
ULTIMATE KCET
CRASH COURSE 2026
Physics
Lecture : 01
MOTION IN A
PLANE[ ]
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Recap *of previous lecture*

1. RECTIFIER’S AND ITS TYPES
2. QUESTIONS
3. UNITS AND MEASUREMENT
4. MOTION IN A STRAIGHT LINE

Topics

to be covered

1. QUESTIONS ON 1D MOTION
2. SCALARS AND VECTORS
3. PROJECTILE MOTION
4. PYQ's + MCQ's

GRAPHS OF KINEMATICS

1. Position – time
2. Velocity – time
3. Acceleration - time

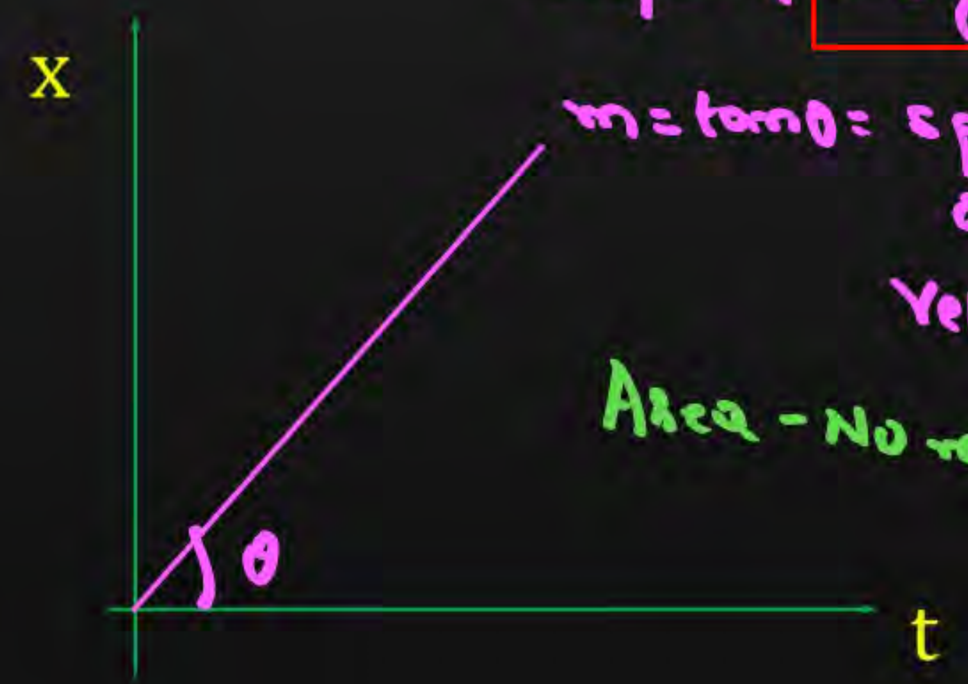
Slope, $m = \tan\theta = \frac{\Delta y}{\Delta x}$ → Diff

Area under graph → Integration.

Slope of x-t graph

$m = \tan\theta =$ speed or Velocity

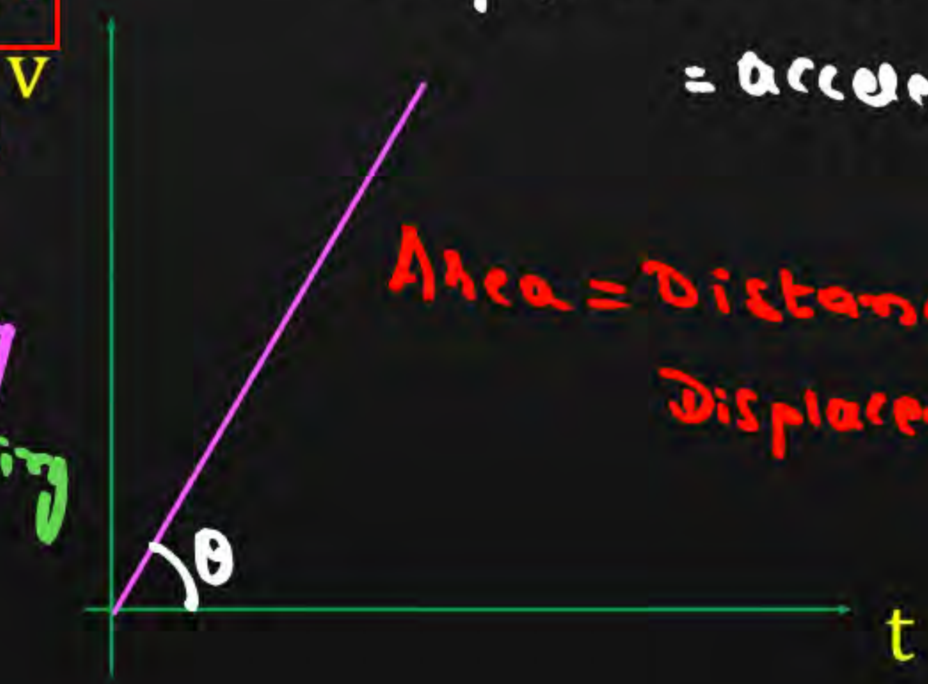
Area - No meaning



v-t graph

Slope, $m = \tan\theta$ = acceleration

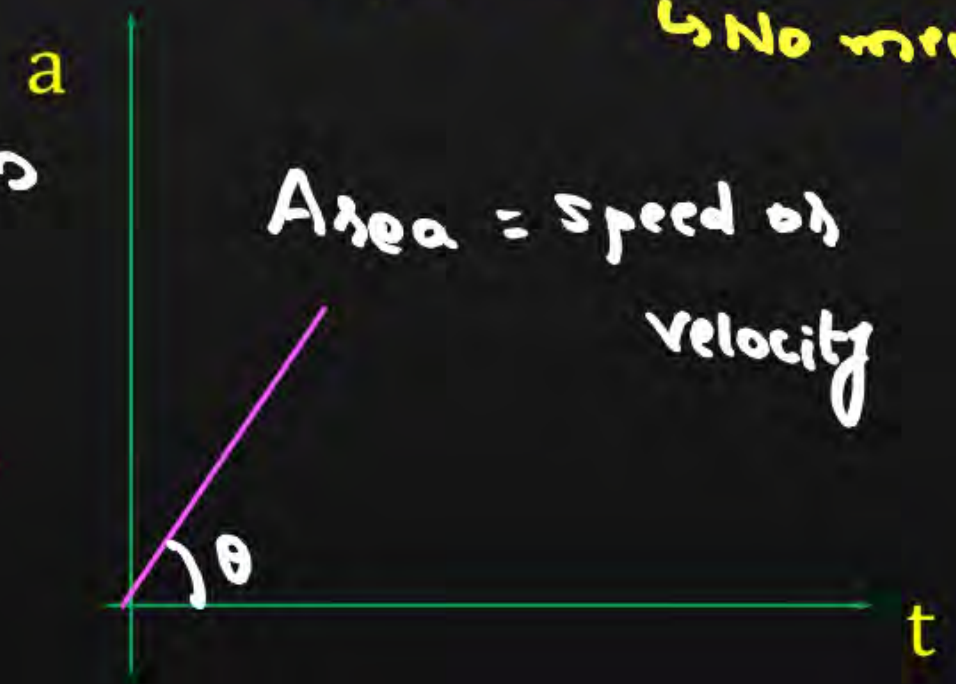
Area = Distance or Displacement



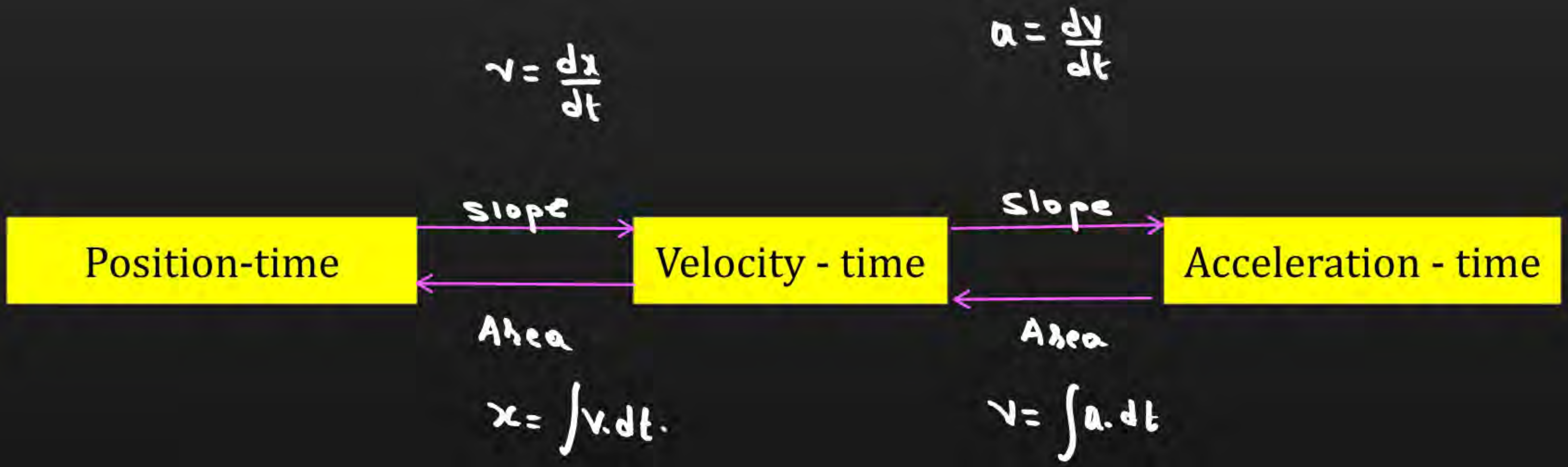
a-t graph

Slope, $m = \tan\theta$
↳ No meaning

Area = speed or velocity

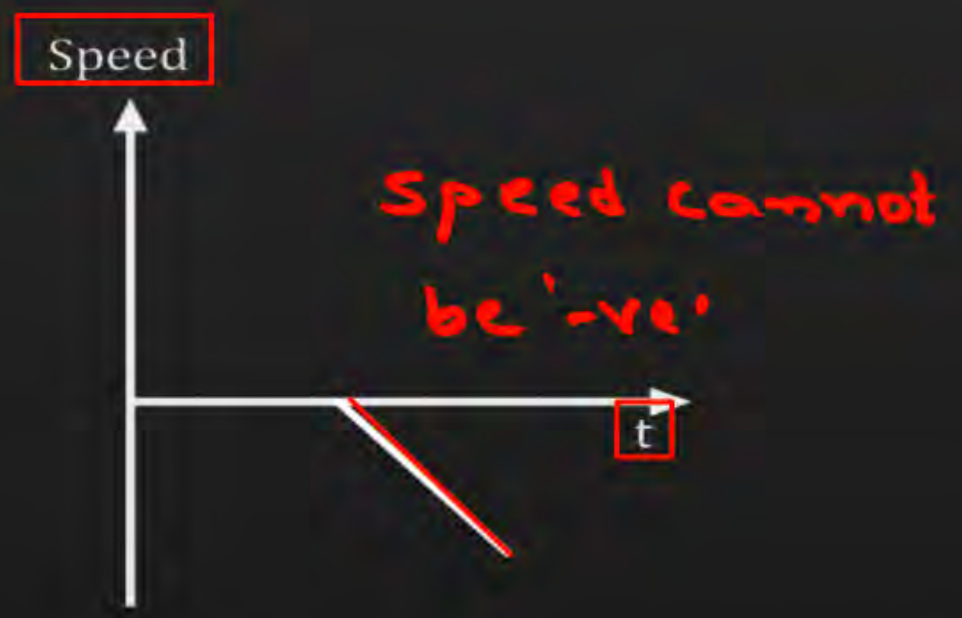


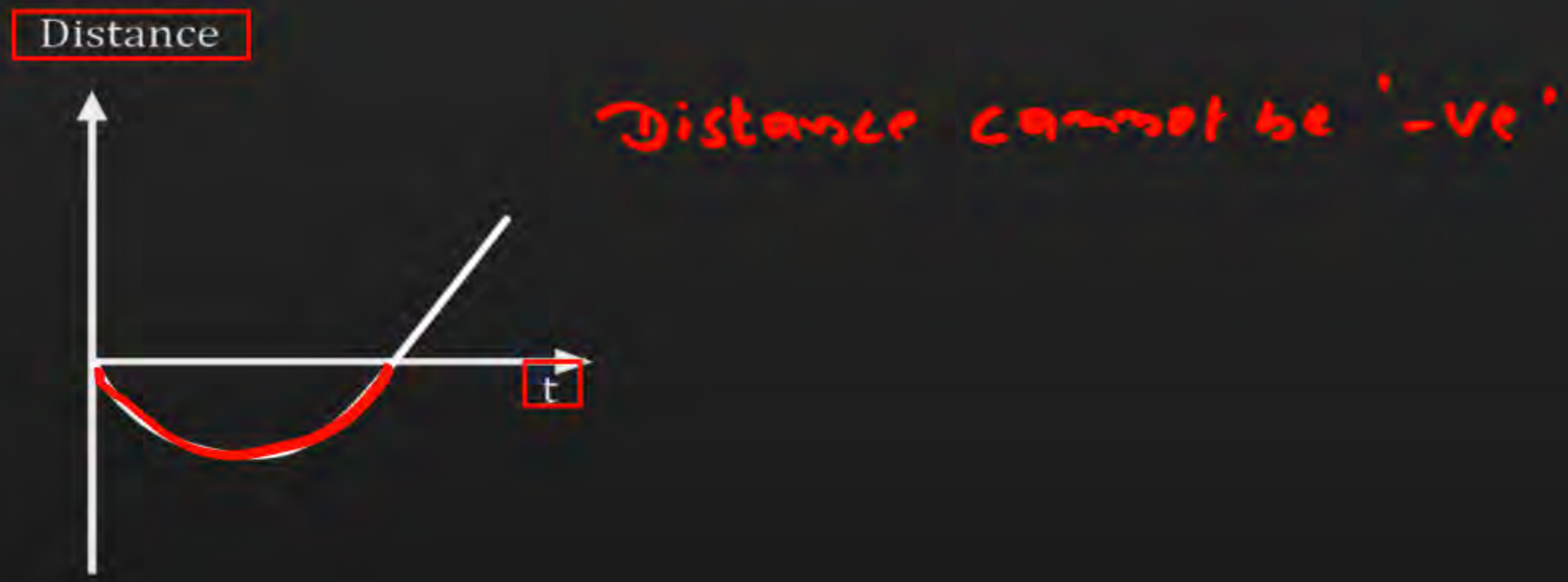
Graph

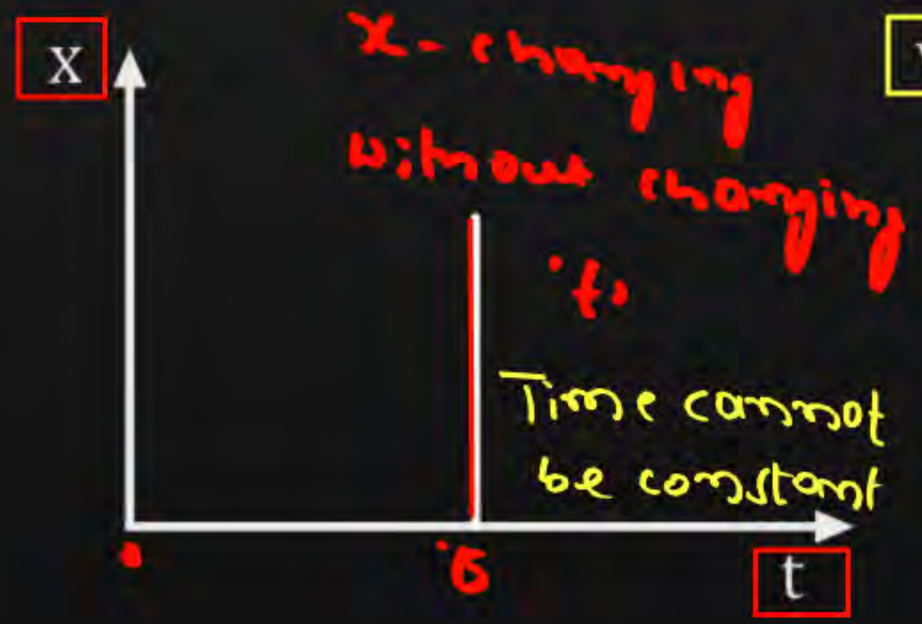


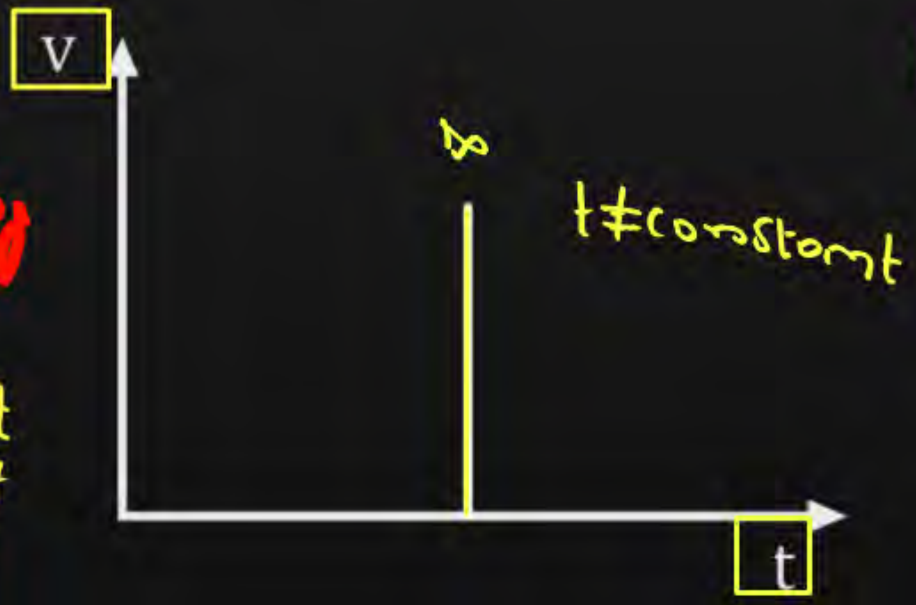
$v = \frac{dx}{dt}$
$a = \frac{dv}{dt}$
slope
slope
Position-time
Velocity - time
Acceleration - time
Area
Area
$x = \int v.dt$
$v = \int a.dt$

GRAPHS THAT ARE IMPOSSIBLE









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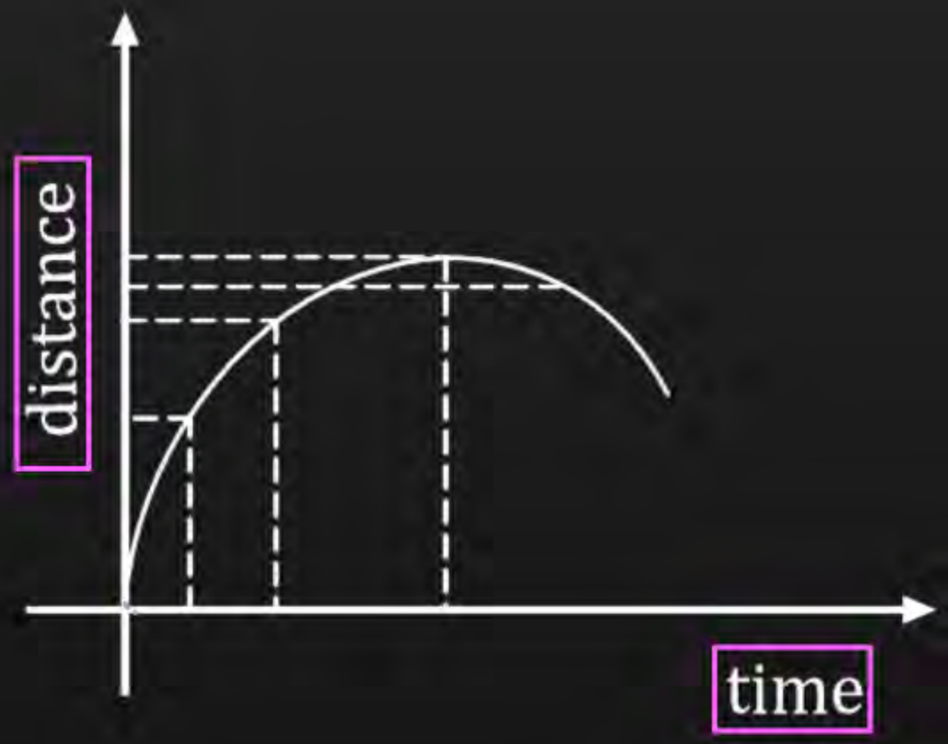

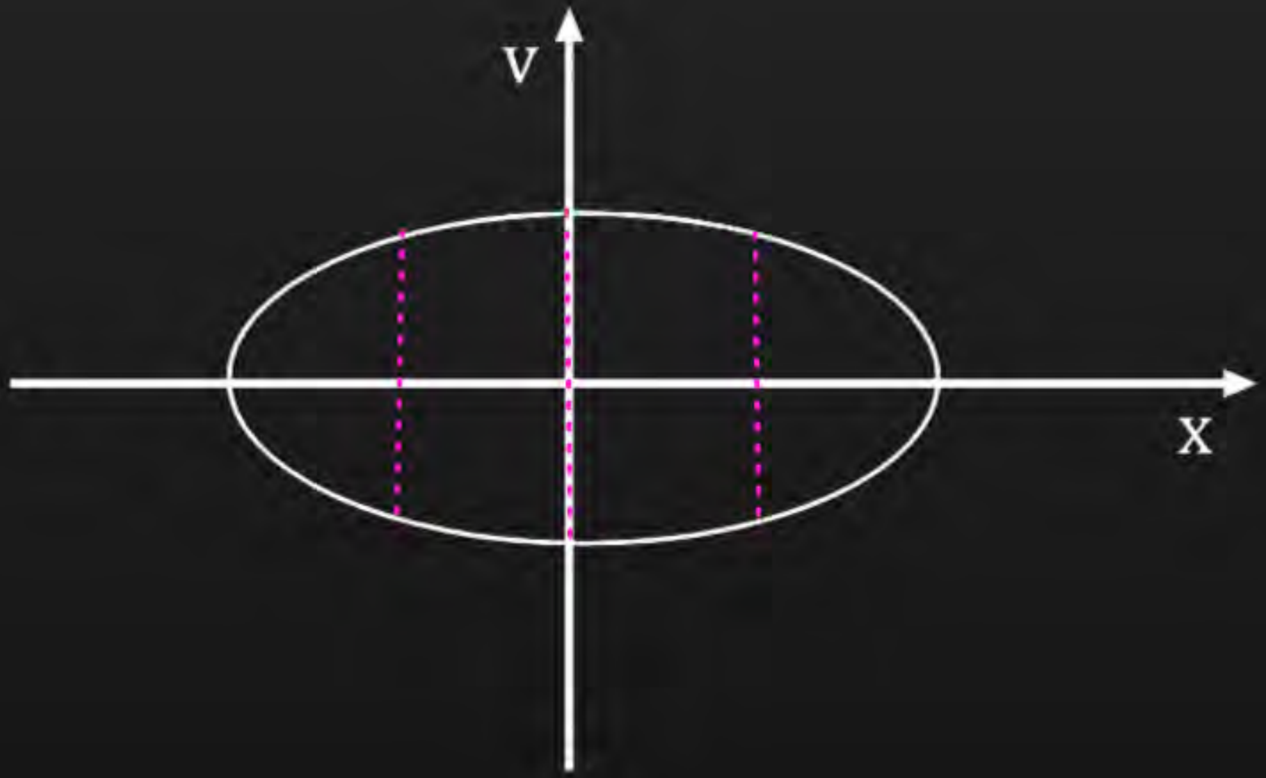

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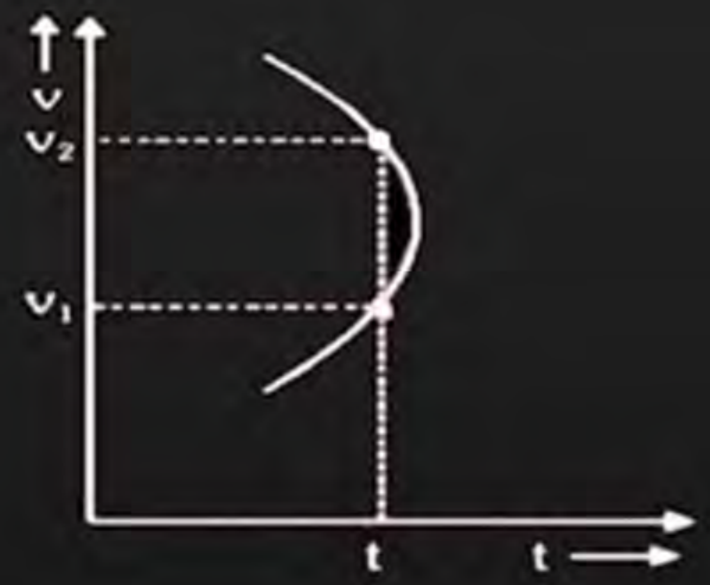
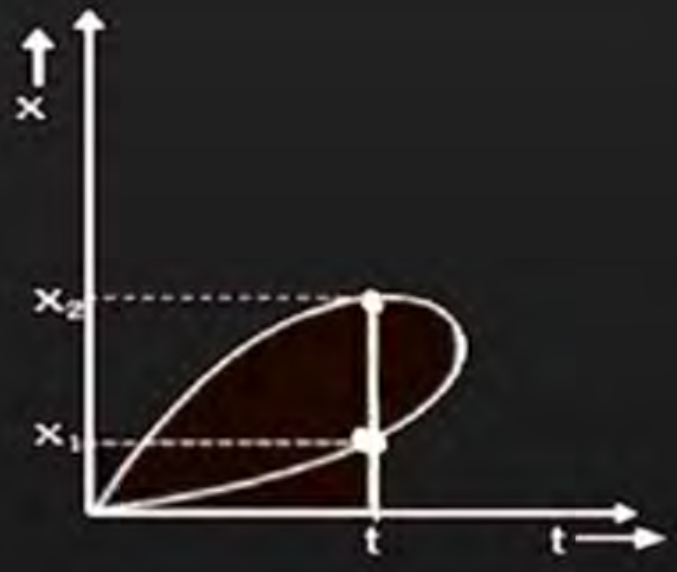
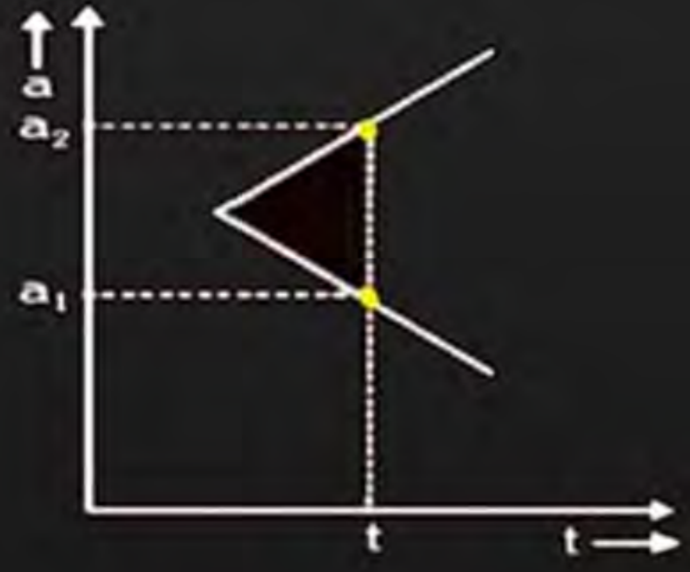






QUESTION

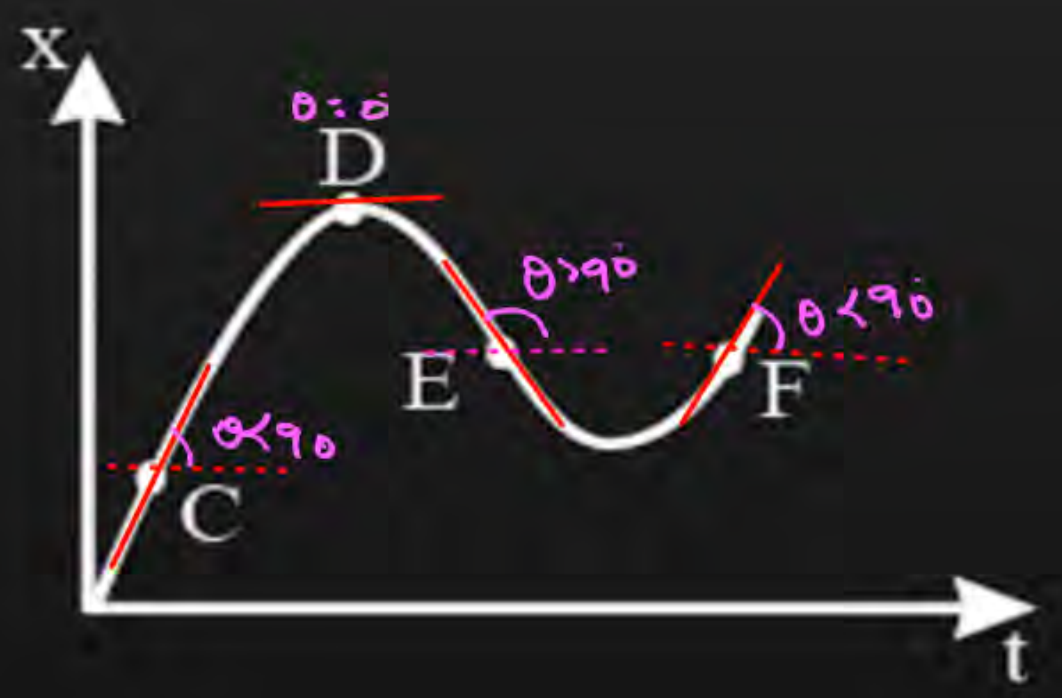
The displacement time graph of a moving particle is shown below. The instantaneous velocity of the particle is negative at the point.

(A) C

(B) D

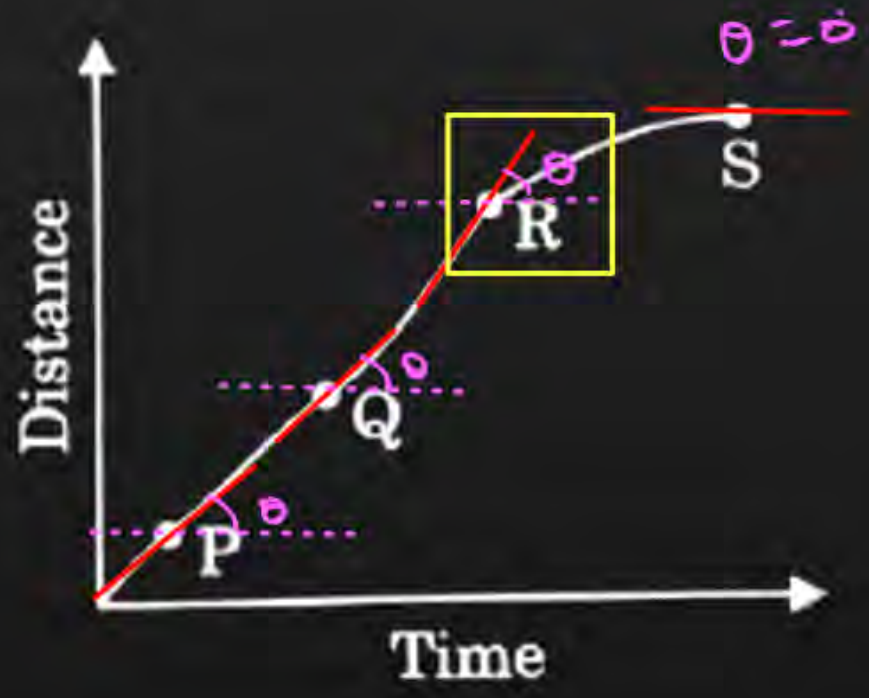
(C) E

(D) F



QUESTION

A particle shows distance-time curve as shown in the figure. The maximum instantaneous velocity of the particle is around the point



(A) P

(B) S

(C) R

(D) Q

QUESTION

For a body moving along a straight line, the following *v*-*t* graph is obtained According to the graph, the displacement during

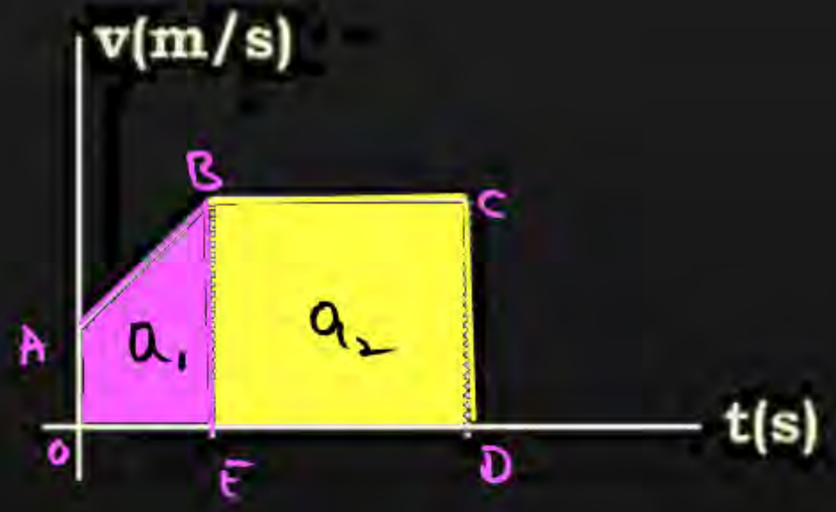
↳ Area.

(A) uniform acceleration is greater than that during uniform motion

(B) uniform acceleration is less than that during uniform motion

(C) uniform acceleration is equal to that during uniform motion

(D) uniform motion is zero



QUESTION

Which of the following graph represents uniform motion (here s is position)

A

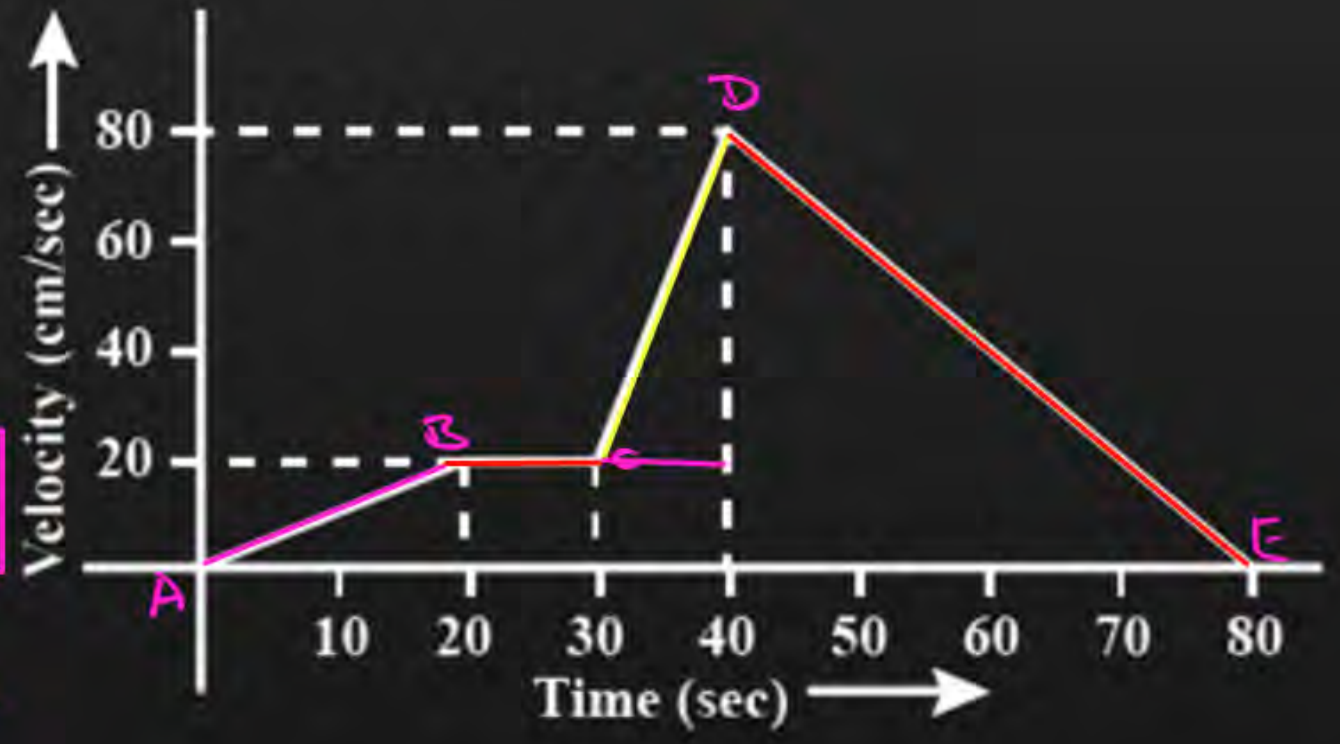

B


C


D


QUESTION

The v-t graph of a moving object is given in figure. The maximum acceleration is



(A) $1\ cm/sec^2$

(B) $2\ cm/sec^2$

(C) $3\ cm/sec^2$

(D) $6\ cm/sec^2$

$A \to B$

$a = \frac{20}{20} = 1\ cm/s^2$

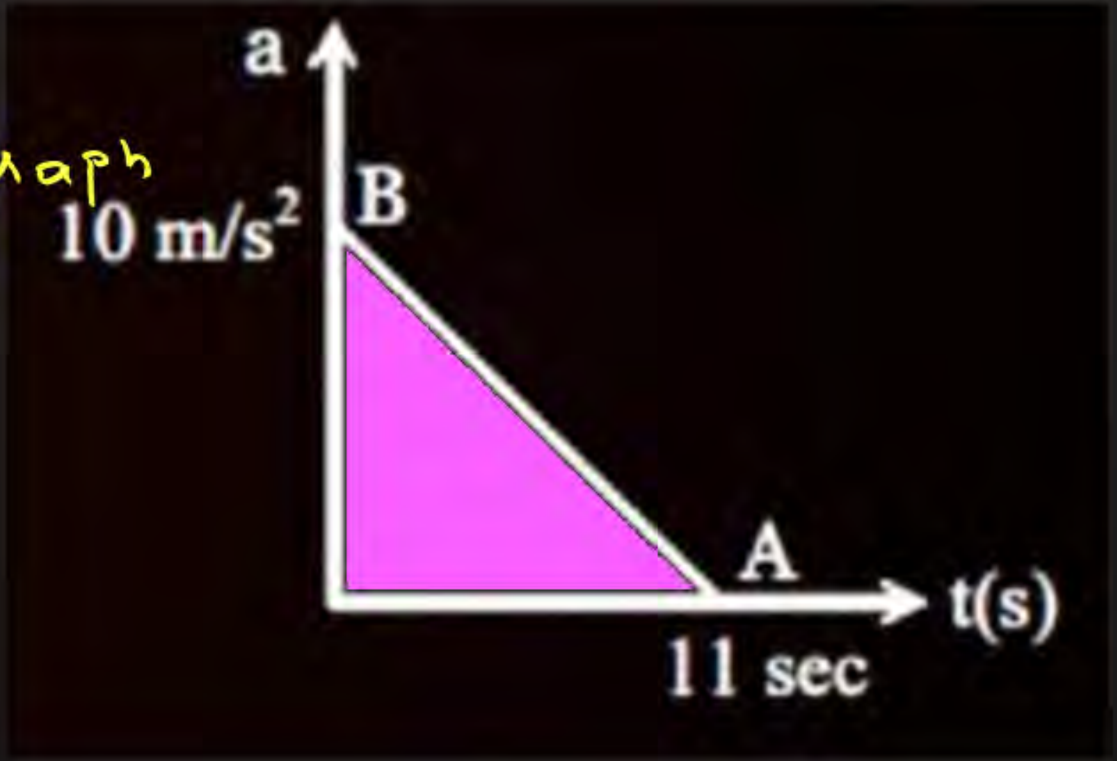
$B \to C$, $a = 0$

$C \to D$, $a = \frac{60}{10} = 6\ cm/s^2$

$D \to E$, $a = \frac{-80}{40} = -2\ cm/s^2$

QUESTION

A particle starts from rest. It acceleration (a) versus time (t) is as shown in the figure. The maximum speed of the particle will be



speed = Area under a-t graph

$= \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 11 \times 10$

$= 55$ m/s

(A) 110m/s

(B) 55m/s

(C) 550m/s

(D) 660m/s

MOTION

UNIFORM-MOTION

$v = const$

$a = 0$

UNIFORM ACCELERATED MOTION

$v \neq constant$

$a = constant$

NON-UNIFORM ACCELERATED MOTION

$v \neq const$

$a \neq const$

KINEMATICS EQUATIONS

speed up ?
yes
no

For a motion of a body moving with a uniform acceleration, the following three equations give the relationship between initial velocity(u), final velocity (v), acceleration (a), time of journey (t) and displacement (S)

$v = u + at \rightarrow S \times$

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

$v^2 = u^2 + 2as \rightarrow t \times$

$S_n = u + \frac{a}{2}[2n-1]$

QUESTION

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

(A) $v = u + at$ ✓

(B) $s = ut + \frac{1}{2}at^2$ ✓

(C) $s = vt + \frac{1}{2}at^2$ ✗

(D) $v^2 - u^2 = 2as$ ✓

QUESTION

A particle starts with velocity of 10 m/s along x-direction and accelerates uniformly at the rates $2ms^{-2}$. The time taken by the particle to reach the velocity of 60 m/s is

A. 30 s

B. 6 s

C. 25 s

D. 3 s

$v = u + at$

$60 = 10 + 2t$

$2t = 50$

$t = 25 s$

QUESTION

A particle is moving along a straight line with constant acceleration. At the end of 10^{th} second its velocity becomes 20 m/s and in 10^{th} it travels a distance of 10 m. Find the acceleration of the particle.

(A) $40\ ms^{-2}$

(B) $10\ ms^{-2}$

(C) $30\ ms^{-2}$

(D) $20\ ms^{-2}$

$n = 10$

$S_n = u + \frac{a}{2}(2n-1)$

$S_{10} = u + \frac{a}{2}(2 \times 10 - 1)$

$10 = u + \frac{a}{2}[19]$ — (1)

$v = u + at$

$20 = u + a \times 10$

$u = 20 - 10a$ — (2)

(2) in (1)

$10 = 20 - 10a + \frac{a}{2} \times 19$

$10 - 20 = \frac{-20a + 19a}{2}$

$-10 = -\frac{a}{2}$

$-20 = -a \Rightarrow a = 20\ m/s^2$

QUESTION

$S_n = u + \frac{a}{2}(2n-1)$

$u=0$

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 distance in the 5th second, after the start of A, then the ratio of $a_1 : a_2$ equal to

(A) 5:9

(B) 5:7

(C) 9:5

(D) 9:7

$(S_n)_A = (S_n)_B$

$\frac{a_1}{2}(2\times5-1) = \frac{a_2}{2}[2\times3-1]$

$\frac{9a_1}{2} = \frac{5a_2}{2} \Rightarrow 9a_1 = 5a_2$

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

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

MOTION UNDER GRAVITY

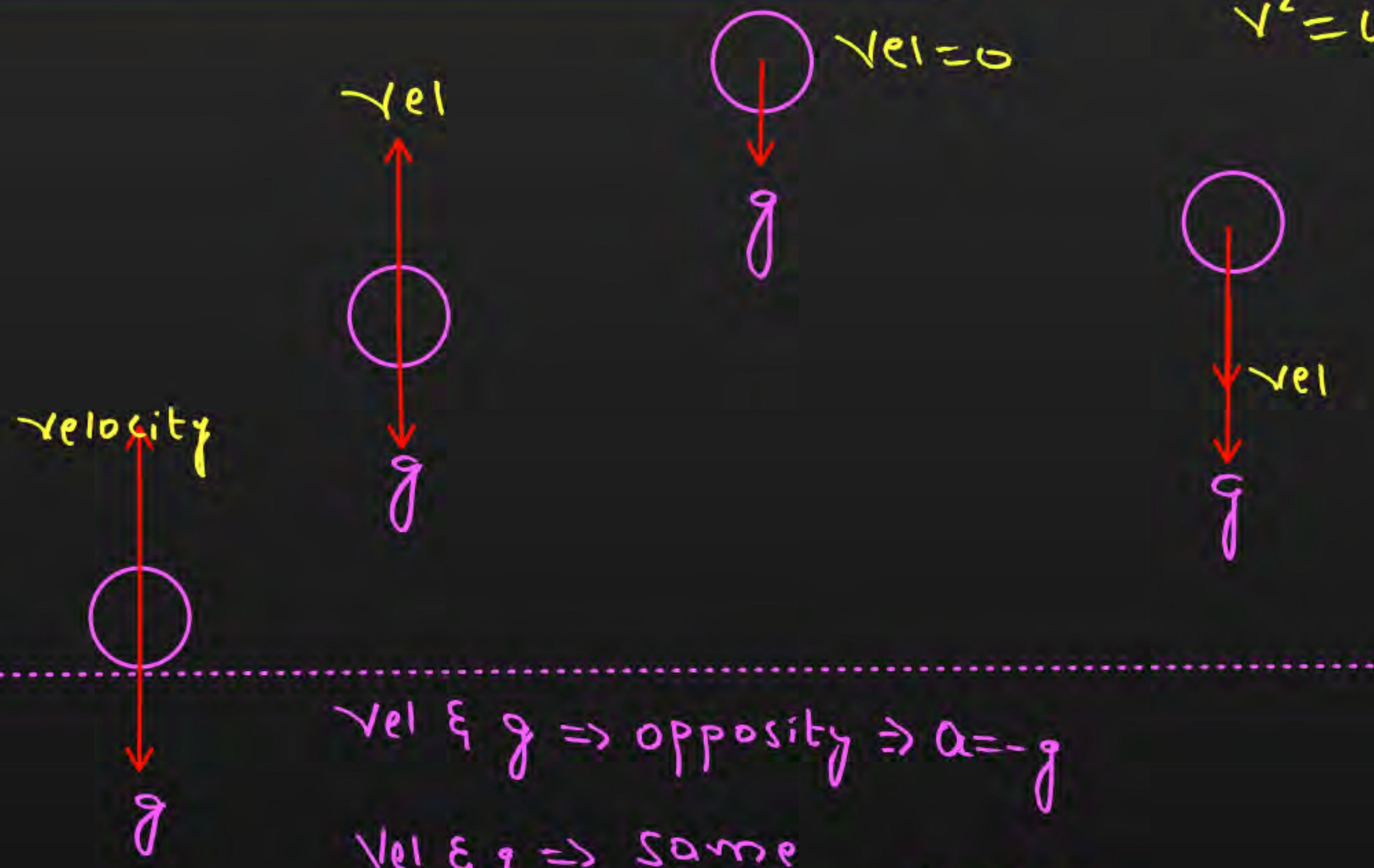
$v = u + at$

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

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

↳ $a = g$

↳ $s = H$



vel & g ⇒ opposite ⇒ $a = -g$

vel & g ⇒ same direction ⇒ $a = g$

QUESTION

A body is thrown vertically upwards from the ground. It reaches a maximum height of 20m in 5s. After what time it will reach the ground from its maximum height position?

(A) 2.5 s

(B) 5 s

(C) 10 s

(D) 25 s

$t_a = 5\ s$

$t_d = t_a = 5\ s$

QUESTION

$a = -g$ $\qquad u$

If a ball is thrown vertically upwards with a velocity of 40 m/s, then velocity of the ball after 2s will be. (Take $g = 10\ m/s^2$)

t

$v = u + at$

$v = 40 + (-10) \times 2$

$v = 40 - 20$

$v = 20\ m/s$

(A) 15 m/s

(B) 20 m/s

(C) 25 m/s

(D) 28 m/s

QUESTION

$a = -g$

A stone is thrown vertically upwards. When stone is at a height half of its maximum height, its speed is 10 m/s, then the maximum height attained by the stone is (Take $g = 10\ m/s^2$)

(A) 8 m

(B) 10 m

(C) 15 m

(D) 20 m

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

$(0)^2 = u^2 + 2(-g)H$

$2gH = u^2$

$H = \frac{u^2}{2g}$

$\frac{h}{2} = \frac{u^2}{2g} = \frac{(10)^2}{10} = 10$

$h = 10\ m$

QUESTION

A boy standing at the top of a tower of 20 m height drops a stone. Assuming, $g = 10\ ms^{-2}$, the velocity with which it hits the ground is

$S = H$, $u = 0$, $a = g$

(A) 20 m/s

(B) 40 m/s

(C) 5 m/s

(D) 10 m/s

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

$$v^2 = (0)^2 + 2gH$$

$$v^2 = 2 \times 10 \times 20$$

$$v^2 = 400$$

$$v = \sqrt{400}$$

$$v = 20\ m/s$$

QUESTION

$u=0,\ a=g$

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

$\frac{t_A}{t_B} = \sqrt{\frac{H_A}{H_B}} = \sqrt{\frac{16}{25}} = \frac{4}{5}$

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

$H = \frac{1}{2}gt^2$

$t^2 = \frac{2H}{g}$

$t = \sqrt{\frac{2H}{g}} \propto \sqrt{H}$

(A) –5/4

(B) 12/5

(C) 5/12

(D) 4/5

$\frac{t_A}{t_B} = \frac{4}{5}$

QUESTION

$u = 0, a = g$

A stone released with zero velocity from the top of a tower, reaches the ground in 4 s. The height of the tower is (Take $g = 10 \text{ m/s}^2$)

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

$H = \frac{1}{2}gt^2$

$H = \frac{1}{2} \times 10 \times (4)^2 = 5 \times 16$

$H = 80 \text{ m}$

A) 20 m

B) 40 m

C) 80 m

D) 160 m

QUESTION

A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 4 ms^{-1}. The ball strikes the water surface after 4s. The height of bridge above water surface is. (Take $g = 10\ m/s^{-2}$)

(A) 68 m

(B) 56 m

(C) 60 m

(D) 64 m

$a = -g$, u, t

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

$H = ut + \frac{1}{2}(-g)t^2$

$H = (4\times4) - \frac{1}{2}\times10\times4^2$

$H = 16 - 5\times16 = 16-80$

$H = 64\,m$ $H = 64\,m$

QUESTION

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

(A) 340 m

(B) 320 m

(C) 300 m

(D) 360 m

u, v

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

$$(80)^2 = (20)^2 + 2(10)H$$

$$6400 = 400 + 20H$$

$$6000 = 20H$$

$$H = 300\ m$$

SCALARS & VECTORS

PHYSICAL QUANTITIES

- **BASED ON DEPENDENCY**
  - FUNDAMENTAL PHYSICAL QUANTITIES
  - DERIVED PHYSICAL QUANTITIES
  - SUPPLEMENTARY PHYSICAL QUANTITIES
- **BASED ON DIRECTION**
  - SCALARS
  - VECTORS

SCALARS & VECTORS

BASED ON DIRECTION

- SCALARS
- VECTORS
- TENSORS

SCALARS & VECTORS

All the physical quantities are classified into 2 categories on the basis of directional and algebra properties.

1. Scalar Physical Quantity [Scalars] : The quantity which has magnitude and may or may not have direction but follow scalar addition i.e angle independent.

Ex : Mass, Length, Time, Temperature and current, etc.

SCALARS & VECTORS

All the physical quantities are classified into 2 categories on the basis of directional and algebra properties.

2. Vector Physical Quantity [Vector] : The quantity which has magnitude and have direction and follow vector laws for addition i.e angle dependent.

Ex : Displacement, Velocity, Acceleration, Force, Momentum etc.

QUESTION

Which of the following is not a vector quantity?

A. Speed

B. Velocity

C. Torque

D. Displacement

REPRESENTATION OF VECTOR

* $\vec{A} = |\vec{A}|\,\hat{A}$

$\vec{A} = A \cdot \hat{A}$

* $\hat{A} = \dfrac{\vec{A}}{A}$

$\vec{A}$ - Vector A

$|\vec{A}|$ - Magnitude of vector A Modulus of vector A Mod of vector A

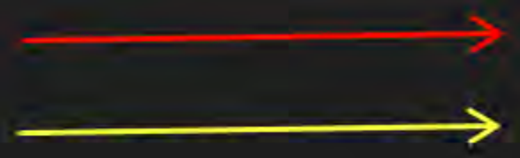
$\hat{A}$ - Direction of vector A Unit vector along A

TYPES OF VECTORS

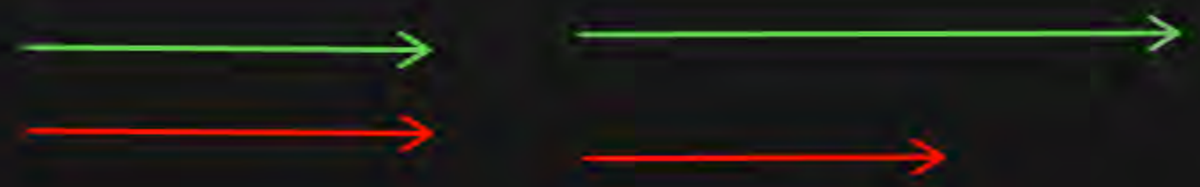
3. Null Vector
↳ mag = 0

4. Unit vector,
↳ mag = 1

1. Equal Vectors – Vectors have same direction and same magnitude.



2. Parallel Vectors – Vectors have same direction but may or may not have same magnitude



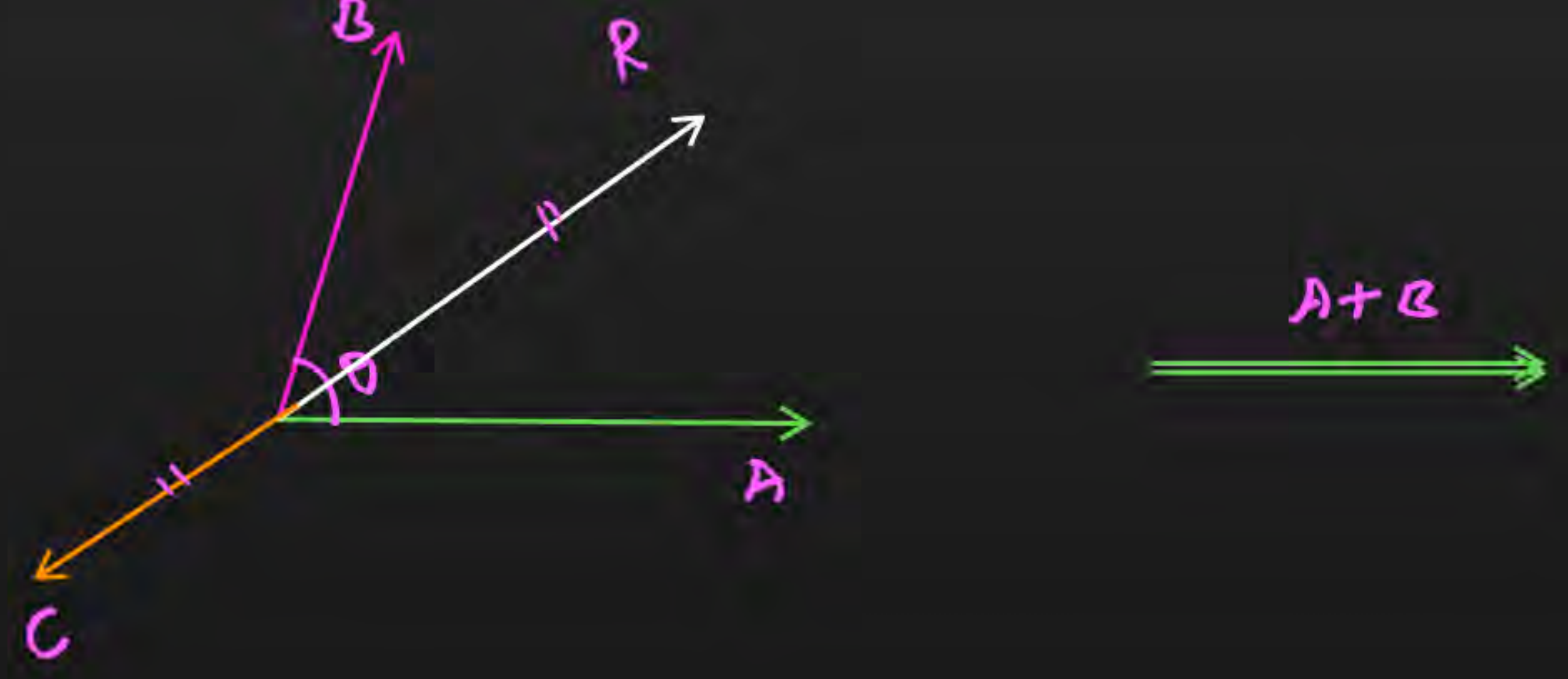
VECTOR ADDITION

$$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$$

Range of vector, $(A - B) \leq R \leq (A + B)$

QUESTION

How many minimum number of coplanar vectors having different magnitudes can be added to given zero resultant.



A) 2

B) 3

C) 4

D) 5

$360 \Rightarrow \frac{2\pi}{\pi/50} = 100$ forces

QUESTION

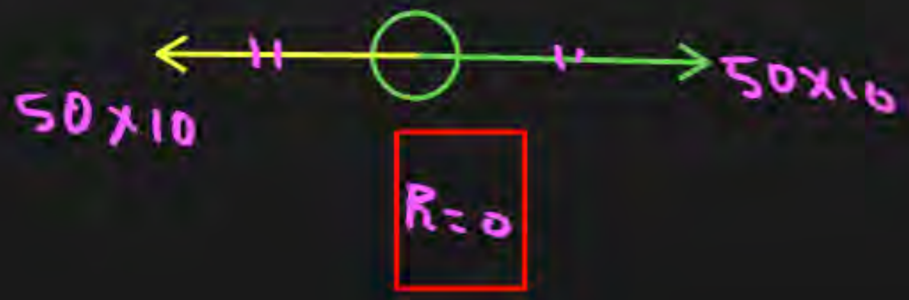
100 coplanar forces each equal to 10 N act on a body. Each force makes angle $\pi/50$ with the preceding force. What is the resultant of the forces.

(A) 1000 N

(B) 500 N

(C) 250 N

(D) Zero



QUESTION

Which pair of the following forces will never give resultant force of 2 N?

	A	B	A − B		A + B
(A)	$2\ N$ and $2\ N$ ✓		0	→	4
(B)	$1\ N$ and $1\ N$ ✓		0	→	2.
(C)	$1\ N$ and $3\ N$		2	→	4
(D)	$1\ N$ and $4\ N$		3	→	5

QUESTION

$\theta = 90^\circ$

Forces F_1 and F_2 act on a point mass in two mutually perpendicular directions. The resultant force on the point mass will be

(A) $F_1 + F_2$

(B) $F_1 - F_2$

(C) $\sqrt{F_1^2 + F_2^2}$

(D) $F_1^2 + F_2^2$

$R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos 90^\circ}$, where $\cos 90^\circ = 0$

$R = \sqrt{F_1^2 + F_2^2}$

QUESTION

Two equal forces (P each) act at a point inclined to each other at an angle of 120º. The magnitude of their resultant

$$R = \sqrt{A^2 + B^2 + 2AB\cos\theta} \quad A \neq B$$

$$R = 2A\cos\left(\frac{\theta}{2}\right), \; A = B$$

$$R = 2P\cos\left(\frac{120°}{2}\right)$$

$$R = 2P \times \frac{1}{2}$$

$$\boxed{R = P}$$

(A) $P/2$

(B) $P/4$

(C) P

(D) $2P$

DOT PRODUCT

The scalar product of two vectors $\vec{A}$ & $\vec{B}$ is a scalar quantity.

$$\vec{A} \cdot \vec{B} = A \cdot B \cos\theta$$

Ex:- Work done, power, energy, speed etc.

CROSS PRODUCT

The cross product of two vectors $\vec{A}$ & $\vec{B}$ is can be written as.

$$\vec{A} \times \vec{B} = AB \sin\theta \, \hat{n}$$

Ex:- Acceleration, Torque, Linear Velocity, Force etc.

PROJECTILE MOTION

When a body moves with constant acceleration such that its initial velocity and acceleration are non-collinear then its path is parabola and motion is known as projectile motion.

PROJECTILE MOTION

- **OBLIQUE**
- **HORIZONTAL**

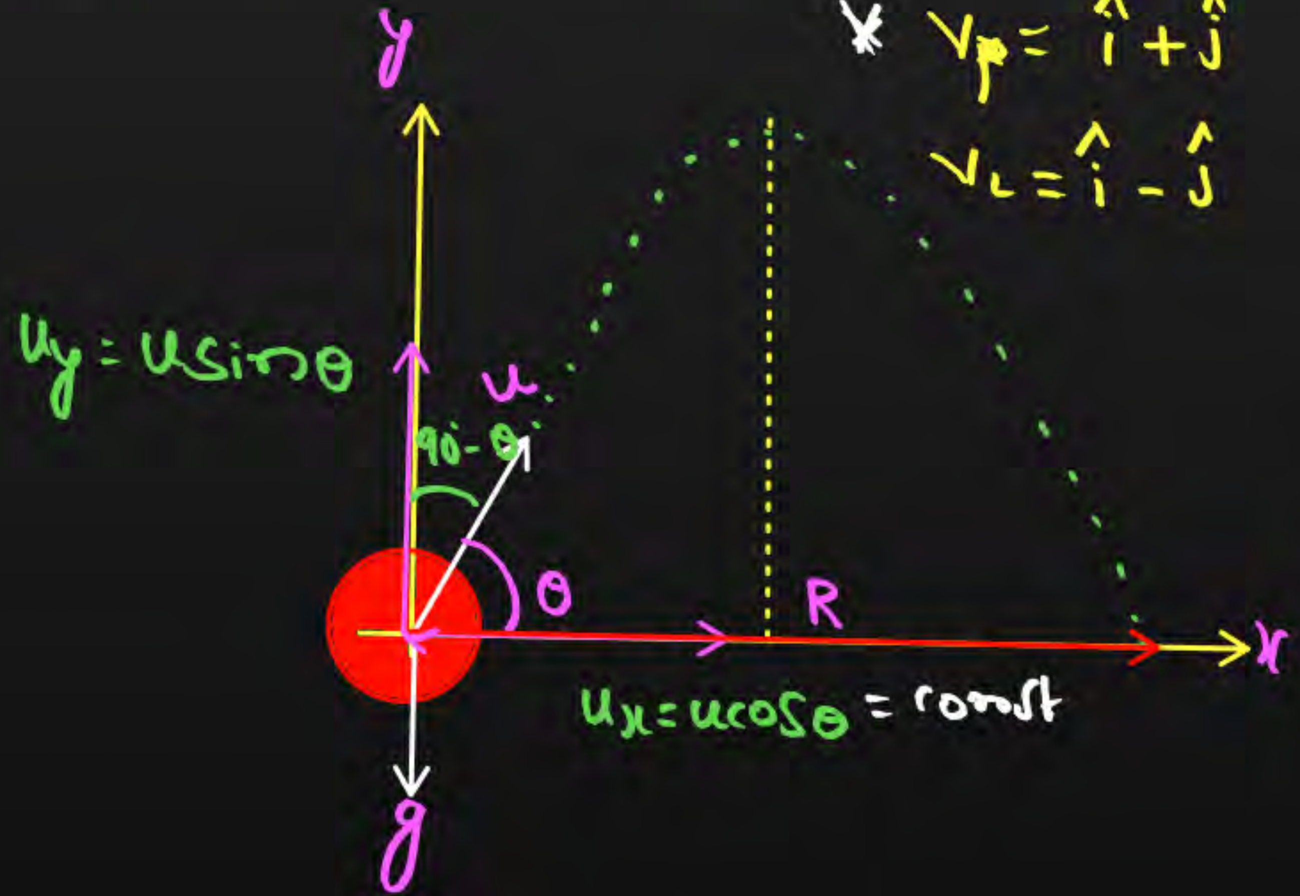
Ground- Ground Projectile Motion

$\tan\theta = \frac{P}{B} = \frac{u_y}{u_x}$

$\theta = \tan^{-1}\left(\frac{u_y}{u_x}\right)$

Projectile Motion = Horizontal Motion + Vertical Motion

2D = 1D + 1D



* $v_p = \hat{i} + \hat{j}$

$v_L = \hat{i} - \hat{j}$

* $T = \frac{2u_y}{g} = \frac{2u\sin\theta}{g}$

* $H = \frac{u_y^2}{2g} = \frac{u^2\sin^2\theta}{2g}$

* $R = u_x \times T = \frac{2u_x u_y}{g} = \frac{u^2\sin 2\theta}{g}$

* $y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta} = x\tan\theta\left[1 - \frac{x}{R}\right]$

Ground- Ground Projectile Motion

Time of flight (T) : Time of flight is the time for which projectile remains in air.

At time T particle will be at ground again, i.e. displacement along Y-axis becomes zero.

$$T = \frac{2u_y}{g} = \frac{2u\sin\theta}{g}$$

Ground- Ground Projectile Motion

Maximum height (H) : At maximum height vertical component of velocity becomes zero. At this instant y coordinate is, its maximum height.

$$H = \frac{u_y^2}{2g} = \frac{u^2 \sin^2\theta}{2g}$$

Ground- Ground Projectile Motion

Horizontal range or Range (R): It is the displacement of particle along X-direction during its complete flight.

$$R = \frac{2u_x u_y}{g} = \frac{u^2 \sin 2\theta}{g}$$

Ground- Ground Projectile Motion

Maximum horizontal range (Rmax) :

$$R = \frac{u^2 \sin 2\theta}{g}, \quad \sin 2\theta = 1$$

$$\sin 2\theta = \sin 90^\circ$$

$$\theta = 45^\circ$$

$$R_{max} = \frac{u^2}{g}$$

* $R \tan\theta = 4H$

$$H = \frac{u^2 \sin^2\theta}{2g}$$

$$\sin^2\theta = 1$$

$$\sin^2\theta = \sin 90^\circ$$

$$\theta = 90$$

$$H_{max} = \frac{u^2}{2g}$$

Ground- Ground Projectile Motion

$A + B = 90 + (90 - \theta)$

$180^\circ - \theta = 90$

$\theta = 180^\circ - 90 = 90^\circ$

Comparison of two projectiles :

Horizontal range : When two projectiles are thrown with equal speeds at angles θ and $(90^\circ - \theta)$ then their ranges are equal but maximum heights attained are different and time of flights are also different.

$A = 90^\circ$ *

$B = 90^\circ - \theta$ *

Complementary angle

$A + B = 90^\circ$

$30^\circ + 60^\circ = 90^\circ$

$45^\circ + 45^\circ = 90^\circ$

$15^\circ + 75^\circ = 90^\circ$

⋮

$$R_\theta = \frac{u^2 \sin 2\theta}{g}$$

$$R_{90^\circ-\theta} = \frac{u^2 \sin 2(90^\circ-\theta)}{g}$$

$$= \frac{u^2 \sin(180^\circ-2\theta)}{g}$$

$$R_{90^\circ-\theta} = \frac{u^2 \sin 2\theta}{g}$$

* VIP

$$\therefore \quad R_\theta = R_{90^\circ-\theta}$$

Ground- Ground Projectile Motion

Maximum height of projectiles :

$$H = \frac{u^2 \sin^2\theta}{2g}$$

$$H_{max} = \frac{u^2}{2g}$$ $\longrightarrow \theta = 90^\circ$

$$H_\theta = \frac{u^2 \sin^2\theta}{2g}$$

$$H_{90^\circ-\theta} = \frac{u^2 \sin^2(90^\circ-\theta)}{2g}$$

$$H_{90^\circ-\theta} = \frac{u^2 \cos^2\theta}{2g}$$

* $H_\theta \neq H_{90^\circ-\theta}$

Ground- Ground Projectile Motion

Time of flight of projectiles :

$$T_\theta = \frac{2u\sin\theta}{g}$$

$$T_{90°-\theta} = \frac{2u\sin(90°-\theta)}{g}$$

$$T_{90°-\theta} = \frac{2u\cos\theta}{g}$$

* $T_\theta \neq T_{90°-\theta}$

Equation of Trajectory

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

*

$$y = x\tan\theta\left[1 - \frac{x}{R}\right]$$

Important points

Relation between Horizontal Range and Height

$$R \tan\theta = 4H$$

QUESTION

$u = u_x\hat{i} + u_y\hat{j}$, $u_x = 6$

$u_y = 8$

A body is projected from ground with velocity $(6\vec{i} + 8\hat{j})$ m/s. Find out:

(A) Time of flight, $T = \frac{2u_y}{g} = \frac{2\times 8}{10} = \frac{16}{10} = 1.6s$ $\boxed{T = 1.6s}$

(B) Maximum height, $H = \frac{u_y^2}{2g} = \frac{(8)^2}{2\times 10} = \frac{64}{2\times 10} = 3.2m$, $\boxed{H = 3.2m}$

(C) Horizontal range, $R = \frac{2u_x u_y}{g} = \frac{2\times 6\times 8}{10} = 9.6m$ $\boxed{R = 9.6m}$

(D) Velocity when body reaches on ground

↳ $\boxed{6\hat{i} - 8\hat{j}}$

QUESTION

A projectile is launched with an initial velocity $\overrightarrow{v_0} = (2\ m/s)\ \hat{\imath}\ +\ (3\ m/s)\ \hat{\jmath}$ At the top of the trajectory, the velocity of the particle is (x horizontal direction, y-vertical direction):

$u_x\ \hat{i} + u_y\ \hat{j}$

A) $\sqrt{2^2 + 3^2}$ m/s

B) 2 m/s

C) 3 m/s

D) 5 m/s

$v_y = 0$

$v_x = u_x = u\cos\theta$

$v_x = u_x = 2$ m/s

QUESTION

$R = \frac{2u_x u_y}{g} = u_x\left(\frac{2u_y}{g}\right) = u_x \times T$

An arrow is shot into the air. Its range is 200 metres (R) and its time of flight is 5 s (T). If the value of g is assumed to be $10\ ms^{-2}$ (g), then the horizontal component of the velocity of arrow is:

A 25 m/s

B 40 m/s

C 31.25 m/s

D 12.5 m/s

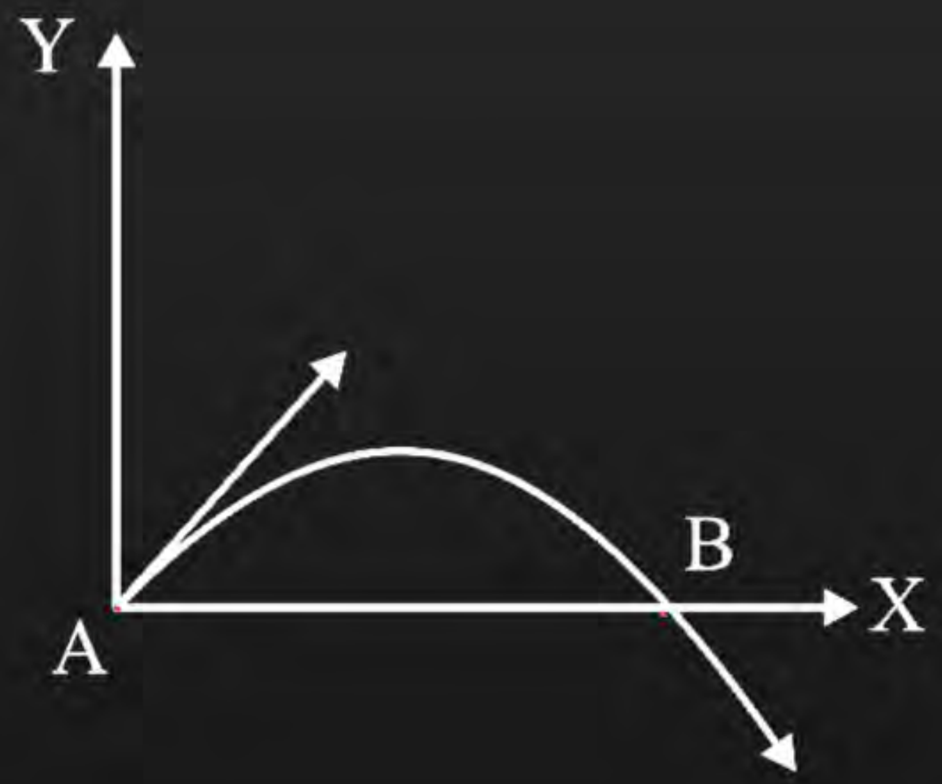
$R = u_x T$

$u_x = \frac{R}{T} = \frac{200}{5} = 40$

$u_x = 40\ m/s$

QUESTION

The velocity of a projectile at the initial point A is $(2\hat{\imath} + 3\hat{\jmath})$ m/s. Its velocity (in m/s) at point B is



A. $-2\hat{\imath} - 3\hat{\jmath}$

B. $-2\hat{\imath} + 3\hat{\jmath}$

C. $2\hat{\imath} - 3\hat{\jmath}$

D. $2\hat{\imath} + 3\hat{\jmath}$

QUESTION

Equations of motion of a projectile are given by $x = 36t$ and $2y = 96t - 98t^2$ m. The angle of projection is equal to

(A) $\sin^{-1}\left(\frac{3}{4}\right)$

(B) $\sin^{-1}\left(\frac{4}{3}\right)$

(C) $\sin^{-1}\left(\frac{4}{5}\right)$

(D) $\sin^{-1}\left(\frac{3}{5}\right)$

$\tan\theta = \frac{u_y}{u_x}$

$\tan\theta = \frac{48}{36} = \frac{4}{3}$

$\sin\theta = \frac{P}{H} = \frac{4}{5}$

$\theta = \sin^{-1}\left(\frac{4}{5}\right)$

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

$u_x = 36(1)$

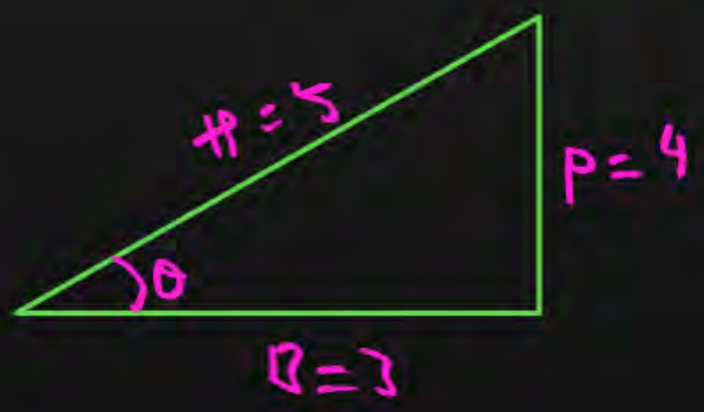
$u_x = 36$ m/s

$y = 48t - 49t^2$

$u_y = \frac{dy}{dt}$

$u_y = 48(1) - 98(t)$

At $t = 0$ s, $u_y = 48$ m/s



QUESTION

$90^\circ - \theta = 90^\circ - 60^\circ = 30^\circ$

A ball is projected with a velocity, $10\ ms^{-1}$, at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be

$v_y = 0$

(A) Zero

(B) $5\sqrt{3}\ ms^{-1}$

(C) $5\ ms^{-1}$

(D) $10\ ms^{-1}$

$\hookrightarrow v_x = u_x = u\cos\theta$

$= 10 \times \cos 30^\circ$

$= 10 \times \frac{\sqrt{3}}{2}$

$= 5\sqrt{3}\ m/s$

QUESTION

A ball is thrown at an angle of 30° to the horizontal. It falls on the ground at a distance of 90m. If the ball is thrown with the same initial speed at an angle 60° to the vertical, it will fall on the ground at a distance of

A. 120 m

B. 27 m

C. 90 m

D. 30 m

$R_\theta = R_{90^\circ - \theta}$

$R_{30^\circ} = R_{60^\circ} = 90\,m$

QUESTION

Two particles are projected with same initial velocity at an angle $30°$ and $60°$ with the horizontal. then,

A their heights will be equal

B their ranges will be equal

C their time of flights will be equal

D their ranges will be different

QUESTION

Two bodies of same mass are projected with the same velocity at an angle $30°$ and $60°$ respectively. The ratio of their horizontal range will be

(A) $1:1$

(B) $1:2$

(C) $1:3$

(D) $2:\sqrt{3}$

QUESTION

For angle of projection 20°, range of a projectile is R. For the same range, another angle of projection should be

A) 40°

B) 50°

C) 60°

D) 70°

$A + B = 90^\circ$

$A + 20^\circ = 90^\circ$

$A = 70^\circ$

QUESTION

If four balls A, B, C and D are projected with same speed, but angles of 15°, 30°, 45° and 60° with the horizontal respectively, the two balls which will fall at the same place will be-

R = same

(A) A and B

(B) A and D

(C) B and D

(D) A and C

QUESTION

The horizontal range is four times the maximum height reached by a projectile. The angle of projection is

(A) 90°

(B) 75°

(C) 60°

(D) 45°

$R \tan\theta = 4H$

$4H \tan\theta = 4H$

$\tan\theta = 1$

$\theta = 45°$

QUESTION

If R is the maximum horizontal range of a particle, then the greatest height attained by it is:

$\theta = 45^\circ$

(A) R

(B) 2R

(C) R/2

(D) R/4

$R \tan\theta = 4H$

$R_{max} = 4H_{max}$

$H_{max} = \frac{R_{max}}{4}$

QUESTION

The equation of a projectile is $y = \sqrt{3}x - \frac{gx^2}{2}$. The angle of projection is:

A. 30°

B. 60°

C. 45°

D. None

$y = \tan\theta \cdot x - \frac{gx^2}{2}$

$\tan\theta = \sqrt{3}$

$\tan\theta = \tan 60^\circ$

$\theta = 60^\circ$

QUESTION

The equation of a projectile is $y = 16x - \frac{x^2}{4}$. The horizontal range is:

(A) 16 m

(B) 8 m

(C) 64 m

(D) 12.8 m

$y = 16x\left[1 - \frac{x^{2}}{4 \times 16x}\right]$

$y = 16x\left[1 - \frac{x}{4 \times 16}\right]$

$y = \tan\theta \cdot x\left(1 - \frac{x}{R}\right]$

$R = 4 \times 16 = 64\,m$

QUESTION

For ground to ground projectile motion equation of path is $y = 12x - \frac{3}{4}x^2$. Given that $g = 10\ ms^{-2}$. What is the range of the projectile?

(A) 36m

(B) 30.6 m

(C) 16 m

(D) 12.4 m

$y = 12x\left[1 - \frac{3x}{4 \times 12}\right]$

$y = 12x\left[1 - \frac{x}{16}\right]$

$y = \tan\theta\, x\left[1 - \frac{x}{R}\right]$

$R = 16m$

QUESTION

A bullet is fired from a gun at the speed of 280 m/s in the direction 30° above the horizontal. The maximum height attained by the bullet is($g = 9.8\ ms^{-2}$, $\sin 30° = 0.5$)

(A) 3000 m

(B) 2800 m

(C) 2000 m

(D) 1000 m

$\sin 30° = \frac{1}{2}$

$\sin^2 30 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

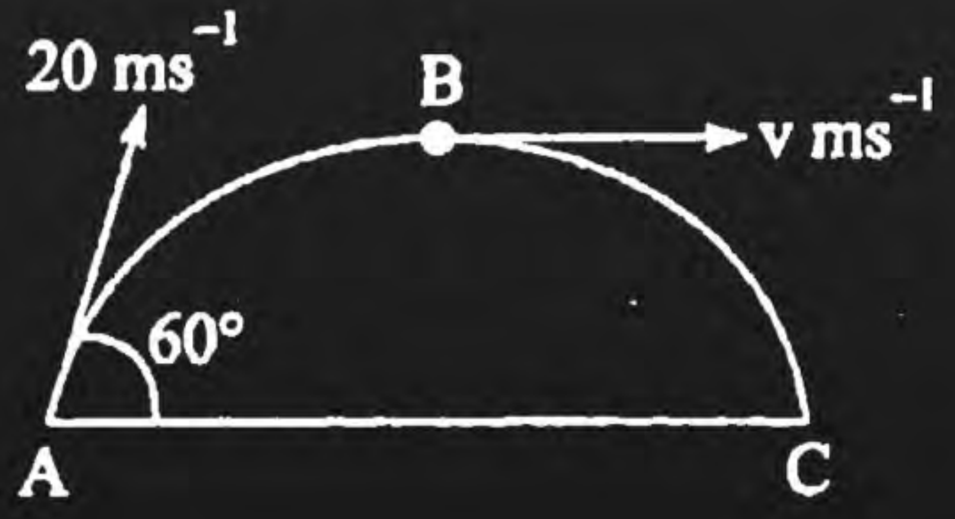
$H = \frac{u^2 \sin^2\theta}{2g}$

$H = \frac{(280)^2 \sin^2 30°}{2 \times 9.8}$

$H = 1000\ m$

QUESTION

A ball is projected from point A with velocity $20\ \text{ms}^{-1}$ at an angle 60° to the horizontal direction. At the highest point B of the path (as shown in figure), the velocity $v\ \text{ms}^{-1}$ of the ball will be:



(A) 20

(B) $10\sqrt{3}$

(C) Zero

(D) 10

QUESTION

H.W

The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is:

R tan θ = 4H

A $\theta = \tan^{-1}\left(\frac{1}{4}\right)$

B $\theta = \tan^{-1}(4)$

C $\theta = \tan^{-1}(2)$

D $\theta = 45^\circ$

QUESTION

A missile is fired for maximum range with an initial velocity of $20 \mathrm{~m/s}$. If $g = 10 \mathrm{~m/s^2}$, the range of the missile is:

A) 40 m

B) 50 m

C) 60 m

D) 20 m

QUESTION

For angles of projection of a projectile at angles ($45^\circ - \theta$) and $(45^\circ + \theta)$, the horizontal ranges described by the projectile are in the ratio of:

A. $1:1$

B. $2:3$

C. $1:2$

D. $3:2$

QUESTION

The maximum range of a gun of horizontal terrain is 16 km . If $g = 10\ \mathrm{ms^{-2}}$, then muzzle velocity of a shell must be:

(A) $100\ \mathrm{ms^{-1}}$

(B) $200\sqrt{2}\ \mathrm{ms^{-1}}$

(C) $400\ \mathrm{ms^{-1}}$

(D) $800\ \mathrm{ms^{-1}}$

Thank

You