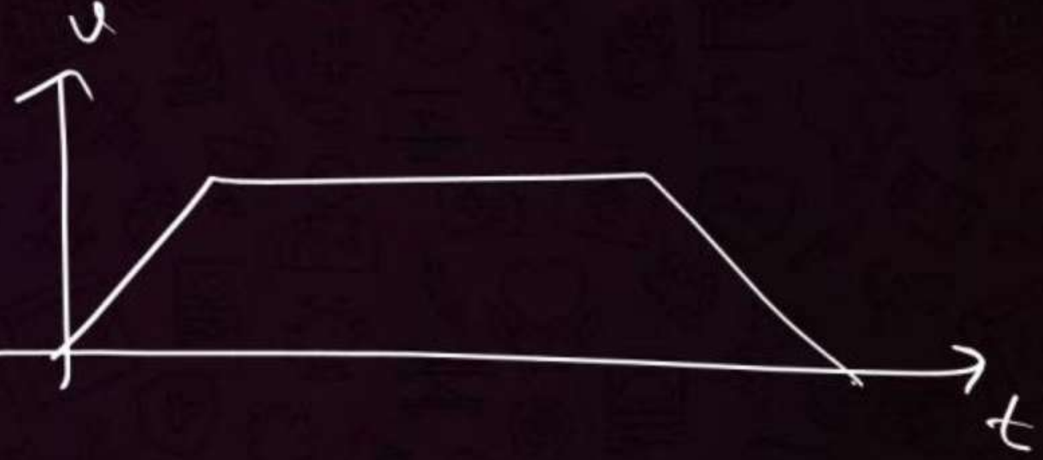


$\frac{1}{2} \times 5 \times 5$

11.5 VT Triangle & Trapezium

Standard.





$\alpha = \frac{u}{t_1}$ $\beta = \frac{u}{t_2}$

$t_1 = \frac{u}{\alpha}$ $t_2 = \frac{u}{\beta}$

$T = t_1 + t_2$

$= \frac{u}{\alpha} + \frac{u}{\beta}$

$u = \frac{\alpha\beta T}{\alpha+\beta}$

$s = \frac{1}{2}\frac{\alpha\beta T^2}{(\alpha+\beta)}$

Difficulty Level : Hard

QUESTION-203

A car accelerates from rest at a constant rate a for some time after which it decelerates at a constant rate β and comes to rest. If total time elapsed is t, then maximum velocity acquired by car will be: [1994]

1. $\frac{(\alpha^2-\beta^2)t}{\alpha\beta}$
2. $\frac{(\alpha^2+\beta^2)t}{\alpha\beta}$
3. $\frac{(\alpha+\beta)t}{\alpha\beta}$
4. $\frac{\alpha\beta t}{\alpha+\beta}$

Difficulty Level : Hard

QUESTION-204

A car starts from rest, attains a velocity of 36 km h^{-1} with an acceleration of 0.2 ms^{-2}, travels 9 km with this uniform velocity and then comes to halt with a uniform deceleration of 0.1 ms^{-2}. The total time of travel of the car is

[NCERT Based]

1. 1050 s
2. 1000 s
3. 950 s
4. 900 s

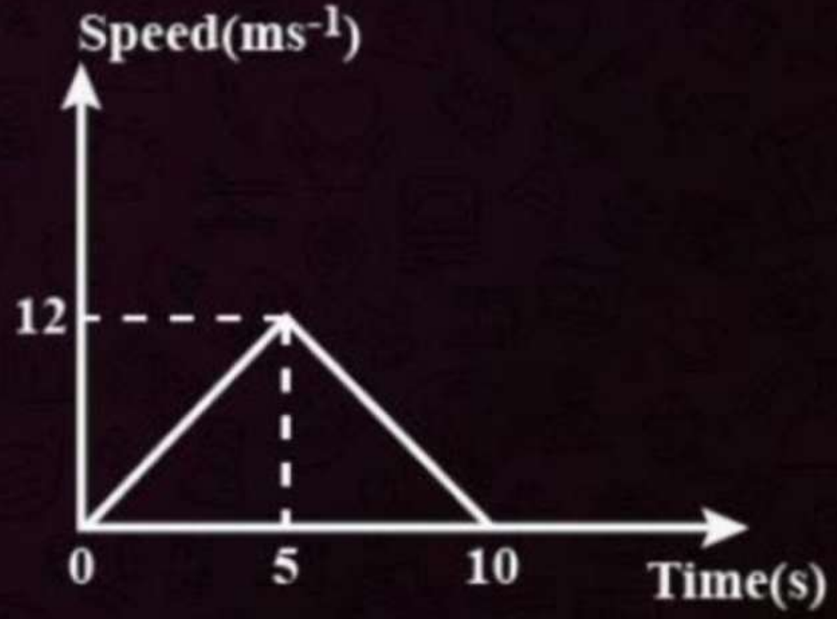
Difficulty Level : Hard

QUESTION-205

The speed-time graph of a particle moving along a fixed direction is shown in the figure. The distance travelled by the particle between $t = 2s$ to $t = 6$ s is

[NCERT Based]

1. 26 m
2. 36 m
3. 46 m
4. 56 m



Difficulty Level : Hard

QUESTION-206

A particle starts from rest, accelerates at 2 m/s^2 for 10 s and then goes with constant speed for 30 s and then decelerates at 4 m/s^2 till it stops. What is the distance travelled by it

1. 750 m
2. 800 m
3. 700 m
4. 850 m

Ans (1)

11.6 Acceleration vs Time

Area = $v - u$

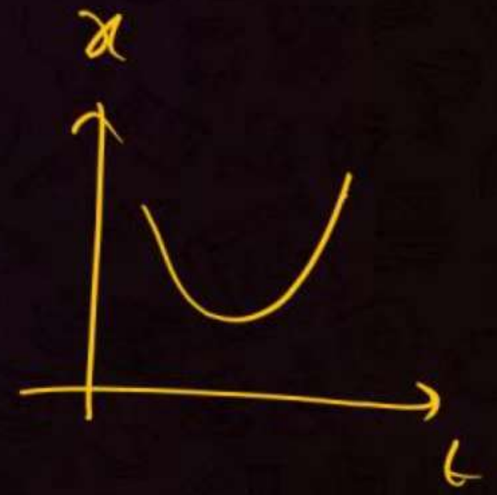
Change in velocity.

Difficulty Level : Easy

QUESTION-207

The path of a particle moving under the influence of a force fixed in magnitude and direction is

1. Straight line
2. Circle
3. Parabola ✓
4. Ellipse



Difficulty Level : Easy

QUESTION-208

The area under acceleration time graph represents the [NCERT Based]

1. Initial velocity
2. Final velocity
3. Change in velocity
4. Distance travelled

Difficulty Level : HArd

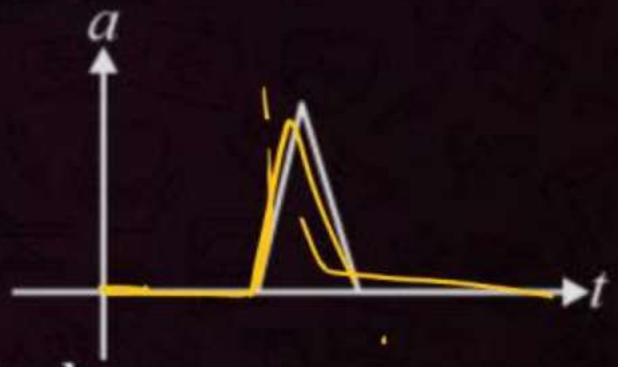
QUESTION-209

The given acceleration time graph represents which of the following physical situations?

[NCERT Based]

1. A cricket ball moving with a uniform speed is hit with a bat for a very short time interval.

F=ma



2. A ball is falling freely from the top of a tower.

3. A car moving with constant velocity on a straight road.

4. A football is kicked into the air vertically upwards.

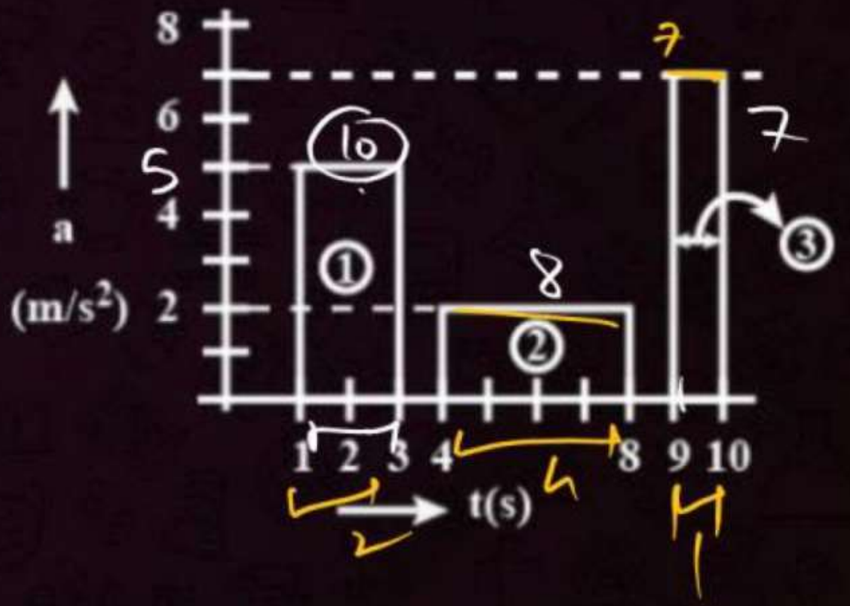
QUESTION-210

Difficulty Level : MEdium

The figure shows a particle moving along x-axis subjected to three intervals of acceleration (a). Rank the intervals according to the changes in velocity they produce in the particle, greatest first.

[NCERT Based]

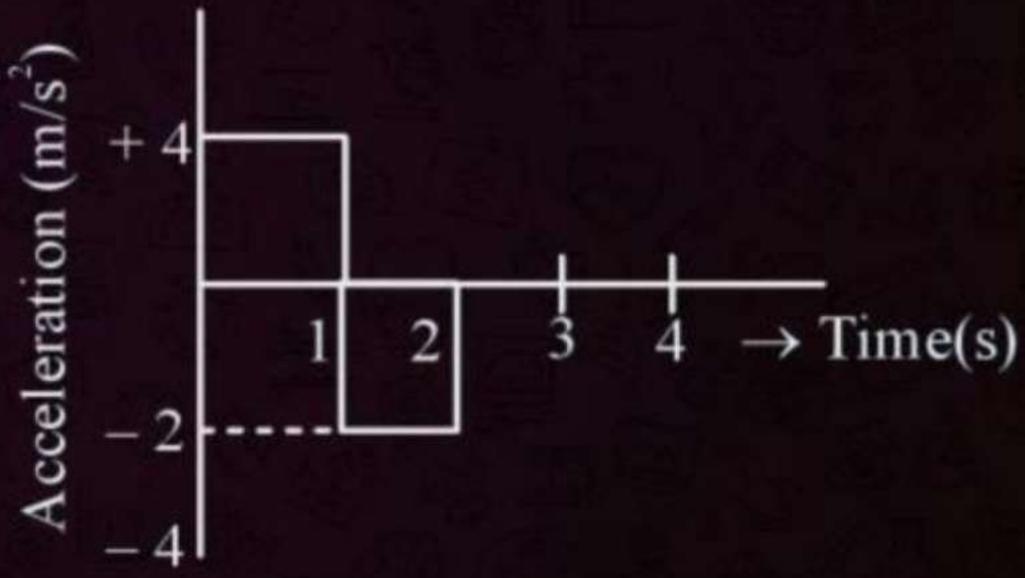
1. $2 > 1 > 3$
2. $2 > 3 > 1$
3. $1 > 3 > 2$
4. $1 > 2 > 3$



QUESTION-211

Difficulty Level : MEdium

A particle starts from rest at $t = 0$ and moves in a straight line with acceleration as shown below. The velocity of the particle at $t = 3$ s is



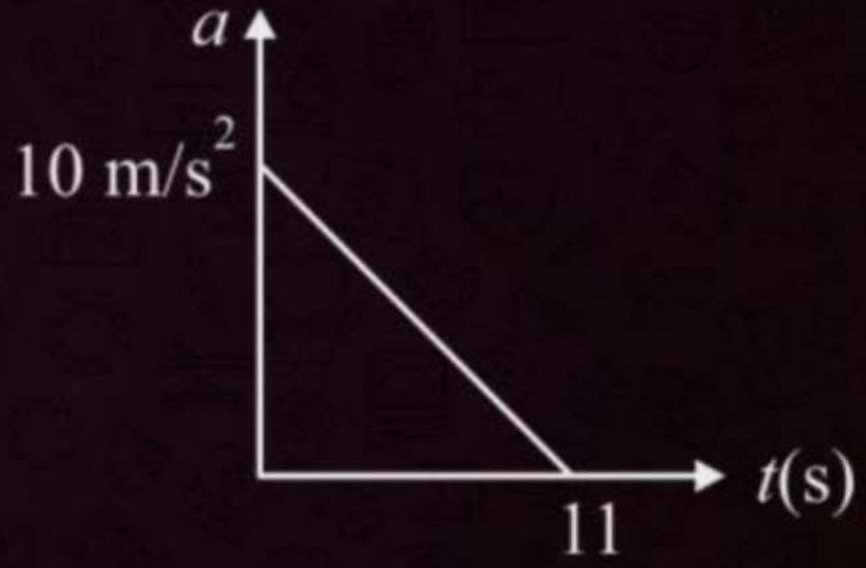
1. $2\ ms^{-1}$
2. $4\ ms^{-1}$
3. $6\ ms^{-1}$
4. $5\ ms^{-1}$

Ans (1)

Difficulty Level : Hard

QUESTION-212

A particle starts from rest. Its acceleration (a) versus time (t) is as shown in the figure. The maximum speed of the particle will be



1. 110 m/s
2. 55 m/s
3. 550 m/s
4. 660 m/s

Ans (2)

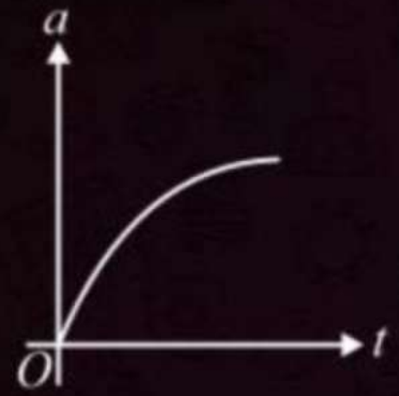
Difficulty Level : Hard

QUESTION-213

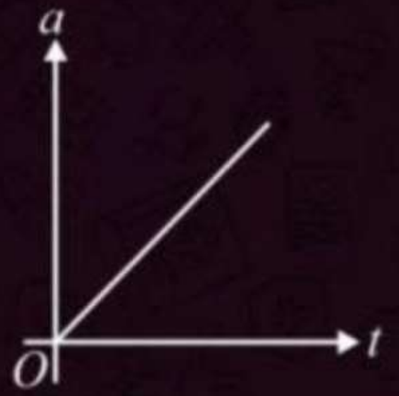
Const. a

The velocity v of a particle moving along x-axis varies with its position (x) as $v = \alpha\sqrt{x}$; where α is a constant. Which of the following graph represents the variation of its acceleration (a) with time (t)?

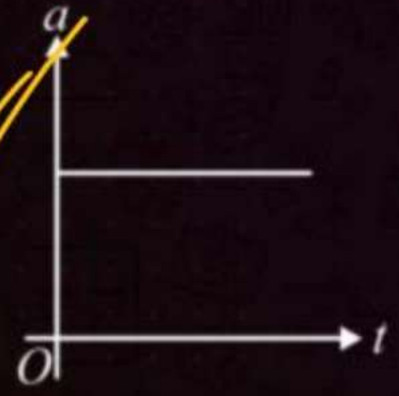
1



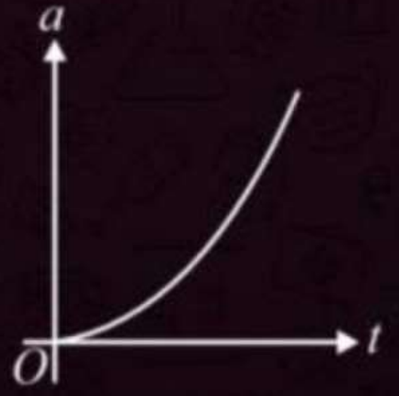
2



3



4



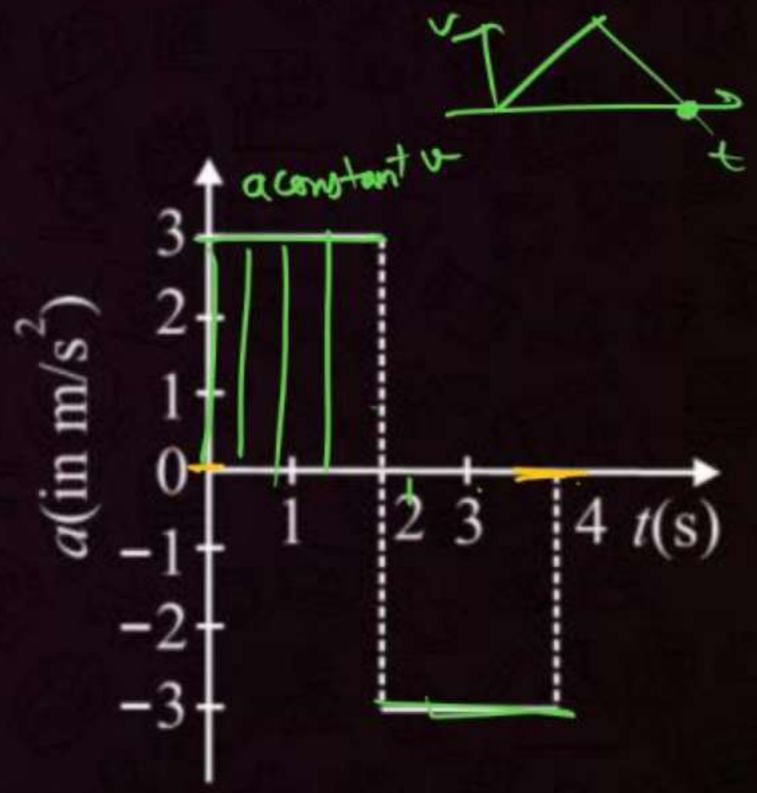
Ans (3)

11.7 Mix - Time

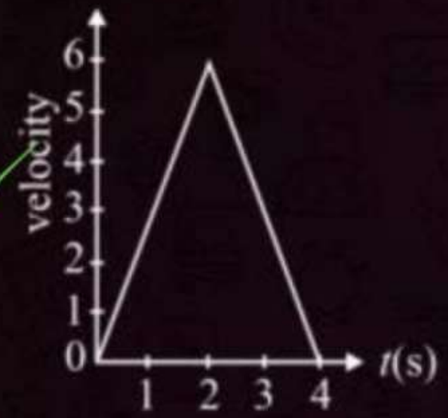
Difficulty Level : Hard

QUESTION-214

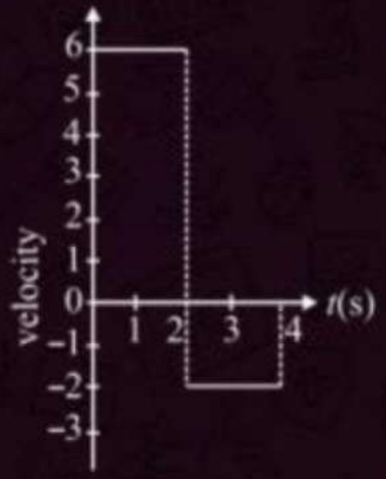
For the motion of a particle acceleration-time graph is shown in figure. The velocity time curve for the duration of 0 - 4 seconds is:



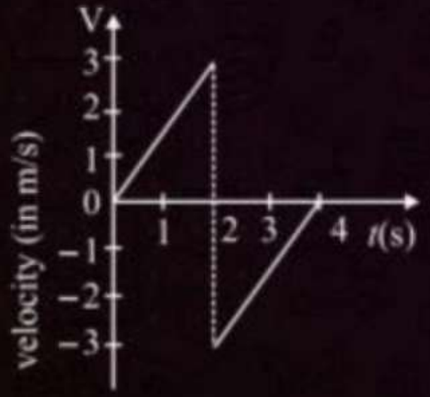
1



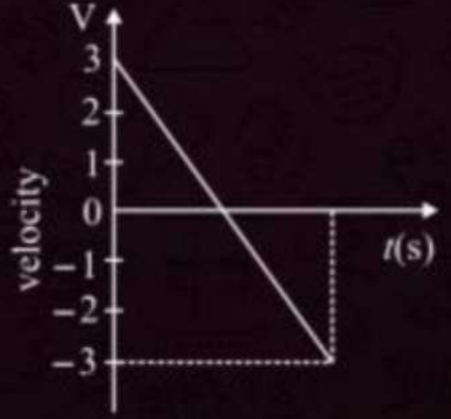
2



3



4



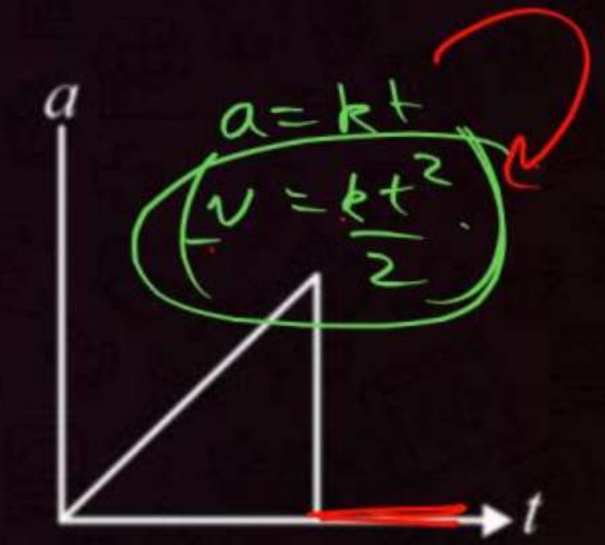
Ans (1)

Difficulty Level : Hard

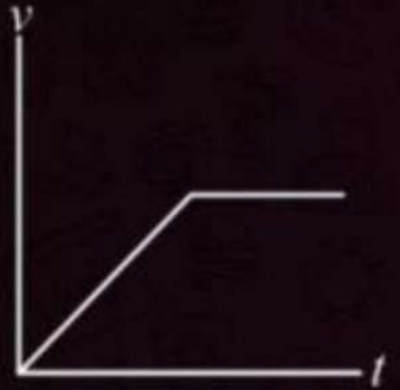
QUESTION-215

The acceleration-time graph of a body is shown below.

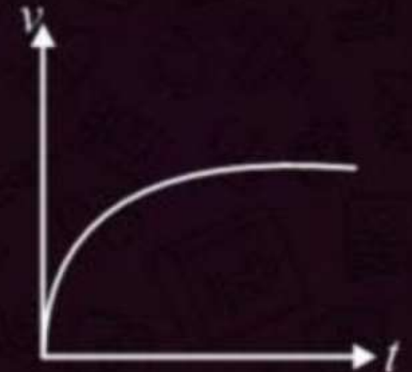
The most probable velocity-time graph of the body is



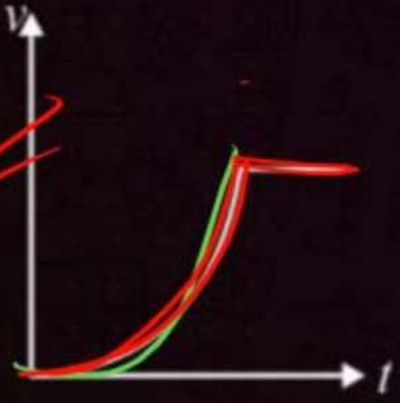
1



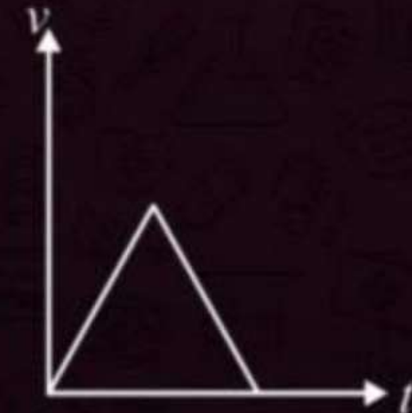
2



3



4



Ans (3)

Difficulty Level : Hard

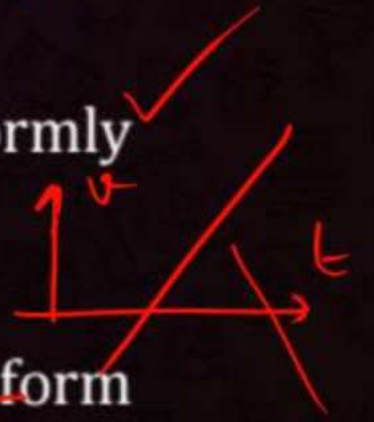
QUESTION-216

Which of the following statements is not correct regarding the motion of a particle in a straight line?

[NCERT Based]

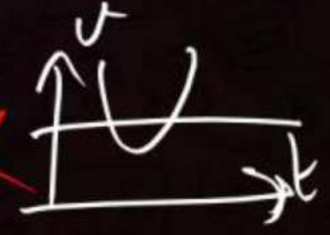
1. x-t graph is a parabola, if motion is uniformly accelerated

2. v-t is a straight line inclined to the time axis, if motion is uniformly accelerated



3. x-t graph is a straight line inclined to the time axis if motion is uniform and acceleration is zero.

4. v-t graph is a parabola if motion is uniform and acceleration is zero.



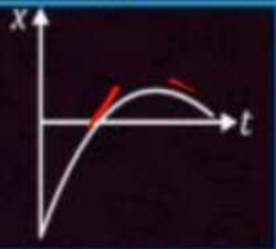
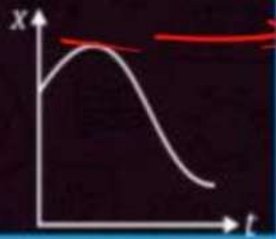
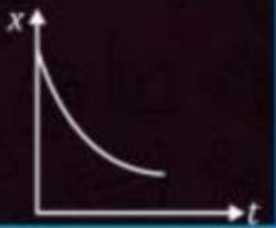
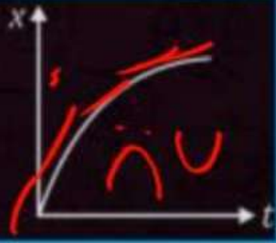
Difficulty Level : Hard

QUESTION-217

Match the Column I with Column II.

[NCERT Based]

1. $A \rightarrow p, B \rightarrow q, C \rightarrow s, D \rightarrow r,$
2. $A \rightarrow q, B \rightarrow p, C \rightarrow r, D \rightarrow s,$
3. $A \rightarrow s, B \rightarrow r, C \rightarrow q, D \rightarrow p,$
4. $A \rightarrow r, B \rightarrow q, C \rightarrow s, D \rightarrow p,$

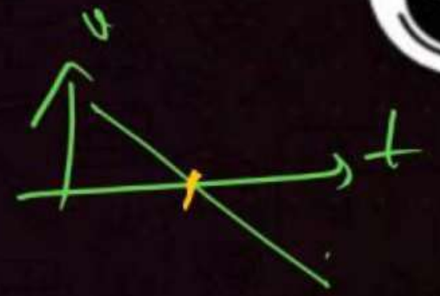
Column-I (Physical quantity)		Column II (Formula)	
(A)		(p)	Has $v > 0$ and $a < 0$ throughout.
(B)		(q)	Has $x > 0$ throughout and has a point with $v = 0$ and a point with $a = 0$
(C)		(r)	Has a point with zero displacement for $t > 0$
(D)		(s)	Has $v < 0$ and $a < 0$

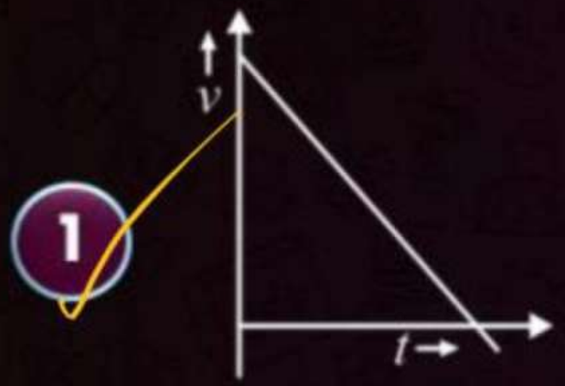
Difficulty Level : Hard

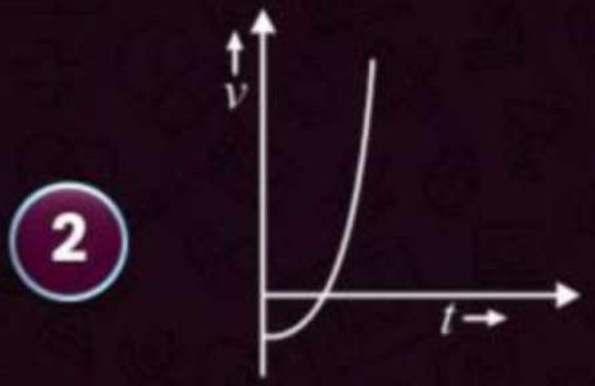
QUESTION-218

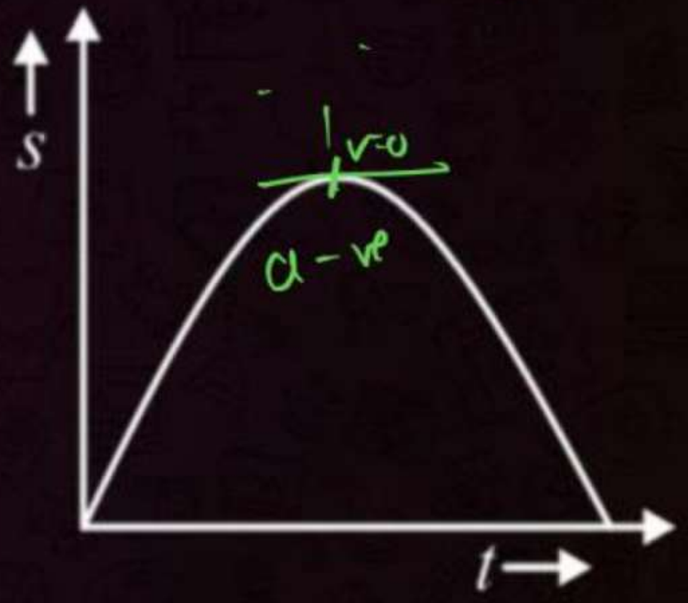
The graph of displacement v/s time is:

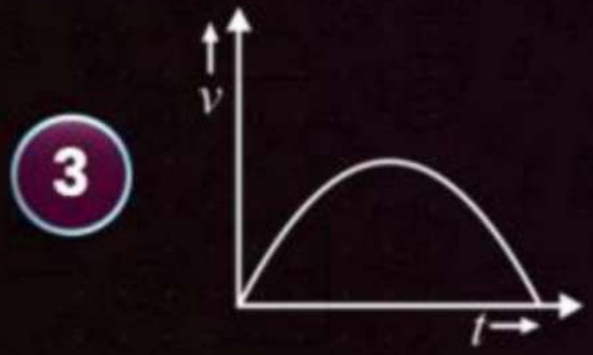
Its corresponding velocity-time graph will be:

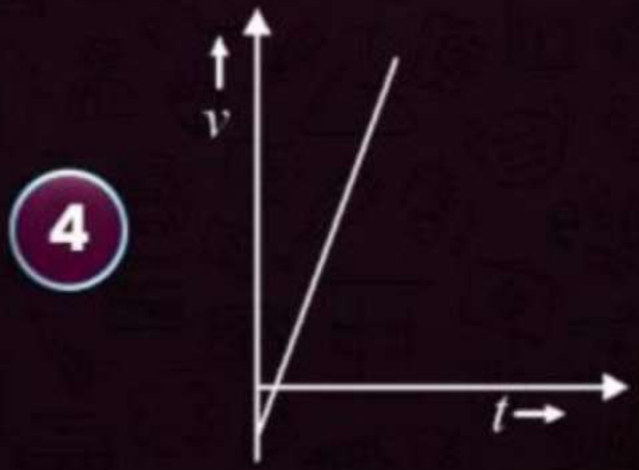








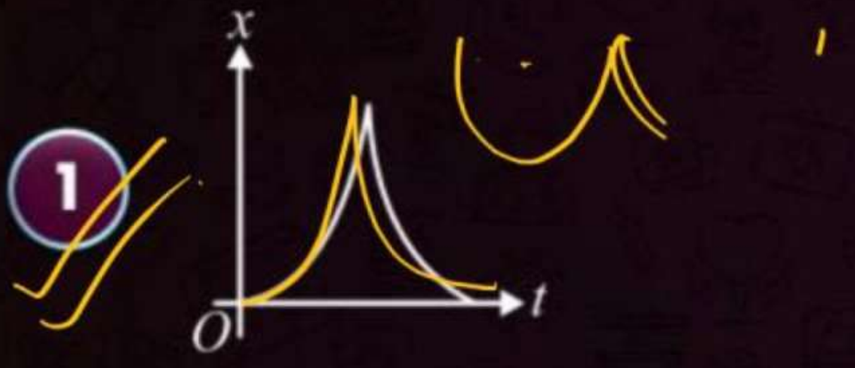




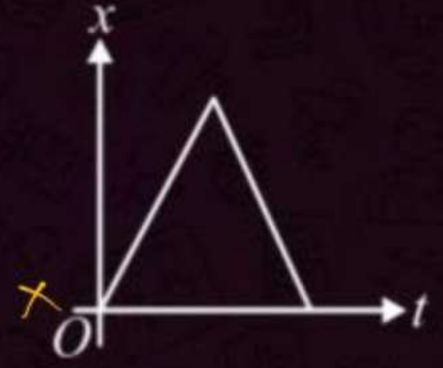
Difficulty Level : Hard

QUESTION-219

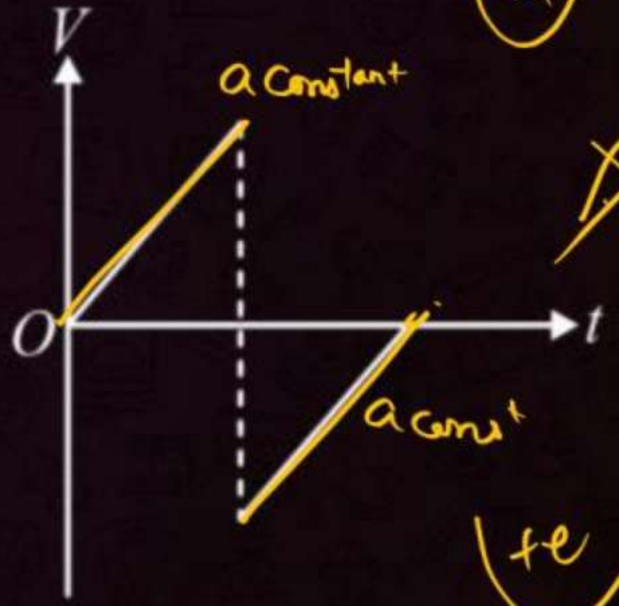
The velocity (v)-time (t) graph for a particle moving along x-axis is shown in the figure. The corresponding position (x)- time (t) is best represented by

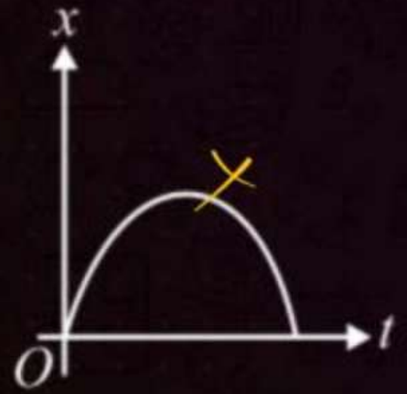


1

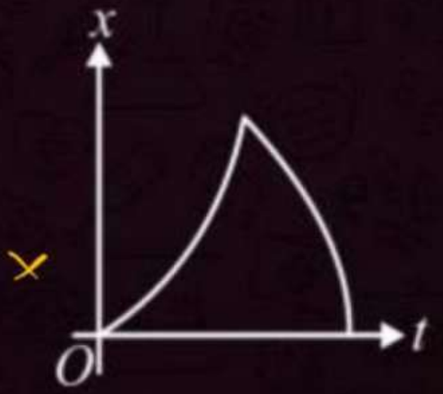


2





3

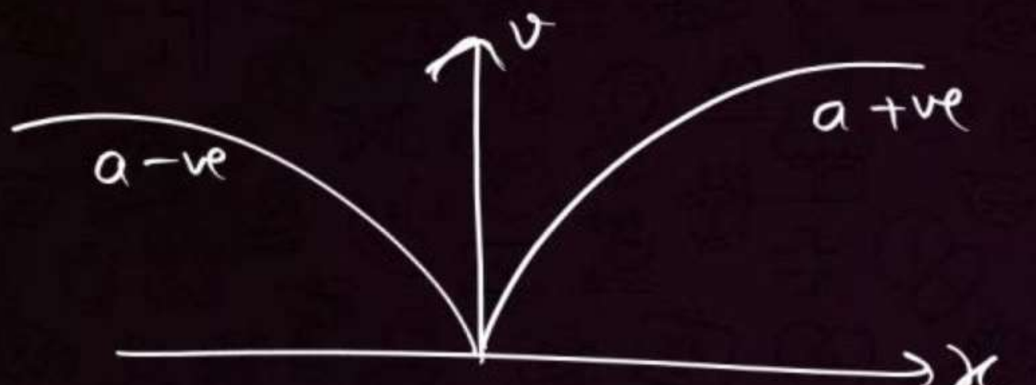


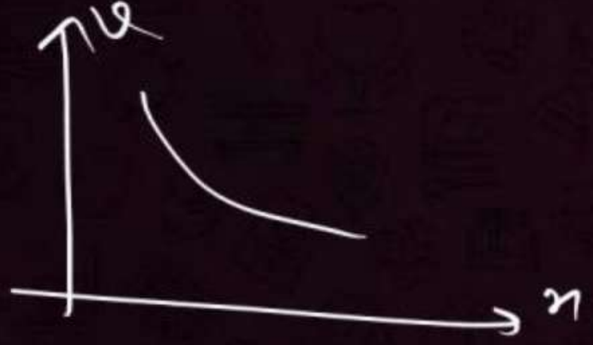
4

Ans (1)

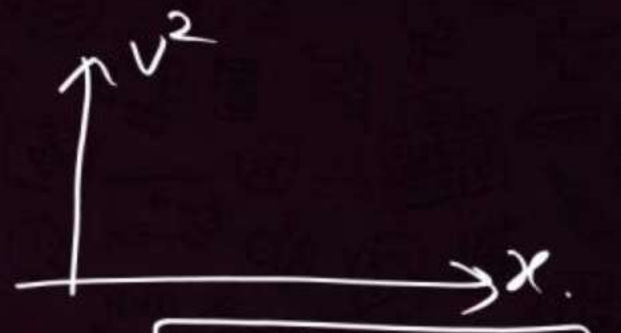
11.8 Timeless Graphs

v d s a constant





$$\left(\frac{dv}{dx} = \frac{a}{v}\right)$$

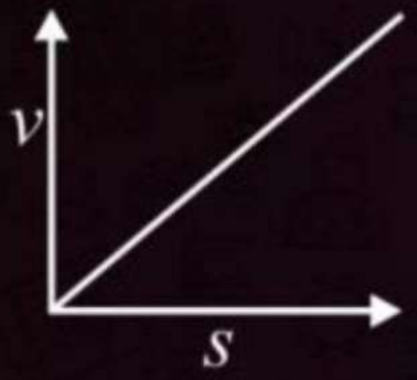


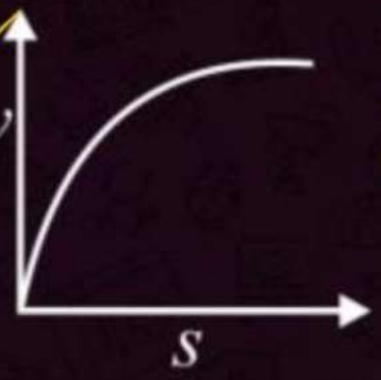
$$\frac{d(v^2)}{dx} = 2a$$

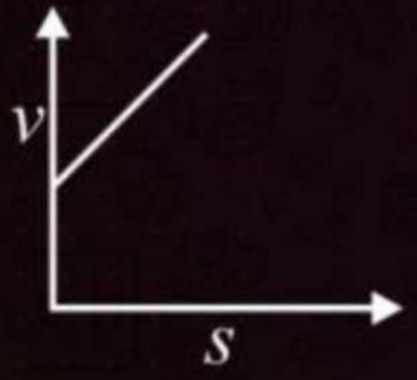
Difficulty Level : YODHA

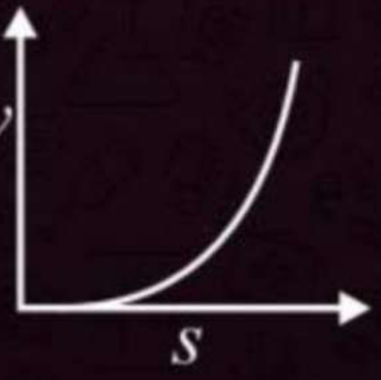
QUESTION-220

A particle starts from rest and move with constant acceleration. Its velocity-displacement curve is:

1. 

2. 

3. 

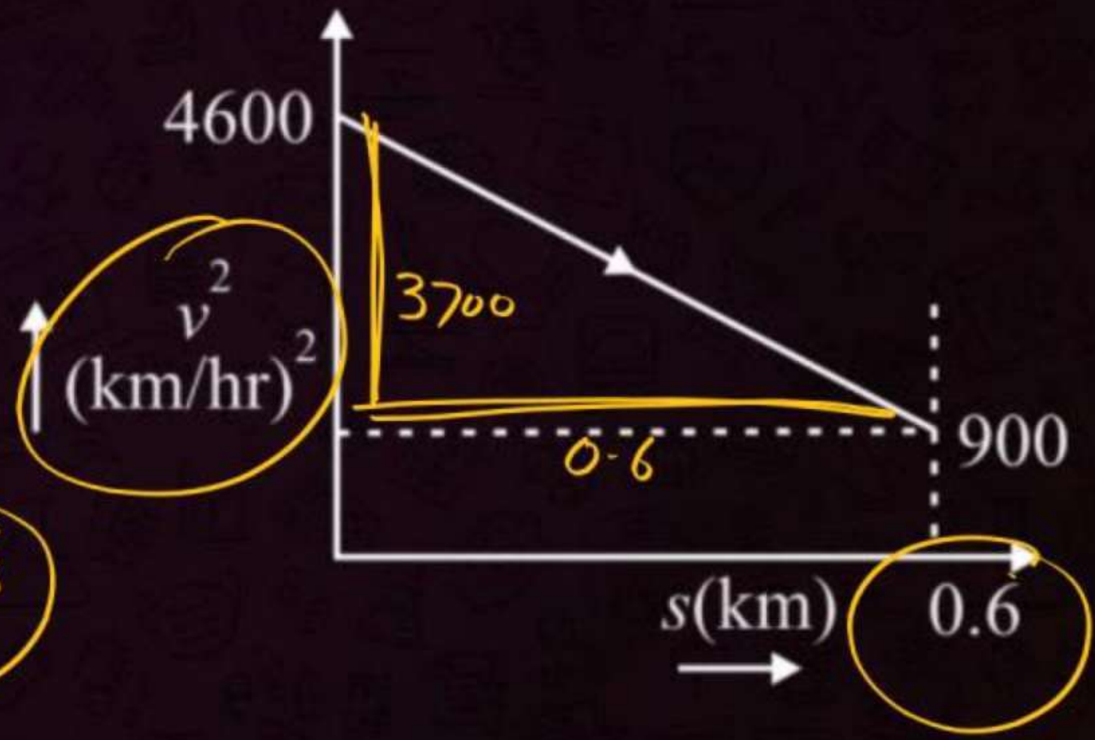
4. 

Ans (2)

Difficulty Level : HARD

QUESTION-221

Graph between the square of the velocity (v) of a particle and the distance (s) moved is shown in figure. The acceleration of the particle in kilometers per hour square is:



(1) 2250

(2) 3084

(3) - 2250

(4) - 3084

slope $(v^2 - s) \longrightarrow 2a$

$2a = -\frac{37000}{0.6}$

$a = -\frac{37000}{12} = -3083$

Ans (4)

Difficulty Level : YODHA

QUESTION-223

The velocity (v) of a particle moving along x-axis varies with its position x as shown in figure. The acceleration (a) of particle varies with position (x) as

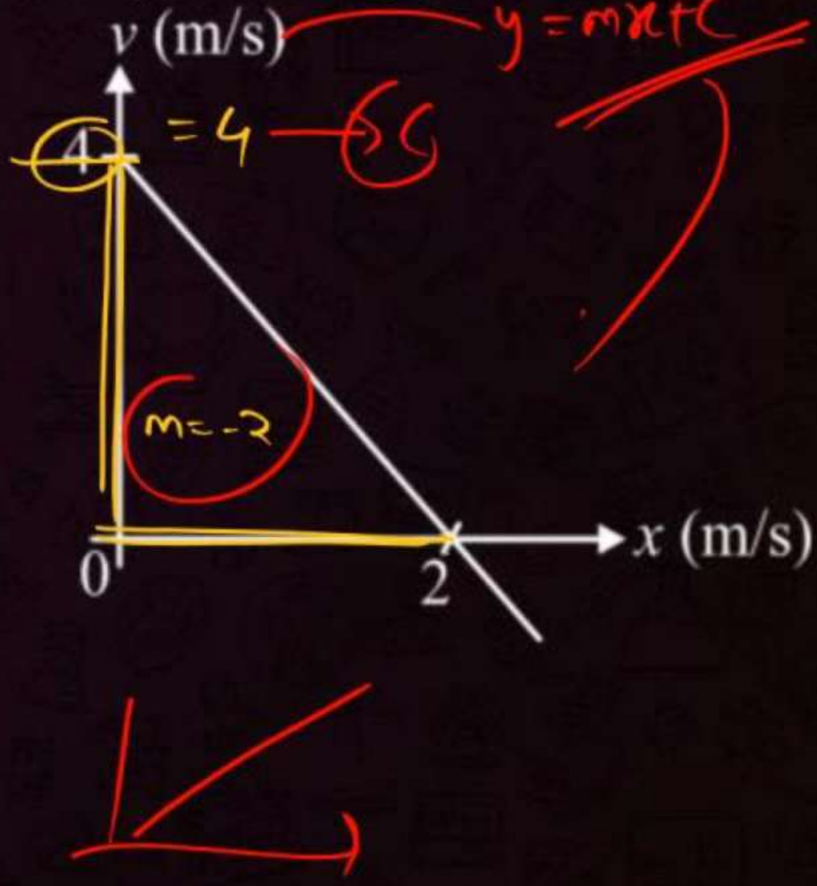
1. $a^2 = x + 3$
2. $a = 2x^2 + 4$
3. $2a = 3x + 5$
4. $a = 4x - 8$

$v = -2x + 4$

$\frac{dv}{dx} = -2$

$a = v\frac{dv}{dx} = -2(-2x+4)$

$a = 4x - 8$



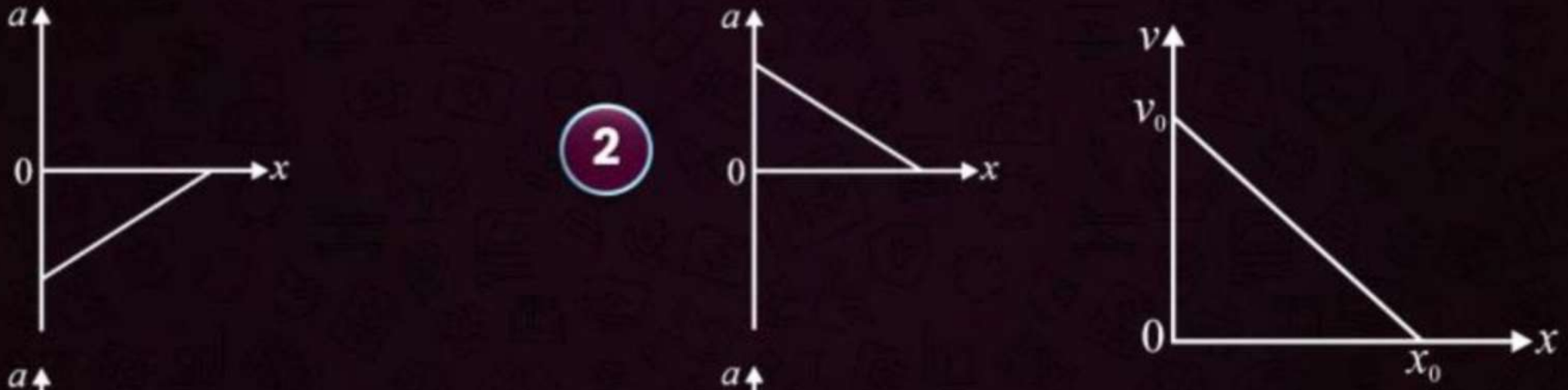
Ans (4)

QUESTION-224

Difficulty Level : YODHA

The velocity-displacement graph of a particle is as shown in the figure. Which of the following graphs correctly represents the variation of acceleration with displacement?

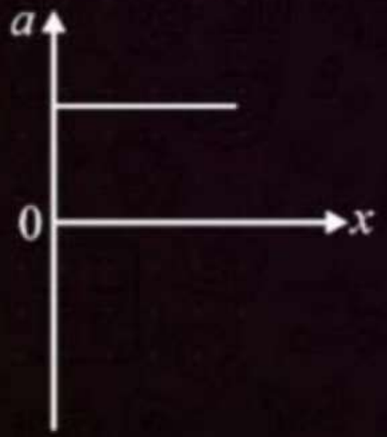
[NCERT Based]



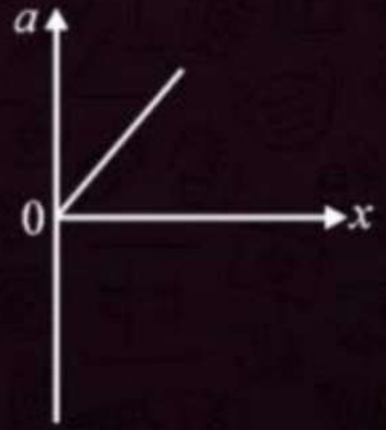
1

2

3



4



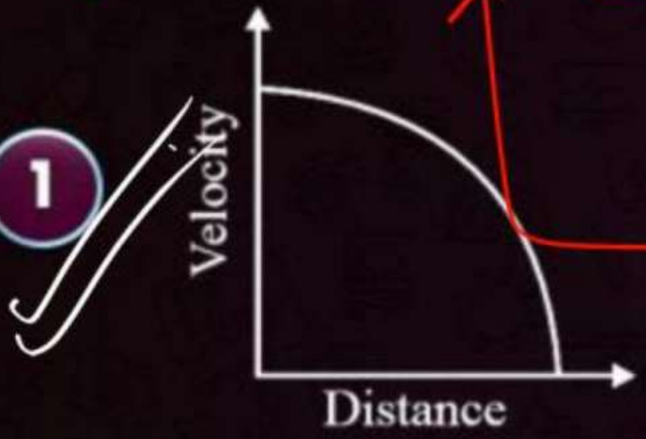
QUESTION-225

Difficulty Level : YODHA

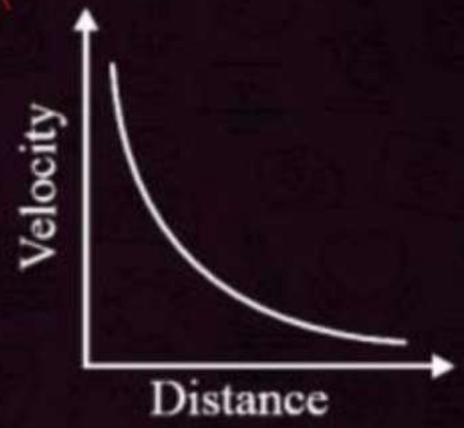
Which graph corresponds to an object moving with a constant negative acceleration and a positive velocity?

[NCERT Based]

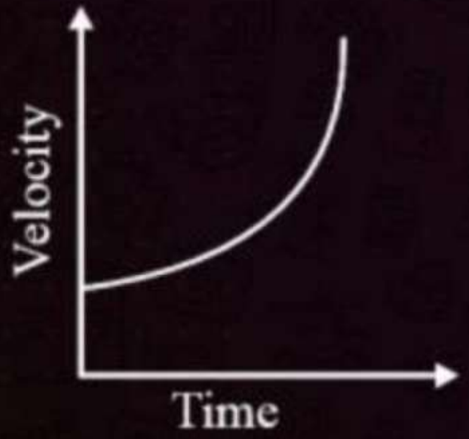
1



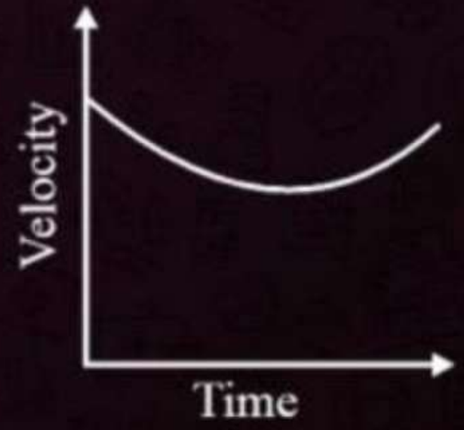
2



3

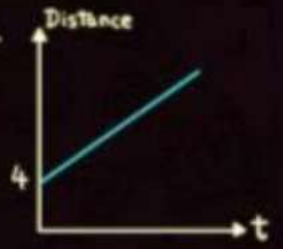


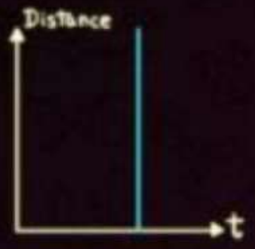
4

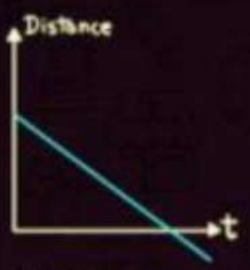


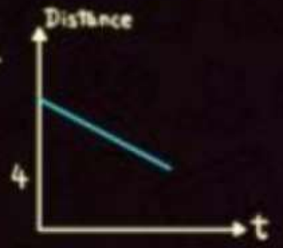
Puppy ~~35~~ – Sambhav Asabbhav

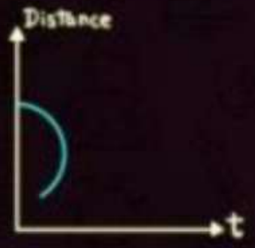
Difficulty Level : Easy

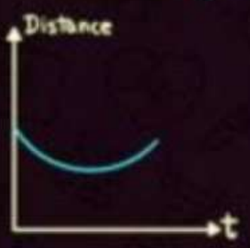
1. 

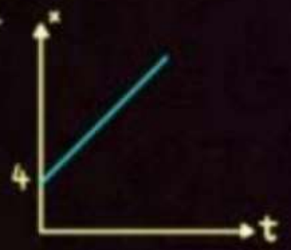
2. 

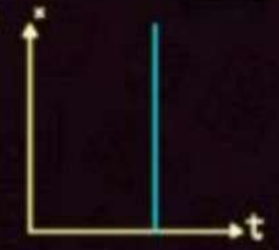
3. 

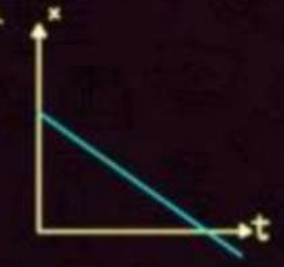
4. 

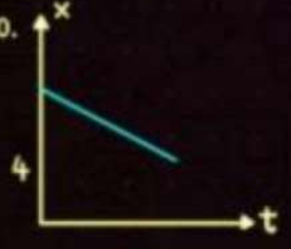
5. 

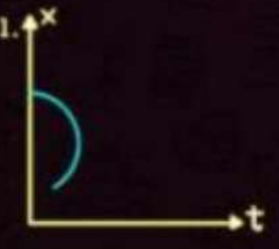
6. 

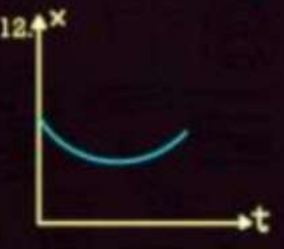
7. 

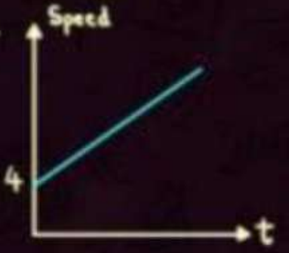
8. 

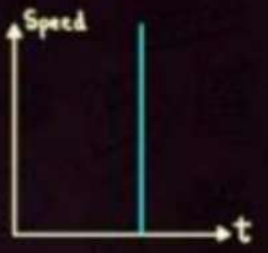
9. 

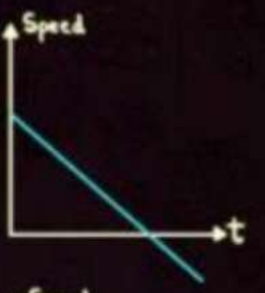
10. 

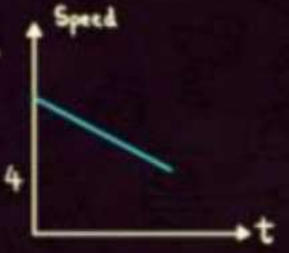
11. 

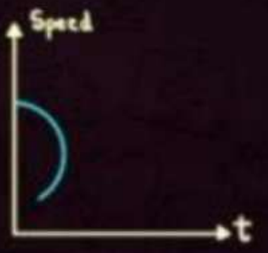
12. 

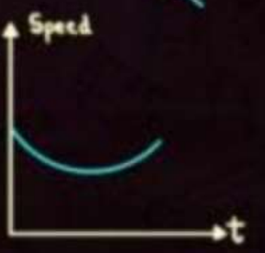
13. 

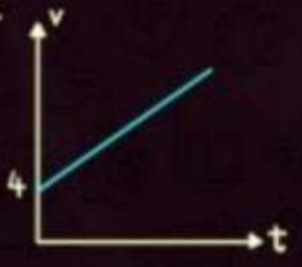
14. 

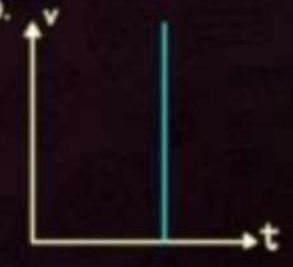
15. 

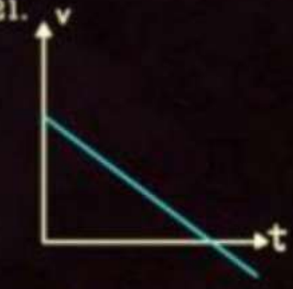
16. 

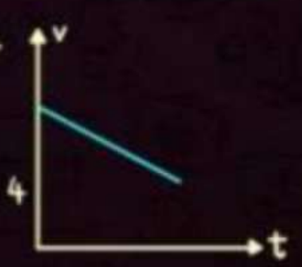
17. 

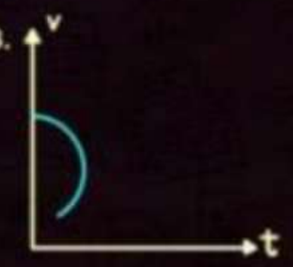
18. 

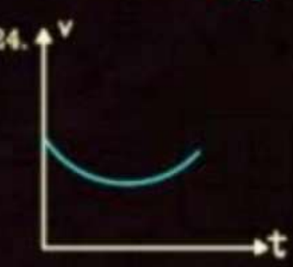
19. 

20. 

21. 

22. 

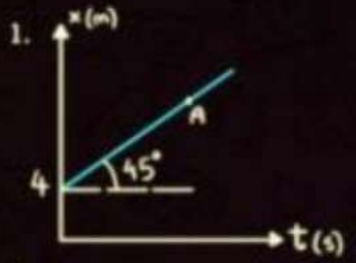
23. 

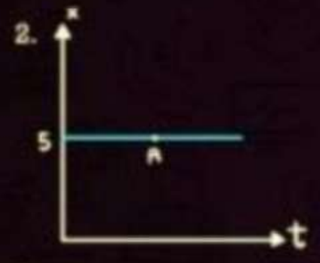
24. 

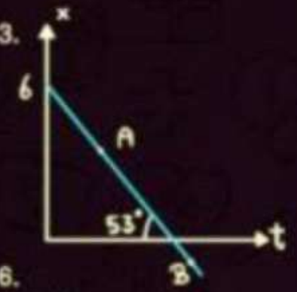
Puppy 36 – Find Velocity

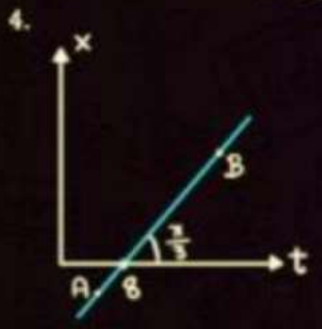
Difficulty Level : MEdium

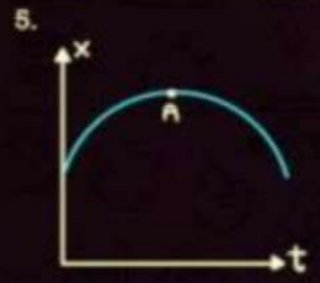
Find velocity when object is at point A and B. x is in metres and t is in seconds.

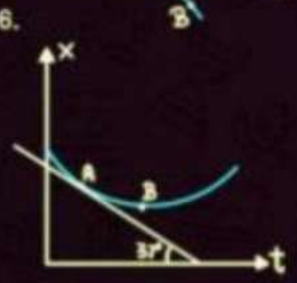
1. 

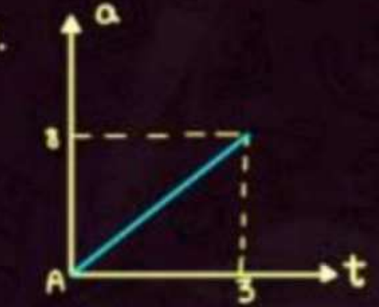
2. 

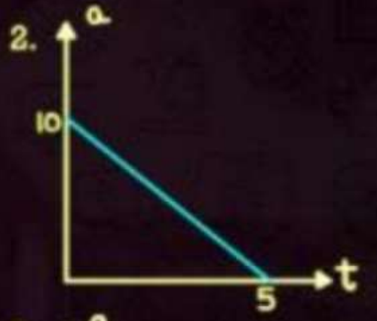
3. 

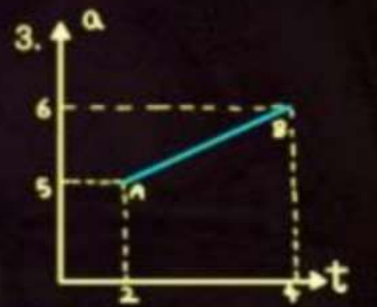
4. 

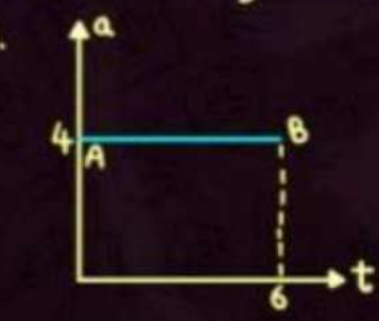
5. 

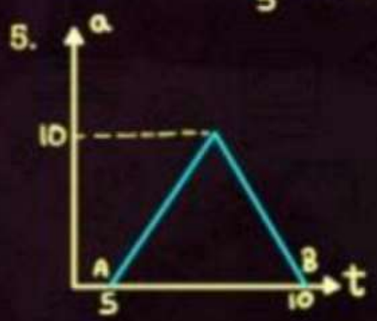
6. 

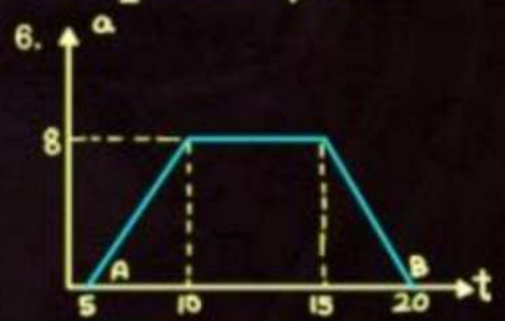
1. 

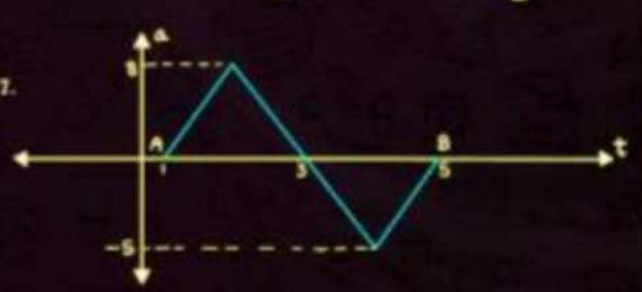
2. 

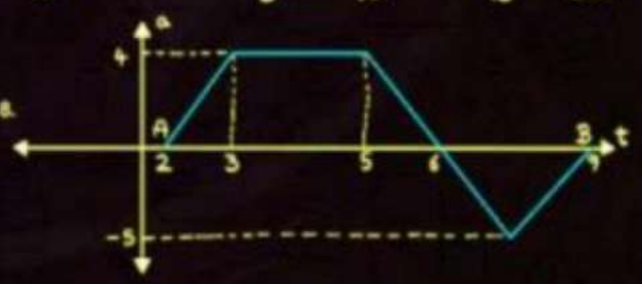
3. 

4. 

5. 

6. 

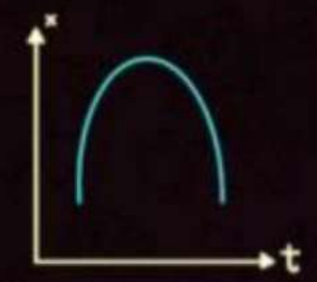
7. 

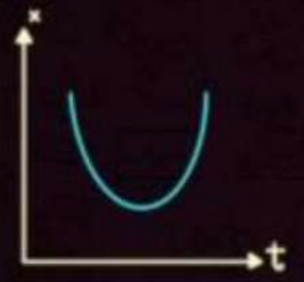
8. 

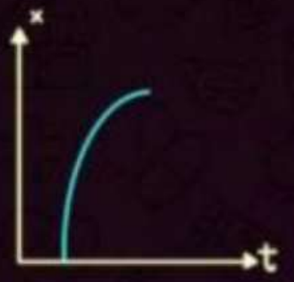
Puppy 37 – Find Acceleration

Difficulty Level : Medium

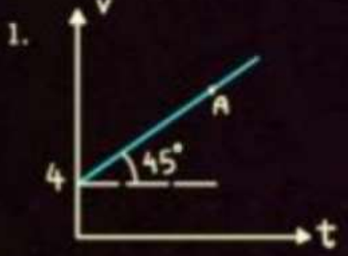
Mark the following graph for accelerating, deceleration and retardation.

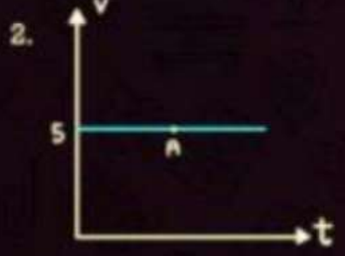
1. 

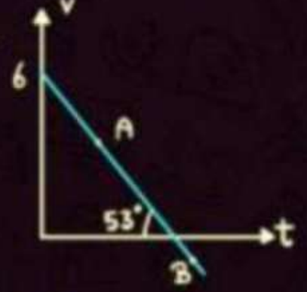
2. 

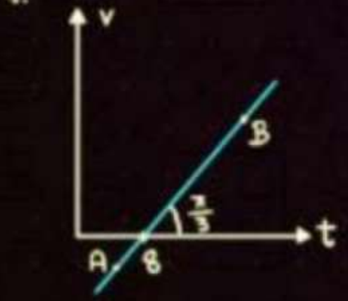
3. 

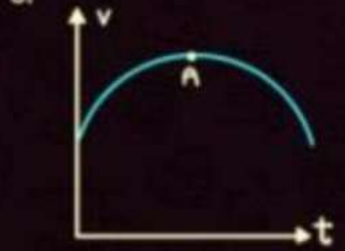
Find acceleration when object is at point A and B. v is in m/s and t is in seconds.

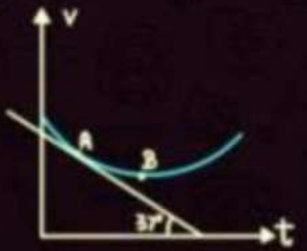
1. 

2. 

3. 

4. 

5. 

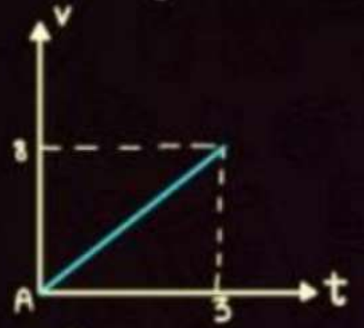
6. 

Puppy 38 – Find Displacement

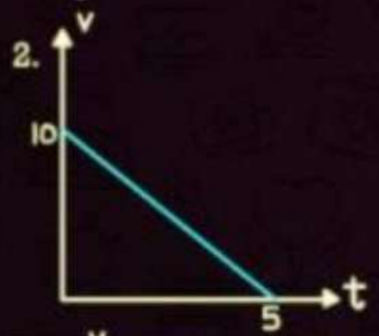
Difficulty Level : MEdium

Find displacement between point A and B.

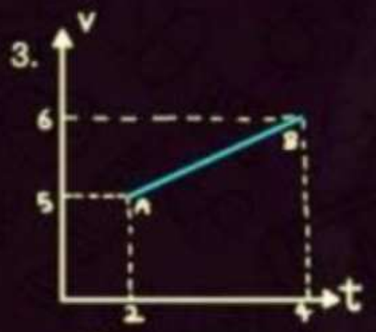
1.



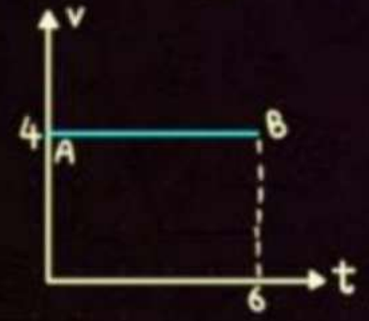
2.



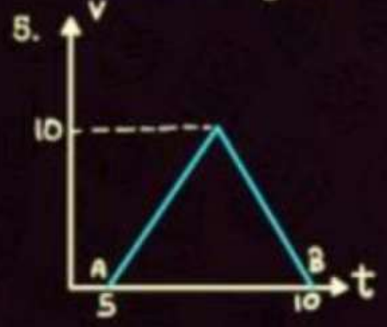
3.



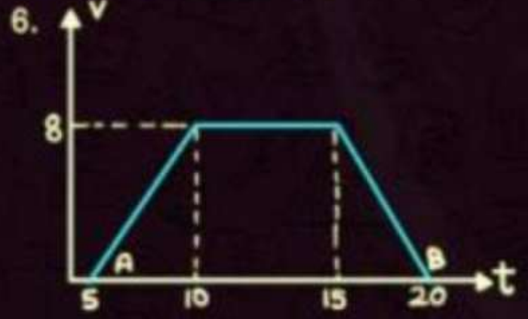
4.



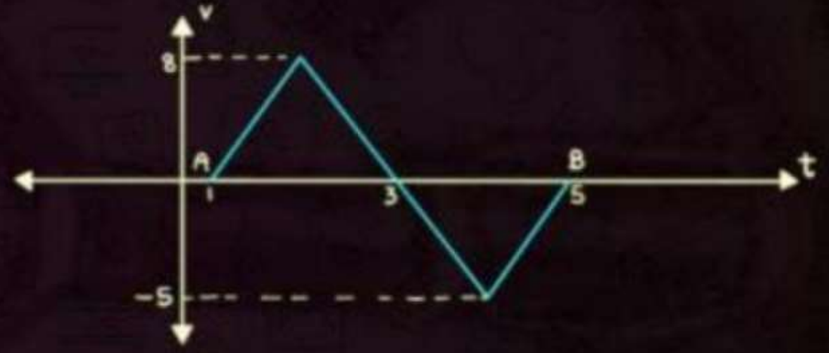
5.



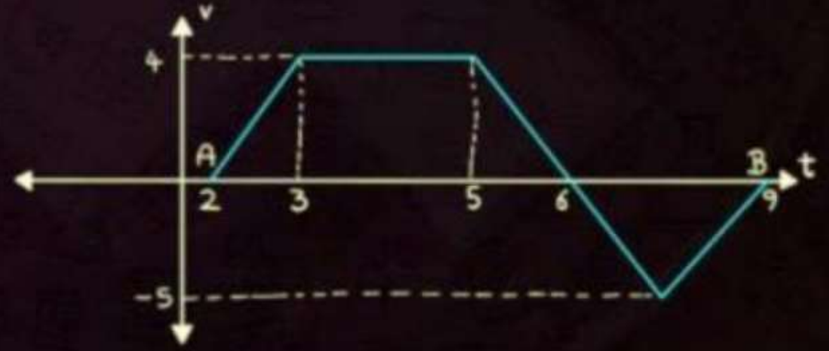
6.



7.



8.

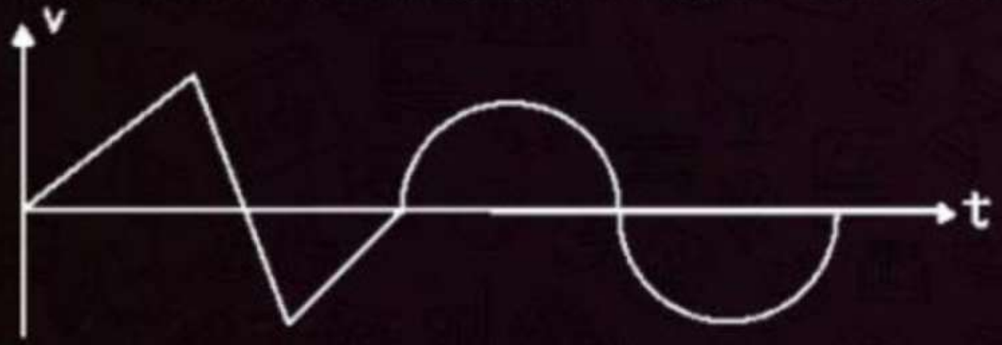


Puppy 39 – Convert

Difficulty Level : Hard

Convert displacement time graph into distance time graph.

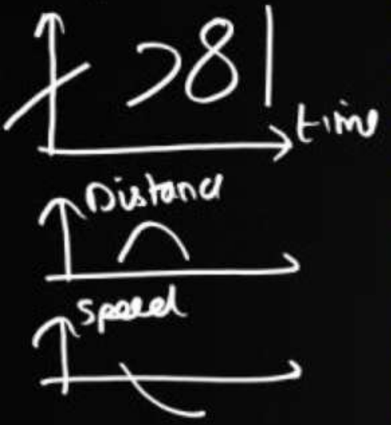
Convert velocity time graph into speed time graph.

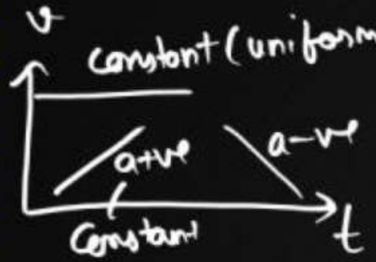


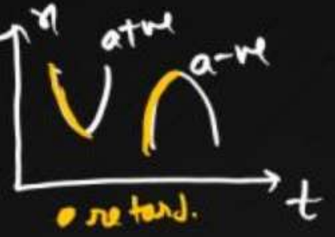
How many times on the graph is average velocity equal to instantenous velocity.

PUPPY POINTS - 4

Impossible Graphs

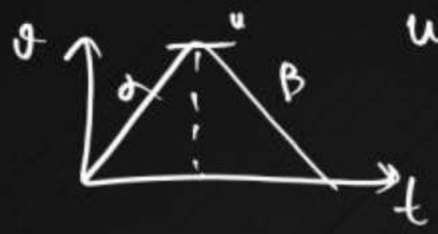






⇒ slope velocity

⇒ ~~area~~



$u = \frac{\alpha\beta T}{\alpha+\beta}$

$S = \frac{1}{2}\left(\frac{\alpha\beta}{\alpha+\beta}\right)T^2$

→ slope a

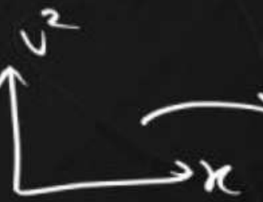
→ Area x.

~~slope~~ → x

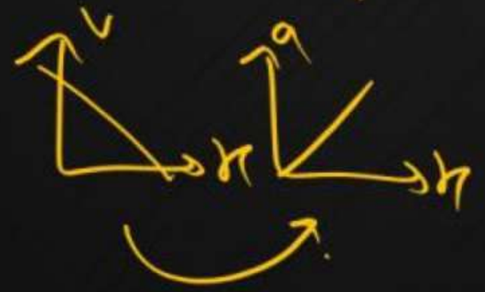
area = v - u

$v \propto \sqrt{x}$

$\left(\frac{dv}{dx} = \frac{a}{v}\right)$



$\frac{d(v^2)}{dx} = 2a$



Part 12 – Theory and AR

QUESTION-226 (Assertion and Reason)

Assertion: The position-time graph of a body moving uniformly in a straight line is parallel to position axis.

Reason: The position-time graph in a non-uniform motion gives constant velocity at all instants of time.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-227 (Assertion and Reason)

Assertion: The average and instantaneous velocities have same value in a uniform motion.

Reason: In uniform motion, the velocity of an object increases uniformly.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-228 (Assertion and Reason)

Assertion: Doubling the initial velocity, the stopping distance of moving object increases by a factor of 4 (for the same deceleration).

Reason: Stopping distance is proportional to the square of the initial velocity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-229 (Assertion and Reason)

Assertion: For a particle, area under acceleration- time graph gives the velocity.

Reason: Rate of change of velocity is acceleration.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-230 (Assertion and Reason)

Assertion: The acceleration of an object at a particular time is the slope of the velocity-time graph at that instant of time.

Reason: For uniform motion acceleration is zero.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-231 (Assertion and Reason)

Assertion: Acceleration and velocity cannot change values abruptly at an instant.

Reason: Their changes can either be continuous or discontinuous.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-232 (Assertion and Reason)

Assertion: A particle may be momentarily at rest and yet have non-zero acceleration.

Reason: The zero velocity of a particle at any instant does not necessarily imply zero acceleration at that instant.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-233 (Assertion and Reason)

Assertion: The accelerated motion of an object may be due to change in magnitude of velocity or direction of velocity or both.

Reason: Acceleration can be produced only by change in the magnitude of the velocity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-234 (Assertion and Reason)

Assertion: An object may fall with a constant velocity.

Reason: This happens when acceleration of the object is equal to acceleration due to gravity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-235 (Assertion and Reason)

Assertion: Kinematic equations are exact and are always correct.

Reason: The definitions of instantaneous velocity and acceleration are true only for motion in which the magnitude and direction of acceleration are constant during the course of motion.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-236 (Assertion and Reason)

Assertion: A body can have acceleration even if its velocity is zero at a given instant of time.

Reason: A body is momentarily at rest when it reverses its direction of motion.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-237 (Assertion and Reason)

Assertion: Two balls of different masses are thrown vertically upward with the same speed. They will pass through their point of projection in the downward direction with the same speed.

Reason: The maximum height and downward velocity attained at the point of projection are independent of the mass of the ball.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-238 (Assertion and Reason)

Assertion: If the displacement of the body is zero, the distance covered by it may not be zero.

Reason: Displacement is a vector quantity and distance is a scalar quantity. Displacement is a vector quantity and distance is a scalar quantity. Displacement is a vector quantity and distance is a scalar quantity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-239 (Assertion and Reason)

Assertion: The average velocity of an object over an interval of time is either smaller than or equal to the average speed of the object over the same interval.

Reason: Velocity is a vector quantity and speed is a scalar quantity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-240 (Assertion and Reason)

Assertion: An object can have constant speed but variable velocity.

Reason: Speed is a scalar but velocity is a vector quantity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-241 (Assertion and Reason)

Assertion: The speed of a body can be negative.

Reason: If the body is moving in the opposite direction of pos- itive motion, then its speed is negative.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-242 (Assertion and Reason)

Assertion: The position-time graph of a uniform motion in one dimension of a body can have negative slope.

Reason: When the speed of body decreases with time, the position-time graph of the moving body has a negative slope.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-243 (Assertion and Reason)

Assertion: A positive acceleration of a body can be associated with a 'slowing down' of the body.

Reason: Acceleration is a vector quantity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-244 (Assertion and Reason)

Assertion: A negative acceleration of a body can be associated with a 'speeding up' of the body.

Reason: Increase in speed of a moving body is independent of its direction of motion.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-245 (Assertion and Reason)

Assertion: Straight line motion is the natural tendency of the body.

Reason: When a body is subjected to a uniform acceleration, it always moves in a straight line.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-246 (Assertion and Reason)

Assertion: Rocket in flight is not an illustration of projectile.

Reason: Rocket takes flight due to combustion of fuel and does not move under the gravity effect alone.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-247 (Assertion and Reason)

Assertion: The average speed of a body over a given inter- val of time is equal to the average velocity of the body in the same interval of time, if a body moves in a straight line in one direction.

Reason: Because in this case, distance travelled by a body is equal to the displacement of the body.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-248 (Assertion and Reason)

Assertion: Position-time graph of a stationary object is a straight-line parallel to time axis.

Reason: For a stationary object, position does not change with time.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-249 (Assertion and Reason)

Assertion: The slope of displacement-time graph of a body moving with high velocity is steeper than the slope of displacement-time graph of a body with low velocity.

Reason: Slope of displacement-time graph = Velocity of the body.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-250 (Assertion and Reason)

Assertion: Distance-time graph of the motion of a body having uniformly accelerated motion is a straight line inclined to the -time axis.

Reason: Distance travelled by a body having uniformly accel- erated motion is directly proportional to the time taken.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-251 (Assertion and Reason)

Assertion: A body having non-zero acceleration can have a constant velocity.

Reason: Acceleration is the rate of change of speed.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-252 (Assertion and Reason)

Assertion: A body, whatever its motion, is always at rest in a frame of reference which is fixed to the body itself.

Reason: The relative velocity of a body with respect to itself is zero.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-253 (Assertion and Reason)

Assertion: Displacement of a body may be zero when distance travelled by it is not zero.

Reason: The displacement is the longest distance between initial and final position.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-254 (Assertion and Reason)

Assertion: The equation of motion can be applied only if acceleration is along the direction of velocity and is constant.

Reason: If the acceleration of a body is constant then its motion is known as uniform motion.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-255 (Assertion and Reason)

Assertion: A bus moving towards north takes a turn and starts moving towards east with the same speed. There will be change in the velocity of the bus.

Reason: Velocity is a vector quantity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-256 (Assertion and Reason)

Assertion: The relative velocity between any two bodies moving in the opposite direction is equal to sum of the velocities of two bodies.

Reason: Sometimes relative velocity between two bodies is equal to difference in velocities of the two.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-257 (Assertion and Reason)

Assertion: The displacement-time graph of a body moving with uniform acceleration is a straight line.

Reason: The displacement is proportional to time for uniformly accelerated motion.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-258 (Assertion and Reason)

Assertion: Velocity-time graph for an object in uniform motion along a straight path is a straight line parallel to the time axis.

Reason: In uniform motion of an object, velocity increases as the square of time elapsed.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-259 (Assertion and Reason)

Assertion: A body may be accelerated even when it is moving uniformly.

Reason: When direction of motion of the body is not changing, then body must have zero acceleration.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-260 (Assertion and Reason)

Assertion: A body falling freely under gravity moves with constant velocity.

Reason: The body falls freely, when acceleration of a body is equal to acceleration due to gravity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-261 (Assertion and Reason)

Assertion: Displacement of a body is vector sum of the area under velocity-time graph.

Reason: Displacement is a vector quantity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-262 (Assertion and Reason)

Assertion: The position-time graph of a body moving uniformly is a straight line.

Reason: The slope of position-time graph in a uniform motion gives the velocity of an object.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-263 (Assertion and Reason)

Assertion: The average speed of an object may be equal to arithmetic mean of individual speed.

Reason: Average speed is equal to total distance travelled per total time taken.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-264 (Assertion and Reason)

Assertion: The average and instantaneous velocities have the same values in a uniform motion.

Reason: In uniform motion, the velocity of an object increases uniformly.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-265 (Assertion and Reason)

Assertion: The speedometer of a car measures the instantaneous speed of the car.
Reason: Reading of speedometer gives the total distance covered per unit time.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-266 (Assertion and Reason)

Assertion: The relative velocity between any two objects falling freely is always zero.

Reason: Velocity between two objects is equal to difference in the speeds of the two moving objects.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-267 (Assertion and Reason)

Assertion: Description of an event depends on the frame of reference chosen for the description.

Reason: Coordinate system with a clock constitutes a frame of reference.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-268 (Assertion and Reason)

Assertion: The sign of acceleration does not tell us whether the particle speed is increasing or decreasing.

Reason: The sign of acceleration depends on the choice of reference.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-269 (Assertion and Reason)

Assertion: We do not consider rate of change of acceleration in the study of linear motion.

Reason: The basic laws of motion involves only constant acceleration.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-270 (Assertion and Reason)

Assertion: The acceleration of car becomes more when accelerator is pushed hard.

Reason: By pushing hard, time of application of force becomes small.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-271 (Assertion and Reason)

Assertion: If a body is thrown upwards, the distance covered by it in the last second of upward motion is about 5 m irrespec-tive of its initial speed.

Reason: The distance covered in the last second of upward motion is equal to that covered in the first second of downward motion when the particle is dropped.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-272 (Assertion and Reason)

Assertion: Area under acceleration-time graph gives change in velocity.

Reason: Area under *x*-*y* graph gives physical quantity repre-sented by *xy*.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-273 (Assertion and Reason)

Assertion: The *v-f* graph perpendicular to the time axis is not possible.

Reason: If *v-t* graph is perpendicular to the time axis, the acceleration of the particle should be infinite.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-274 (Assertion and Reason)

Assertion: The instantaneous velocity does not depend on instantaneous position vector.

Reason: The instantaneous velocity and average velocity of a particle are always the same.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-275 (Assertion and Reason)

Assertion: A man who can swim at a speed v relative to water wants to cross the river of width d, flowing with speed u. He cannot reach a point opposite him across the river if $u > v$.

Reason: The time to reach the opposite point across the river is equal $(d/v \cos\theta)$ where $\sin\theta=(u/v)$ and if $u > v$, the time taken will come out to be imaginary.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-276 (Assertion and Reason)

Assertion: If two particles, moving with constant velocities are to meet, then the relative velocity must be along the line joining the two particles.

Reason: Relative velocity means motion of one particle as viewed from the other.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-277 (Assertion and Reason)

Assertion: Two balls are dropped one after the other from a tall tower. The distance between them increases linearly with time (elapsed after the second ball is dropped and before the first hits ground).

Reason: Relative acceleration is zero, whereas relative veloc-ity is non-zero in the above situation.

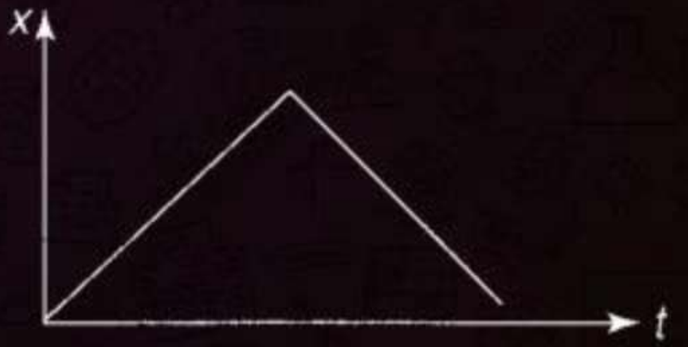
1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-278 (Assertion and Reason)

Assertion: For a particle undergoing rectilinear motion, the x-r graph can be shown as in the figure below.

Reason: Infinitesimal changes in velocity are physically possi-ble only in infinitesimal time.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.



QUESTION-279 (Assertion and Reason)

Assertion: $\left|\frac{d\vec{v}}{dt}\right| = \frac{d}{dt}|\vec{v}|$ Here $\vec{v}$ has its usual meaning.

Reason: If a particle is acted upon by an external force, its momentum may change.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-280 (Assertion and Reason)

Assertion: Area under velocity-time graph gives distance and displacement both.

Reason: Area under acceleration-time graph gives change in velocity.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-281 (Assertion and Reason)

Assertion: The average speed and average velocity of a particle are different physical quantities.

Reason: The average speed and average velocity have the same dimensions.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-282 (Assertion and Reason)

Assertion: A man can cross river of width d in minimum time 1. If the velocity of the river increases, minimum time to cross the river by the man will remain unchanged. lettreizh dive

Reason: Velocity of the river is perpendicular to the width of river in case of minimum time. So, time to cross the river is independent of velocity of river.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-283 (Assertion and Reason)

Assertion: If a particle is moving in a straight line with constant retardation, its velocity must be zero at a particular instant of time.

Reason: If a particle moves under retardation its velocity decreases.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-284 (Assertion and Reason)

Assertion: In a uniformly accelerated motion, velocity-time graph is a straight line with positive slope.

Reason: Acceleration is the rate of change of velocity,

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-285 (Assertion and Reason)

Assertion: A particle is moving on a horizontal surface. Its path will be a straight line if initial velocity and acceleration are along the same horizontal surface.

Reason: Angle between velocity and acceleration determines the path.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-286 (Assertion and Reason)

Assertion: If air resistance is considered then the time of ascent is more than the time of descent.

Reason: The magnitude of acceleration will be the same in upward and downward motion but directions are opposite.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-287 (Assertion and Reason)

Assertion: If air resistance is considered, then 1 kg iron hits the ground faster than 1 kg cotton dropped from the same point.

Reason: The magnitude of air resistance is directly propor- tional to the surface area of body.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-288 (Assertion and Reason)

Assertion: No body in this universe is absolutely at rest or in motion.

Reason: Rest or motion of a body is defined by its position.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-289 (Assertion and Reason)

Assertion: In their planetary motion around the Sun, different planets can be presumed to be the particles.

Reason: If the size of a body is negligible in comparison to its range of motion then the body is known as a particle.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-290 (Assertion and Reason)

Assertion: A car accelerated from initial position and then returned at the initial point, at that time its average velocity is zero.

Reason: Car's speed increases throughout the motion.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-291 (Assertion and Reason)

Assertion: A person completes half of his journey with speed v_1 and rest half with speed v_2. The average speed of the person is $v = \frac{2v_1v_2}{v_1 + v_2}$.

Reason: If same distance is covered by different speeds, then the average speed is harmonic mean of both the speeds.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-292 (Assertion and Reason)

Assertion: Positive acceleration means acceleration increasing with time.

Reason: In accelerated motion, speed always increases.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-293 (Assertion and Reason)

Assertion: If displacement of a particle is directly proportional to the square of time, then the particle is moving with uniform acceleration.

Reason: Acceleration is second derivative of displacement.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-294 (Assertion and Reason)

Assertion: If the graph is plotted between distance and time then it is always an increasing curve.

Reason: Distance never decreases with time for a body in motion.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

QUESTION-295 (Assertion and Reason)

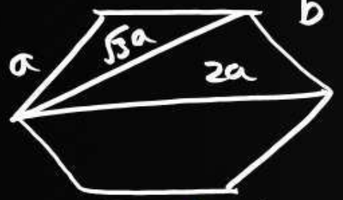
Assertion: If a body starts from rest and moves with uniform acceleration then the distances covered by the body in successive time are in the ratio of odd numbers.

Reason: If a body starts from rest and moves with uniform acceleration then distance covered by the body in 1 seconds is proportional to t^2.

1. If both A and R are true and reason is the correct explanation of assertion.
2. If both A and R are true but reason is not the correct explanation of assertion.
3. If assertion is true but reason is false.
4. If both assertion and reason are false.

13 – Revision and PUPPY POINTS

PUPPY POINTS - 1

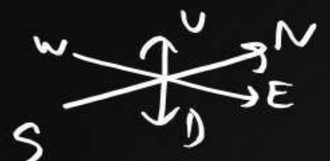


$\frac{x}{\sqrt{x}} = \sqrt{x}$

P.Th.
3,4,6
6,8,10
5,12,13
7,24,25
$a, a\sqrt{2}a$
$a, a, a-\sqrt{3}a$

Distance ≥ displacement

= → st. line without U turn



Drunk

$d-(f-b)$ – hill ≤ (f)

$(f+b)$ – ←

$|\vec{v}_{inst}| = \text{speed}_{inst}$

average speed ≥ avg velocity

$\vec{v}_{avg} = \text{speed}_{avg}\left(\frac{\text{displacement}}{\text{distance}}\right)$

$\text{Speed}_{avg} = \frac{\text{total distance}}{\text{total time}}$

$\text{Velocity}_{avg} = \frac{\text{total displacement}}{\text{total time}}$

same t

$u_{avg} = \frac{u_1+u_2+\cdots}{n}$

$u_{avg} = \frac{u_1+u_2}{2} = \frac{u_1+u_2+u_3}{3}$

same x –

$\frac{n}{u_{avg}} = \frac{1}{u_1}+\frac{1}{u_2}+\cdots$ – (same distance mid journey return journey)

$u_{avg} = \frac{2u_1u_2}{u_1+u_2} = \frac{3u_1u_2u_3}{u_1u_2+u_3u_1+u_2u_3}$

$\Delta\vec{V} = \vec{V}_f - \vec{V}_i$

same speed u in N to E

$\Delta\vec{V} = u\sqrt{2}\,SE$

$a = \frac{\Delta\vec{V}}{t}$

deceleration = –ve a

retardation makes speedless

$a.v < 0$ → change direction

$a = a_t + a_n$

$a_t = \frac{d|v|}{dt}$ → change in speed

$\left|\frac{dv}{dt}\right|$ = magnitude of acceleration

$D = 2\pi R$

$\vec{x} = 0$

$D = \pi R$

$\vec{x} = 2R$

$D = \pi R/2$

$\vec{x} = R\sqrt{2}$

$D = 2\pi R/3$

$\vec{x} = R\sqrt{3}$

$D = \pi R/3$

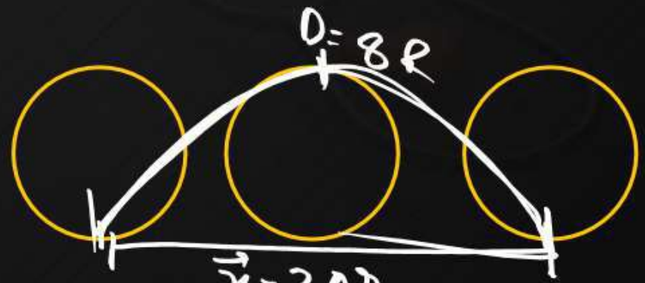
$\vec{x} = R$

$D = R\theta$

$\vec{x} = 2R\sin\left(\frac{\theta}{2}\right)$

same speed u

$\vec{v}_{avg} = \frac{2u\sin(\theta/2)}{\theta}$



$\vec{x} = 2\pi R$

$\vec{x} = R\sqrt{\pi^2+4}$

PUPPY POINTS-2

$\frac{dx^n}{dx} = nx^{n-1}$

$\frac{d(x^{-n})}{dx} = \frac{-n}{x^{n+1}}$

$\frac{d\sqrt{x}}{dx} = \frac{1}{2\sqrt{x}}$

$\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$

$\frac{dk}{dx} = 0$

$\int_a^b x^n dx = \frac{b^{n+1} - a^{n+1}}{n+1}$

$\int_a^b k\,dx = k(b-a)$

$\int_a^b \frac{1}{x} dx = \ln\left(\frac{b}{a}\right)$

$v = \frac{dx}{dt}$

$a = \frac{dv}{dt} = \frac{d^2x}{dt^2} = v\frac{dv}{dx}$

$\int v\,dt = \vec{x}$

$\int a\,dt = \Delta\vec{v} = \vec{v} - \vec{u}$

$v = A\sqrt{Bx + C}$

$\vec{a} = \frac{A^2 B}{2}$

$x \propto t^n \quad t \propto x^{\frac{1}{n}}$

$v \propto t^{n-1} \quad t \propto v^{\frac{1}{n-1}}$

$a \propto t^{n-2} \quad t \propto a^{\frac{1}{n-2}}$

$a \propto v^{\frac{n-2}{n-1}}$

$a \propto x^{\frac{n-2}{n}}$

$v \propto x^{\frac{n-1}{n}}$

time at $v_{max/min}$ $a = 0$

$t = \alpha x^2 + \beta x \rightarrow a = 2\alpha v^3$

$\frac{V_{avg\ distance}}{V_{avg\ time}} = \frac{4}{3}$ ✓✓

PUPPY POINTS-3

$v = u + at$

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

$v^2 = u^2 + 2as$

$S = \left(\frac{u+v}{2}\right)t$

$S_{nth} = u + \frac{(2n-1)a}{2}$

↓

$v = u + gt$

$h = ut + \frac{1}{2}gt^2$

$v^2 = u^2 + 2gh$

$h = \left(\frac{u+v}{2}\right)t$

$h_{nth} = u + \frac{(2n-1)g}{2}$

↑

$v = u - gt$

$h = ut - \frac{1}{2}gt^2$

$v^2 = u^2 - 2gh$

$h = \left(\frac{u+v}{2}\right)t$

$h_{nth} = u - \frac{(2n-1)g}{2}$

Rest $t = \frac{u}{a}$ $t = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2h}{g}}$ $v = \sqrt{2as}$ $v = \sqrt{2gh}$ ★

Stopping Distance $S = \frac{u^2}{2a}$

time $= \frac{u}{a}$

$u = 0 \rightarrow S_{nth} = \frac{(2n-1)a}{2}$

$S_{n+1^{th}} = \frac{(2n+1)a}{2}$

$S_{n-1^{th}} = \frac{(2n-3)a}{2}$

$H_{max} = \frac{u^2}{2g}$

$T_f = 2u/g$

$u = 0$

$v \propto t \propto \sqrt{s}$

$s \propto t^2 \propto v^2$

$a = \frac{\Delta v}{t}$ Change in velocity per second

Rest — Galileo Ratio (Drop) v

n sec	n^{th} sec	5m	5m	m/s
x	x	20m	15m	20
$4x$	$3x$	45m	25m	30
$9x$	$5x$	80	35m	40
$16x$	$7x$	125	45m	50
$25x$	$9x$	180	55	60
per sec		↓	↓	
$a = g/2$		n	n^{th}	

Ahaa... Rater

Same distance me kitna time

$\sqrt{1} \cdot \sqrt{1}$

$\sqrt{2} \cdot \sqrt{2}-\sqrt{1}$

$\sqrt{3} \cdot \sqrt{3}-\sqrt{2}$

$\sqrt{4} \cdot \sqrt{4}-\sqrt{3}$

$x \quad x$

$2x \quad x$

$3x \quad x$

Well

$t_{Total} = \sqrt{\frac{2h}{g}} + \frac{h}{v_x}$

Air Resistance

time come down > up

$v_{mid\,journey} = \sqrt{\frac{u^2+v^2}{2}}$

distance in same time are same → uniform

distance in same time are in AP → a constant

Bullet - Plank (a constant) ∩ bada

No of Plank $= N = \frac{v^2}{v^2 - u^2}$ ↳ after 1 plank

U turn $\overrightarrow{v}$ $\overleftarrow{a}$

Check $v = 0$ at what time

Distance before & after ↓ separate calculate

Ekhdo time $u = \frac{1}{2}g(t_1 + t_2)$ $h = \frac{1}{2}gt_1t_2$

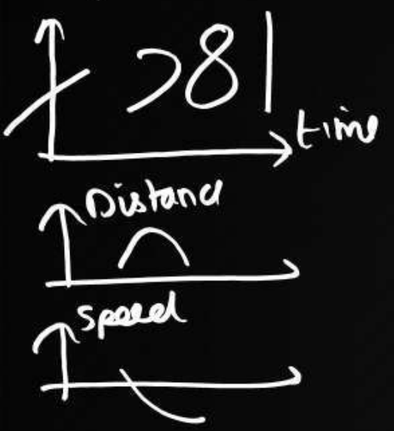
$t_0 = \sqrt{t_1 t_2}$

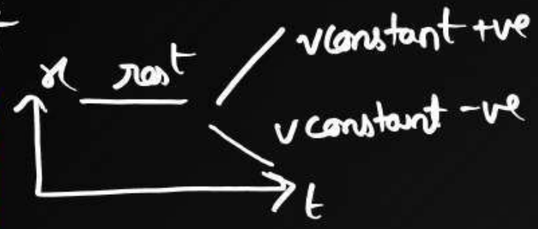
Thrown from tower

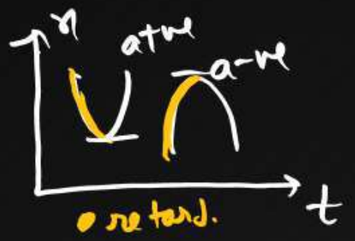
$\therefore h = ut - \frac{1}{2}gt^2 \rightarrow \left(t = \frac{v}{g}\left[1 + \sqrt{1 + \frac{2gh}{v^2}}\right]\right)$

PUPPY POINTS - 4

Impossible Graphs

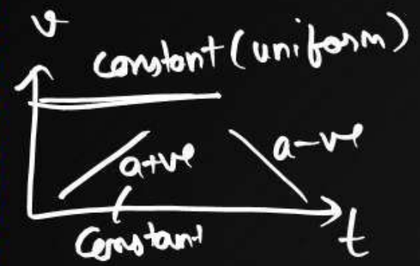


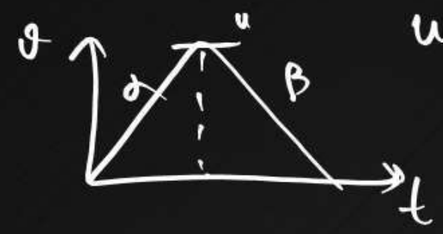




→ slope velocity

~~→ area~~



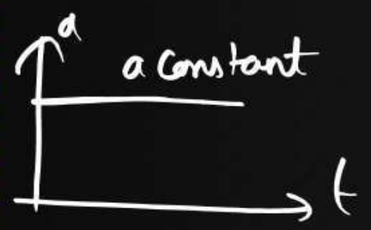


$u = \frac{\alpha\beta T}{\alpha+\beta}$

$\delta = \frac{1}{2}\left(\frac{\alpha\beta}{\alpha+\beta}\right)T^2$

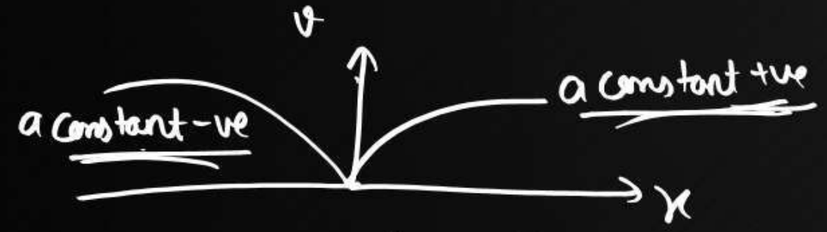
→ slope a

→ Area x.

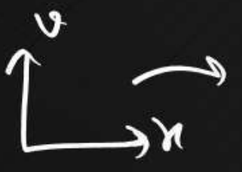


~~slope~~ → x

area = v - u

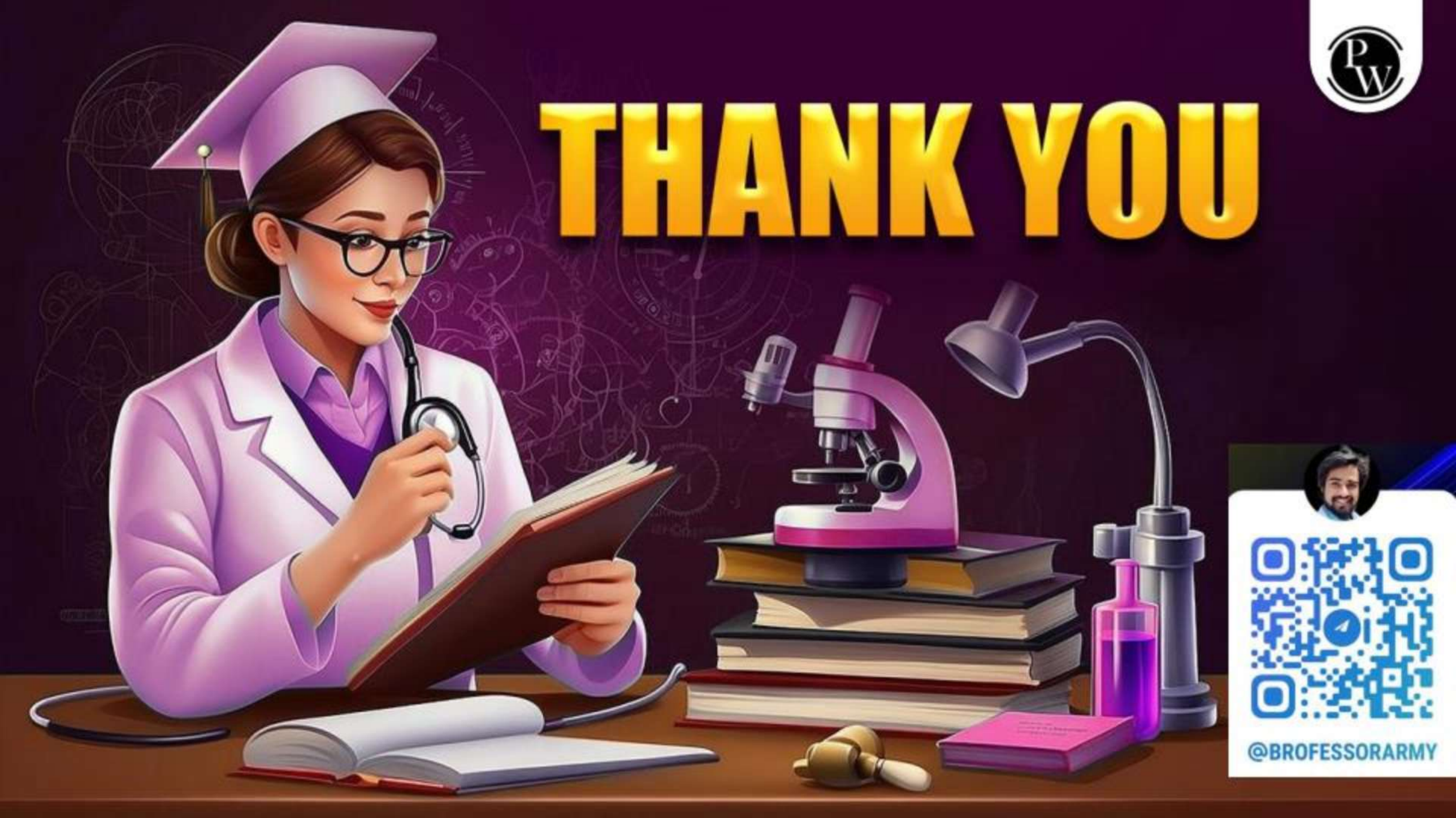


$v \propto \sqrt{x}$.



$\frac{dv}{dx} = \frac{a}{v}$

$\frac{d(v^2)}{dx} = 2a$


THANK YOU
@BROFESSORARMY