Unit - 2
Kinematics

SUMMARY

- speed = $\dfrac{\text{distance x}}{\text{time t}}$

  Average speed = $\dfrac{\text{Total distance}}{\text{Total time}}$

- Instantaneous speed = $\lim\limits_{\Delta t \to 0} \dfrac{\Delta x}{\Delta t}$

- Velocity $v = \dfrac{\text{displacement}}{\text{time}} = \dfrac{\overrightarrow{\Delta r}}{\Delta t}$

  Instaneous velocity $\vec{\upsilon} = \lim\limits_{\Delta t \to 0} \dfrac{\overrightarrow{\Delta r}}{\Delta t} = \dfrac{\overrightarrow{\Delta r}}{dt}$

- Average acceleration Gave = $\dfrac{\Delta \upsilon}{\Delta t}$

- Instantaneous acceleration $\vec{a} = \lim\limits_{\Delta t \to} \dfrac{\Delta \vec{\upsilon}}{\Delta t} = \dfrac{d\vec{\upsilon}}{dt}$

- Equation for Uniformally accelerated motion

  (1) $\upsilon = \upsilon_0 + at$ (3) $d = \upsilon_o t + \dfrac{1}{2} at^2$

  (2) $s = \left(\dfrac{Vo + V}{2}\right)t$ (4) $V^2 = Vo^2 + 2ad$

- Distance covered in n^{th} Second $S_n = V_o + \dfrac{a}{2}(2n - 1)$

- **About Vectors**

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

  $\vec{A} \cdot \vec{A} = |\vec{A}|^2$ | $\vec{A} \times \vec{A} = 0$

  $\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{i} = 1$ | $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = 0$

  $\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{k} = 0$ | $\hat{i} \times \hat{j} = K\ \hat{j} \times \hat{k} = \hat{i}\ \hat{k} \times \hat{i} = \hat{j}$

  $\cos\theta = \dfrac{\vec{A} \cdot \vec{B}}{AB}$ | $\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ Ax & Ay & Az \\ Bx & By & Bz \end{vmatrix}$

$\vec{A}$ ^ $\vec{B}$ then $\vec{A} \cdot \vec{B} = 0$

$\vec{A}$ ^ $\vec{B}$ then $|\vec{A}$ ´ $\vec{B}| = AB$

$\vec{A} \parallel \vec{B}$ then $\vec{A} \cdot \vec{B} = AB$

$\vec{A} \parallel \vec{B}$ then $\vec{A}$ ´ $\vec{B} = 0$

$|\vec{A}| = |\vec{B}|$ and $\vec{A}$ and $\vec{B}$ is Q the angle between

(1) $\theta = 0$ then $|\vec{A} + \vec{B}| = 2A$

(2) $\theta = 180$ then $|\vec{A} + \vec{B}| = 0$

(3) $\theta = 90$ then $|\vec{A} + \vec{B}| = \sqrt{2}\,A$

(4) $\theta = 60$ then $|\vec{A} + \vec{B}| = \sqrt{3}\,A$

(5) $\theta = 120$ then $|\vec{A} + \vec{B}| = A$

For projectile

- Time to reach the highest point $tm = \frac{\upsilon_o \sin\theta}{g}$

- Maximum height H $= \frac{\upsilon_0^2 \sin^2\theta}{2g}$

- Range R $= \frac{\upsilon_0^2 \sin 2\theta}{g}$

- Maximum Range $R = \frac{\upsilon_0^2}{g}$

- Flight time $T = \frac{2\upsilon_o \sin\theta}{g}$

- Equation of trajectory $y = x\tan\theta - \frac{gx^2}{2\upsilon_o^2 \cos^2\theta}$

- $R = 4H\cot\theta$

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MCQ

For the answer of the following questions choose the correct alternative from among the given ones.

(1) A branch of physics dealing with motion without considering its causes is known as ....

(A) Kinematicas (B) dynamics

(C) Hydrodynemics (D) mechanics

(2) Mechanics is a branch of physics. This branch is ...

(A) Kinematics without dynamics (B) dynamics without Kinematics

(C) Kinematics and dynamics (D) Kinematics or dynamics

(3) To locate the position of the particle we need ...

(A) a frame of referance (B) direction of the particle

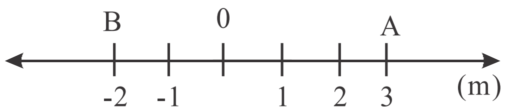
(C) size of the particle (D) mass of the particle

(4) Frame of reference is a ... and a ... from where an obeserver takes his observation,

(A) place, size (B) size, situation

(C) situation, size (D) place, situation

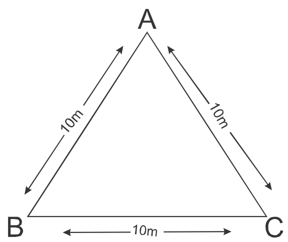
(5)



As shown in the figure a particle moves from 0 to A, and then A to B. Find pathlength and displacement.

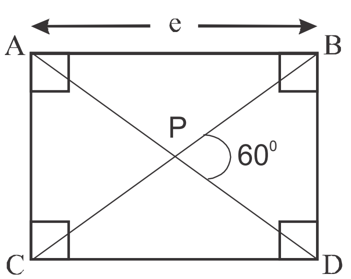
(A) 2m, –2m (B) 8m, –2m (C) 2m, 2m (D) 8m, –8m

(6) A particle moves from A to B and then it moves from B to C as shown in figure. Calculate the ratio between path lenghth and displacement.



(A) 2 (B) 1 (C) $\frac{1}{2}$ (D) ∞

(7) A particle moves from A to P and then it moves from P to B as shown in the figure. Find path length and dispalcement.



(A) $\frac{2l}{\sqrt{3}}$, l (B) $\frac{l}{\sqrt{3}}$, l (C) $2l$, l (D) l, $\frac{2l}{\sqrt{3}}$

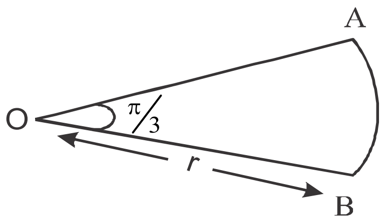
(8) A car goes from one end to the other end of a semicircular path of diameter 'd'. Find the ratio between path legth and displacement.

(A) $\frac{3\pi}{2}$ (B) π (C) 2 (D) $\frac{\pi}{2}$

(9) A particle goes from point A to B. Its displacement is X and pathlength is y. So $\frac{x}{y}$ .....

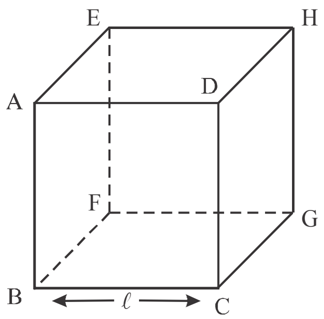
(A) > 1 (B) < 1 **(C)** ≥ 1 (D) ≤ 1

(10) As shown in the figure a partricle statrs its motion from 0 to A. And then it moves from A to B. $\overline{AB}$ is an arc find the Path length



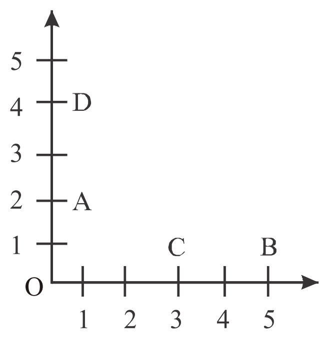
(A) 2r (B) $r+\frac{\pi}{3}$ (C) $\mathbf{r\left(1+\frac{\pi}{3}\right)}$ (D) $\frac{\pi}{3}(r+1)$

(11) Here is a cube made from twelve wire each of length *l*. An ant goes from A to G through path A-B-C-G. Calculate the displacement.



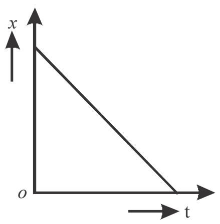
(A) $3l$ (B) $2l$ (C) $\sqrt{3}l$ (D) $\frac{l}{\sqrt{3}}$

(12) As shown in the figure particle P moves from A to B and particle Q moves from C to D. Desplacements for P and Q are x and y respectivey then



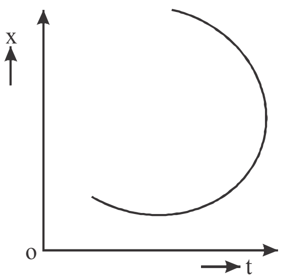
(A) x > y (B) x < y (C) x = y (D) $x \geq y$

(13) Shape of the graph of position $\rightarrow$ time given in the figure for a body shows that



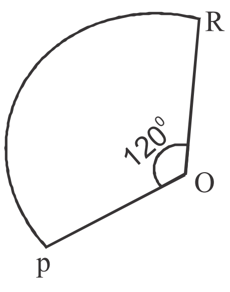
(A) The body moves with constant acceleration
(B) The body moves with zero velocity
(C) The body returns back towards the origin
(D) nothing can be said

(14) The graph of position $\rightarrow$ time shown in the figure for a particle is not possible because ...



(A) velocity can not have two values on one time
(B) Displacement can not have two values at one time
(C) Acceleration can not have two values at one time
(D) A, B and c are true

(15) An ant goes from P to Q on a circular path in 20 second Raidus OP = 10m. What is the average speed and average velocity of it ?



(A) $\frac{\pi}{6}\,ms^{-1}, 3\,ms^{-1}$ (B) $\frac{\pi}{3}\,\mathbf{ms^{-1}}, \frac{\sqrt{3}}{2}\,\mathbf{ms^{-1}}$

(C) $\frac{\pi}{3}\,ms^{-1}, \sqrt{3}\,ms^{-1}$ (D) $\pi\,ms^{-1}, \sqrt{6}\,ms^{-1}$

(16) A particle is thrown in upward direction with initial velocity of 60 m/s. Find average speed and average velocity after 10 seconds. [$g = 10\ ms^{-2}$]

(A) $26ms^{-1}$, $16ms^{-1}$ (B) $26ms^{-1}$, $10ms^{-1}$
(C) $20ms^{-1}$, $10ms^{-1}$ (D) $15ms^{-1}$, $25ms^{-1}$

(17) The ratio of pathlength and the resepective time interval is
(A) Mean Velocity (B) Mean speed
(C) intantaneous velocity (D) intantaneous speed

(18) A car moving over a straight path covers a distance x with constant speed 10 ms^{-1} and then the same distance with constant speed of V_2. If average speed of the car is 16ms^{-1}, then V_2 = ...
(A) 30 ms^{-1} (B) 20 ms^{-1} (C) 40 ms^{-1} (D) 25 ms^{-1}

(19) A bus travells between two points A ans B. V_1 and V_2 are it average speed and average velocity then
(A) $v_1 > v_2$ (B) $v_1 < v_2$ (C) $v_1 = v_2$ (D) depends on situation

(20) A car covers one third part of its straight path with speed V_1 and the rest with speed V_2. What is its average speed ?
(A) $\frac{3v_1v_2}{2v_1 + v_2}$ (B) $\frac{2v_1v_2}{3v_1 + v_2}$ (C) $\frac{3v_1 v_2}{v_1 + 2v_2}$ (D) $\frac{3v_1v_2}{2v_1 + 2v_2}$

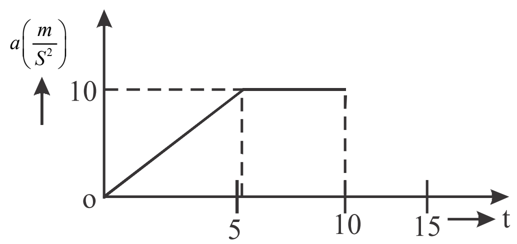
(21) Rohit completes a semicirular path of radius R in 10 seconds. Calculate average speed and average velocity in ms^{-1}.
(A) $\frac{2\pi R}{10}, \frac{2R}{10}$ (B) $\frac{\pi R}{10}, \frac{R}{10}$ **(C)** $\mathbf{\frac{\pi R}{10}, \frac{2R}{10}}$ (D) $\frac{2\pi R}{10}, \frac{R}{10}$

(22) A particle moves 4m in the south direction. Then it moves 3m in the west direction. The time taken by the particle is 2 second. What is the ratio between average speed and average velocity ?
(A) $\frac{5}{7}$ (B) $\frac{7}{5}$ (C) $\frac{14}{5}$ (D) $\frac{5}{14}$

(23) A particle is projected vertically upwards with velocity 30ms^{-1}. Find the ratio of average speed and instantaneous velocity after 6s. [g = 10ms^{-1}]
(A) $\mathbf{\frac{1}{2}}$ (B) 2 (C) 3 (D) 4

(24) The motion of a particle along a straight line is described by the function $x = (3t - 2)^2$. Calculate the acceleration after 10s.
(A) 9ms^{-2} (B) 18mls (C) 36$ms^{-\alpha}$ (D) 6$ms^{-\alpha}$

(25) Given figure shows a graph at acceleration → time for a rectilinear motion. Find average acceleration in first 10 seconds.



(A) 10ms^{-2} (B) 15ms^{-2} (C) 7.5ms^{-2} (D) 30ms^{-2}

(26) A body starts its motion with zero velocity and its acceleration is 3m/s^2. Find the distance travelled by it in fifth second.
(A) 15.5m (B) 17.5m **(C) 13.5m** (D) 14.5m

(27) A body is moving in x direction with constant acceleration α. Find the difference of the displacement covered by it in nth second and (n–1)th second.

(A) α (B) $\frac{\alpha}{2}$ (C) 3α (D) $\frac{3}{2}\alpha$

(28) What does the speedometer measure kept in motorbike ?

(A) Average Velocity (B) Average speed

(C) intantaneous speed (D) intantaneous Velocity

(29) The displacement of a particle in x direction is given by $x = 9 - 5t + 4t^2$. Find the Velocity at timt t = 0

(A) $-8\ ms^{-1}$ **(B) $-5\ ms^{-1}$** (C) $3\ ms^{-1}$ (D) $10\ ms^{-1}$

(30) A freely falling particle covers a building of 45m height in one second. Find the height of the point from where the particle was released. [$g = 10ms^{-2}$]

(A) 120m **(B) 125m** (C) 25m (D) 80m

(31) The distance travelled by a particle is given by $s = 3 + 2t + 5t^2$ The initial velocity of the particle is ...

(A) 2 unit (B) 3 unit (C) 10 unit (D) 5 unit

(32) A particle is thrown in upward direction with Velocity V_0. It passes through a point p of height h at time t_1 and t_2 so $t_1 + t_2$ = ...

(A) $\frac{v_0}{g}$ **(B) $\frac{2v_0}{g}$** (C) $\frac{2h}{g}$ (D) $\frac{h}{2g}$

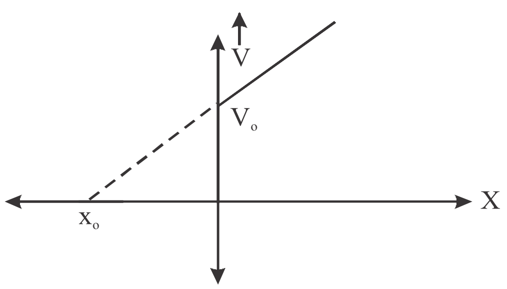
(33) A particle is thrown in upward direction with initial velocity V_0. It crosses point P at height h at time t_1 and t_2 so t_1t_2 = ________

(A) $\frac{2h}{g}$ (B) $\frac{V_0^2}{2g}$ (C) $\frac{2V_0^2}{g}$ (D) $\frac{h}{2g}$

(34) Ball A is thrown in upward from the top of a tower of height h. At the same time ball B starts to fall from that point. When A comes to the top of the tower, B reaches the ground. Find the the time to reach maximum height for A.

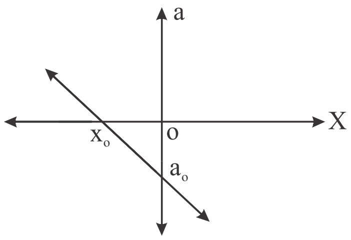
(A) $\sqrt{\frac{h}{g}}$ (B) $\sqrt{\frac{2h}{g}}$ **(C) $\sqrt{\frac{h}{2g}}$** (D) $\sqrt{\frac{4h}{g}}$

(35) In the figure Velocity (V) $\rightarrow$ position graph is given. Find the true equation.



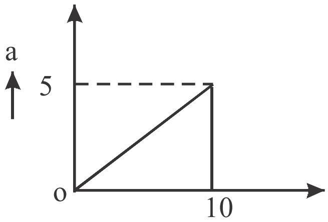
(A) $v = \frac{v_0}{x_0}x - v_0$ (B) $v = -\frac{v_0}{x_0}x + v_0$ (C) $v = \frac{-v_0}{x_0}x - v_0$ **(D) $v = \frac{v_0}{x_0}x + v_0$**

(36) In the figure there is a graph of $a \rightarrow x$ for a moving particle. Hence $\frac{da}{dt} = ...$ V



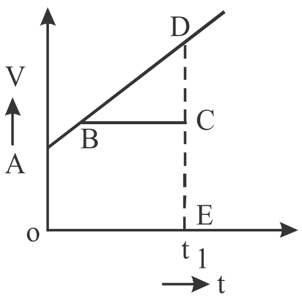
(A) $\frac{x_0}{a_0}$ (B) $\frac{-x_0}{a_0}$ (C) $\frac{-a_0}{x_0}$ (D) $\frac{a_0}{x_0}$

(37) A particle is moving in a straight line with intial velocity of 10 ms^{-1}. A graph of acceleration $\rightarrow$ time of the particle is given in the figure. Find velocity at t = 10 s.



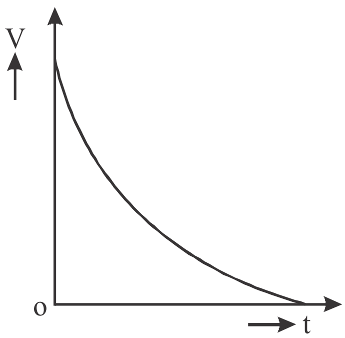
(A) 25 ms^{-1} (B) 35 ms^{-1} (C) 45 ms^{-1} (D) 15 ms^{-1}

(38) A graph of moving body with constant acceleration is given in the figure. What is the velocity after time t ?



(A) $0A + \frac{DC}{BC} \cdot 0E$ (B) $0A + \frac{DC}{BC} \cdot DE$ (C) $AB + \frac{BC}{DC} \cdot 0E$ (D) $0A + \frac{DC}{BC} \cdot AD$

(39)



The graph given in the figure shows that the body is moving with .....

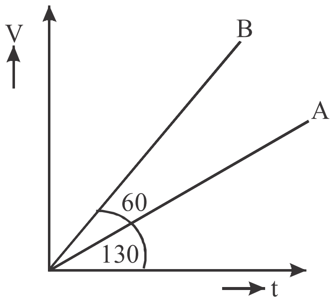
(A) increasing acceleration **(B) decreasing acceleration**

(C) constant velocity (D) increasing velocity

(40) Slope of the velocity-time graph gives __________ of a moving body.
(A) displacement (B) acceleration (C) initial velocity (D) final velocity

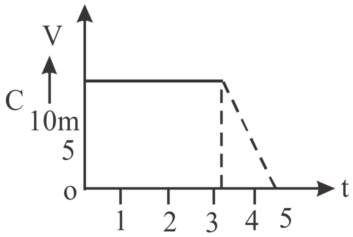
(41) The intercept of the velocity-time graph on the velocity axis gives.
(A) initial velocity (B) final velocity (C) average velocity (D) instanteneous velocity

(42) Here are the graphs of velocity $\rightarrow$ time of two cars A and B, Find the ratio of the acceleration after time t.



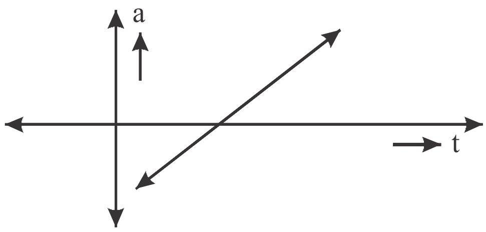
(A) $\frac{1}{\sqrt{3}}$ (B) $\mathbf{\frac{1}{3}}$ (C) $\sqrt{3}$ (D) 3

(43) Here is a velocity - time graph of a motorbike moving in one direction. Calculate the distance covered by it in last two seconds.



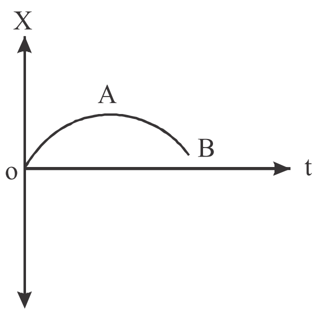
(A) 5 m (B) 20 m **(C) 50 m** (D) 25 m

(44)



In the above figure acceleration (a) $\rightarrow$ time (t) graph is given. Hence V α .....
(A) a (B) $\sqrt{a}$ (C) a^2 (D) a^3

(45)



The graph of displacent (x) $\rightarrow$ time (t) for an object is given in the figure. In which part of the graph the acceleration of the particle is positive ?
(A) OA (B) AB
(C) 0 - A - B (D) acceleration is not positive at any part.

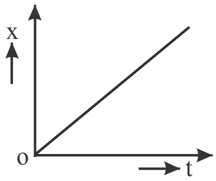
(46) In a uniformly accelerated motion the slope of velocity - time graph gives ....
(A) The instantaneous velocity (B) The acceleration
(C) The initial velocity (D) The final velocity

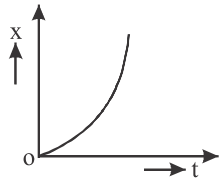
(47) The area covered by the curve of V – t graph and time axis is equal to magnitude of ....
(A) change in velocity (B) change in acceleration
(C) displacement (D) final velocity

(48) An object moves in a straight line. It starts from the rest and its acceleration is $2 ms^{-2}$. After reaching a certain point it comes back to the original point. In this movement its acceleration is $-3 ms^{2}$. till it comes to rest. The total time taken for the movement is 5 second. Calculate the maximum velocity.
(A) $6\ ms^{-1}$ (B) $5\ ms^{-1}$ (C) $10\ ms^{-1}$ (D) $4\ ms^{-1}$

(49) The relation between time and displacement of a moving particle is given by $t = 2\alpha x^2$ where α is a constant. The shape of the graph $x \rightarrow y$ is ...
(A) parabola (B) hyperbola (C) ellips (D) circle

(50) Here are the graphs of $x \rightarrow t$ of a moving body. Which of them is not suitable ?

(A)


(B)


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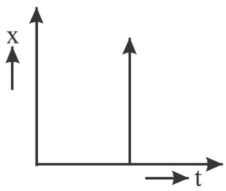
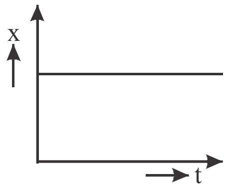
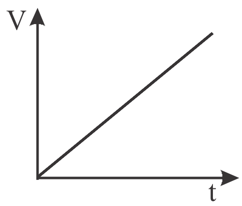
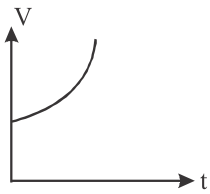


(D)


(51) Here are the graphs of $v \rightarrow t$ of a moving body. Which of them is not suitable ?

(A)


(B)


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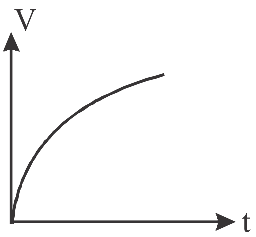
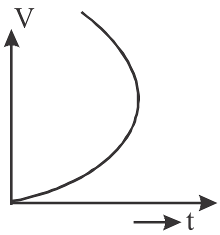
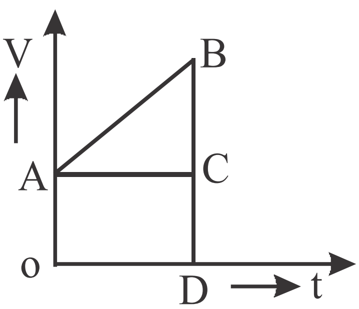


(D)


Comprehension type questions



In the figure there is a graph of velocity $\rightarrow$ time for a particle.

(52) Which area shows the displacement covered by the particle after time t

(A) closed fig AODCA (B) closed fig. ABCA

(C) closed fig. AODCBA (D) none of above

(53) Which part shows initial velocity of the particle ?

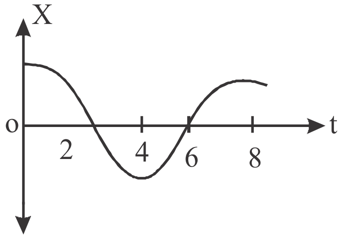
(A) OA (B) AB (C) AC (D) AOA

(54) How will you calculate the acceleration of the particle ?

(A) taking length of AB (B) taking magnitude of BC

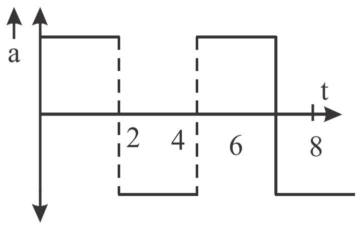
(C) taking slope of AC (D) taking slope of AB

(55)

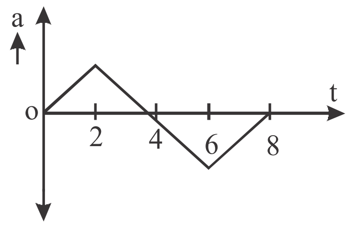


Given graph shows relation between position and time. Find correct graph of acceleration $\rightarrow$ time

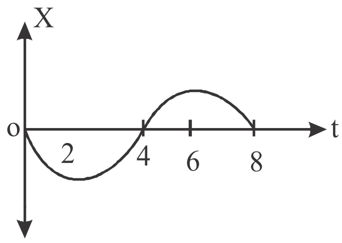
(A)



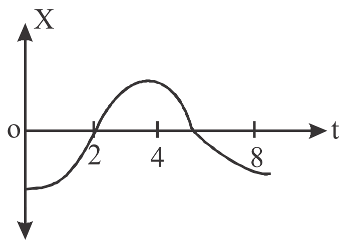
(B)



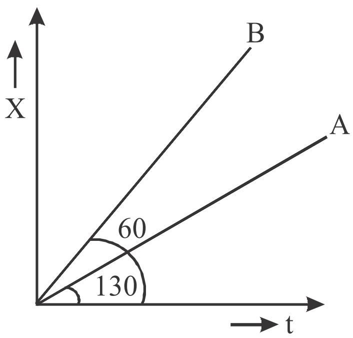
(C)



(D)

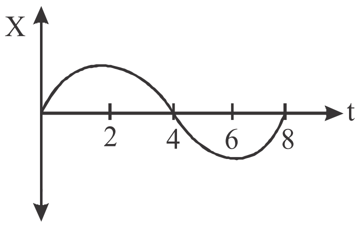


(56)

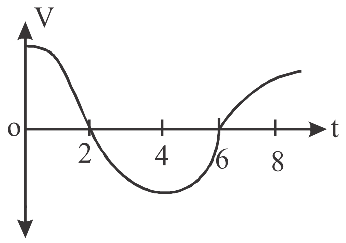


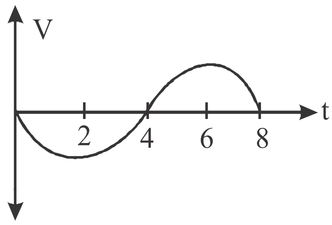
Here are displacement $\rightarrow$ time graphs of particle A and B. If V_A and V_B are velocities of the particles respectively, then $\frac{V_A}{V_B}$ = ...

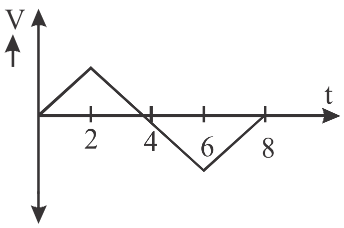
(A) $\frac{1}{3}$ (B) 3 (C) $\frac{1}{\sqrt{3}}$ (D) $\sqrt{3}$

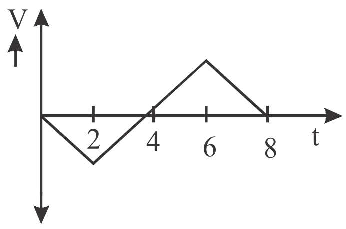
(57) 

Given graph shows relation between position (x) $\rightarrow$ time (t) Find the correct graph of velocity $\rightarrow$ time.

(A) 

(B) 

(C) 

(D) 

(58) Particles A and B are released from the same height at an interval of 2 s. After some time t the distance between A and B is 100m. Calculate time t.

(A) 8 s **(B) 6 s** (C) 3 s (D) 12 s

(59) As shown in the figure a particle is released from P. It reachet at point Q at time t_1 and reaches at point R at time t_2 so $\frac{t_1}{t_2}$ = ...

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

(60) A particle moves in stright line. Its position is given by $x = 2 + 5t - 3t^2$. Find the ratio of intial velocity and initial acceleration.

(A) $+\frac{5}{6}$ **(B)** $\mathbf{-\frac{5}{6}}$ (C) $\frac{6}{5}$ (D) $-\frac{6}{5}$

(61) A particle is moving in a circle of radius R with constant speed. It coveres an angle θ in some time interval. Find displacement in this interval of time.

(A) $2R\cos\frac{\theta}{2}$ **(B)** $\mathbf{2R\sin\frac{\theta}{2}}$ (C) $2R\cos\theta$ (D) $2R\sin\theta$

(62) A particle is moving in a straight line with initial velocity of 200 ms^{-1} acceleration of the particle is given by $a = 3t^2 - 2t$. Find velocity of the particle at 10 second.

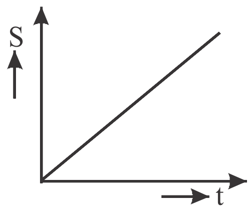
(A) 1100ms^{-1} (B) 300ms^{-1} (C) 900ms^{-1} (D) 100ms^{-1}

(63) Angle of projection, maximum height and time to reach the maximum height of a particle are θ , H and tm respectivley. Find the true relation.

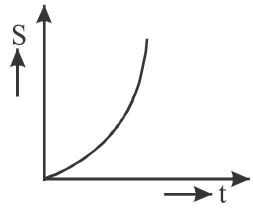
(A) $t_m = \sqrt{\frac{H}{2g}}$ (B) $\mathbf{t_m = \sqrt{\frac{2H}{g}}}$ (C) $t_m = \sqrt{\frac{4H}{g}}$ (D) $t_m = \sqrt{\frac{H}{4g}}$

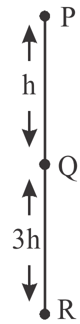
(64) Particle A is projected vertically upward from a top of a tower. At the same time particle B is dropped from the same point. The graph of distance (s) between the two particle varies with time is.

(A)

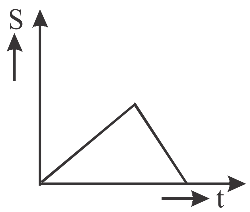


(B)

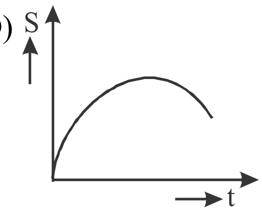




(C)



(D)



(65) A car is moving with speed 30m. Due to application of brakes it travells 30m before stopping. Find its acceleration.

(A) $15\frac{m}{s^2}$ (B) $\mathbf{-15\frac{m}{s^2}}$ (C) $30\frac{m}{s^2}$ (D) $10\frac{m}{s^2}$

(66) A particle moves with a constant acceleration $2m/s^2$. Its intial velocity is 10m/s. Find velocity after t second.

(A) $(10 + t)\ ms^{-1}$ (B) $5(2 + t)ms^{-1}$ (C) $2\ (5 + t)ms^{-1}$ (D) $(10 + t^2)\ ms^{-1}$

(67) A particle moves in a straight lime with constant acceleration. At t = 10s velocity and displacement of the particle are $16ms^{-1}$ and 39m respectively. What will be the velocity after 10 s ...

(A) $22\ ms^{-1}$ (B) $18\ ms^{-1}$ (C) $20\ ms^{-1}$ (D) $28\ ms^{-1}$

(68) A particle moves with constant acceleration $2m/s^2$ in x direction. The distance travelled in fifth second is 19 m. Calculate the distance travelled after 5 second.

(A) 50 m (B) 75 m (C) 80 m (D) 70 m

(69) Two bodies of masses m_1 and m_2 are dropped from heights H and 2H respectively. The ratio of time taken by the bodies to touch the ground is ...

(A) $\frac{1}{2}$ (B) 2 **(C)** $\mathbf{\frac{1}{\sqrt{2}}}$ (D) $\frac{\sqrt{2}}{1}$

(70) A freely falling stone crashes through a horizontal glass plate at time t and losses half of its velocity. After time $\frac{t}{2}$ it falls on the ground. The glass plate is 60 m high from the ground. Find the total distance travelled by the stone. $[g = 10ms^{-2}]$

(A) 120 m (B) 80 m (C) 100 m (D) 140 m

(71) A freely falling object travells distance H. Its velocity is V. Hence, in travelling further distance of 4H its velocity will become ....

(A) $\sqrt{3}V$ **(B)** $\mathbf{\sqrt{5}V}$ (C) 2V (D) 3V

(72) A ball is thrown vertically upward direction. Neglacting the air resistance velocity of the ball in air will

(A) zero **(B) decrease when it is going up**

(C) decrease when it is coming down (D) remain constant

(73) Two particles P and Q get 5 m closer each second while travelling in opposite direction. They get 1 m closer each second while travelling in same direction. The speeds of P and Q are respectively ...

(A) 5 ms^{-1}, 1 ms^{-1} (B) 3 ms^{-1}, 4 ms^{-1} (C) 3 ms^{-1}, 2 ms^{-1} (D) 10 ms^{-1}, 5 ms^{-1}

(74) Motion of a porticle is described by an equation $\upsilon = (A + y)^{\frac{1}{2}}$ where v, y and A are velocity distance and a constant respectively. Find the acceleratrion of the particle.

(A) 1 unit (B) 2 unit **(C) $\frac{1}{2}$ unit** (D) 3 unit

(75) The minumum distance in which a car can be stopped is x. The velocity of the car is V. If the velocity is 2V then find the stopping distance.

(A) 2x (B) 4x (C) 3x (D) $\frac{1}{2}$ x

(76) A particle moves in one direction with acceleration 2 ms^{-2} and initial velocity 3 ms^{-1}.After what time its displacement will be 10 m ?

(A) 1 s **(B) 2 s** (C) 3 s (D) 4 s

(77) A goods train is moving with constant acceleration. when engine passes through a signal its speed is U. Midpoint of the train passes the signal with speed V. What will be the speed of the last wagon ?

(A) $\sqrt{\frac{V^2 - U^2}{2}}$ (B) $\sqrt{\frac{V^2 + U^2}{2}}$

(C) $\sqrt{\frac{2V^2 - U^2}{2}}$ **(D) $\sqrt{2V^2 - U^2}$**

(78) Displacement of a particle in y direction is given by $y = t^2 - 5t + 5$ where t is in second. Calculate the time when its velocity is zero.

(A) 5 s **(B) 2.5 s** (C) 10 s (D) 3 s

(79) The area under acceleration versus time graph for any time interval represents...

(A) Intial velocity (B) final velocity

(C) change invelocity in the time interval

(D) Distance covered by the particle

(80) A ball is thrown vertically upward. What is the velocity and acceleration of the ball at the maximum height ?

(A) –gt ms^{-1}, 0 **(B) 0, –9 ms^{-2}** (C) g ms^{-1}, 0 (D) 0, –gt ms^{-2}

(81) The relation between velocity and position of a particle is V = Ax + B where A and B are constants. Acceleration of the particle is 10 ms^{-2} when its velocity is V, How much is the acceleration when its velocity is 2V.

(A) 20 ms^{-2} (B) 10 ms^{-1} (C) 5 ms^{-2} (D) 0

(82) A particle moves on a plane along the path $y = Ax^3 + B$ in such a way that $\frac{dx}{dt} = c$. c, A, B are constans. Calculate the acceleration of the particle.

(A) $3Axc\hat{j}ms^{-2}$ (B) $5Axc^2\hat{j}ms^{-2}$

(C) $3Axc^2\hat{j}ms^{-2}$ (D) $\left(c\hat{i} + 3Axc^2\hat{j}\right)ms^{-2}$

(83) The relation between velocity and position of a particle is given by $V = \alpha - \beta x$. Its initial velocity is zero. Find its velocity at time $t = \frac{1}{B}$

(A) e ms^{-1} (B) 0 ms^{-1} **(C) $\frac{1}{e}ms^{-1}$** (D) e^2 ms^{-1}

(84) An object moves in x - y plane. Equations for displacement in x and y direction are x = 3sin2t and y = 3cos2t Speed of the particle is

(A) zero (B) constant and nonzero

(C) increasing with time t (D) decreasing with time t

(85) Motion of a particle is decribed by $x = (t - 2)^2$ Find its velocity when it passes through origin.

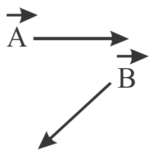
(A) 0 (B) 2 ms^{-1} (C) 4 ms^{-1} (D) 8 ms^{-1}

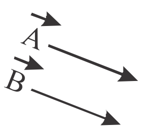
(86) To introduce a vector quantity ....

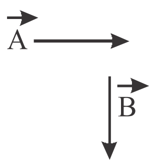
(A) it needs magnitude not direction (B) it needs direction not magnitude

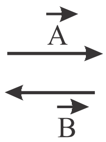
(C) it need both magnitude and direction (D) nothing is needed

(87) Which pair of two vectors is antiparallel.

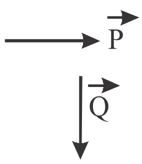
(A) 

(B) 

(C) 

(D) 

(88) In the above figure $\vec{P}$ and $\vec{Q}$ are two vectors. What from followings is true



(A) $\vec{P}$ and $\vec{Q}$ are equal (B) $\vec{P}$ and $\vec{Q}$ are perpendicular

(C) $\vec{P}$ and $\vec{Q}$ are antiparallel (D) $\vec{P}$ and $\vec{Q}$ are in same direction

(89) Which from the following is a scalar ?

(A) Electric current (B) Velocity (C) acceleration (D) Electric field

(90) $\vec{P}$ and $\vec{Q}$ are equal vectors what from the followings is true.

(A) $\vec{P}$ and $\vec{Q}$ are antiparallel (B) $\vec{P}$ and $\vec{Q}$ are parallel

(C) $\vec{P}$ and $\vec{Q}$ may be perpendicular (D) $\vec{P}$ and $\vec{Q}$ may be free vectors

(91) $\vec{P} = \vec{Q}$ is true, if ...

(A) their magnitudes are equal
(B) they are in same direction
(C) their magnitudes are equal and they are in same direction
(D) their magnitudes are not equal and they are not in same direction

(92) $\vec{A}$ and $\vec{B}$ are in opposite direction so they are

(A) parallel vectors (B) anti parallel vector
(C) equal vector (D) perpendicular vector

(93) $\vec{A} = \hat{1} + 2\hat{j} + 2\hat{k}$. Calculate the angle between $\vec{A}$ and Y axis.

(A) $\mathbf{\sin^{-1}\frac{\sqrt{5}}{3}}$ (B) $\sin^{-1}\frac{1}{\sqrt{3}}$ (C) $\sin^{-1}\frac{\sqrt{10}}{3}$ (D) $\cos^{-1}\frac{\sqrt{5}}{3}$

(94) $\vec{A}$ and $\vec{B}$ are nonzero vectors. Which from the followings is true ?

(A) $\mathbf{\left|\vec{A}+\vec{B}\right|^2 - \left|\vec{A}-\vec{B}\right|^2 = 2\left(A^2+B^2\right)}$ (B) $\left|\vec{A}+\vec{B}\right|^2 - \left|\vec{A}-\vec{B}\right|^2 = 2\left(A^2-B^2\right)$

(C) $\left|\vec{A}+\vec{B}\right|^2 - \left|\vec{A}-\vec{B}\right|^2 = A^2+B^2$ (D) $\left|\vec{A}+\vec{B}\right|^2 - \left|\vec{A}-\vec{B}\right|^2 = A^2-B^2$

(95) $\vec{C} = \vec{A} + \vec{B}$ and A = B = C Find the angle between $\vec{A}$ and $\vec{B}$

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ **(C)** $\frac{2\pi}{3}$ (D) 0

(96) The resultant of two vectors is maximum when they.

(A) are at right angles to each other (B) act in oppsite direction
(C) act in same direction (D) are act 120^0 to each other

(97) The resultant of two veetors $\vec{A}$ and $\vec{B}$

(A) can be smaller than A – B in magnitude
(B) can be greater than A + B in magnitude
(C) can't be greater than A + B or smaller than A – B in magnitude
(D) none of above is true

(98) The resultant of two forces of magnitude 2N and 3N can never be.

(A) 4N (B) 1N (C) 2.5N (D) $\mathbf{\frac{1}{2}N}$

(99) The sum of $\vec{P}$ and $\vec{Q}$ is at right agnles to their difference then

(A) A = B (B) A = 2B (C) B = 2A (D) A = B = A – B

(100) Magnitudes of $\vec{A}$, $\vec{B}$ and $\vec{C}$ are 41, 40 and 9 respectively, $\vec{A} = \vec{B} + \vec{C}$ Find the angle between $\vec{A}$ and $\vec{B}$

(A) $\sin^{-1}\frac{9}{40}$ (B) $\mathbf{\sin^{-1}\frac{9}{41}}$ (C) $\tan^{-1}\frac{9}{41}$ (D) $\tan^{-1}\frac{41}{40}$

(101) If $\vec{A} = 3\hat{i} + 4\hat{j} + 9\hat{k}$ is multiplied by 3, then the component of the new vector along z direction is ...

(A) –3 (B) + 3 **(C) –27** (D) + 27

(102) $\vec{A}+\vec{B}$ is perpendicular to $\vec{A}$ and $|\vec{B}| = 2|\vec{A}+\vec{B}|$ What is the angle between $\vec{A}$ and $\vec{B}$

(A) $\frac{\pi}{6}$ (B) $\mathbf{\frac{5\pi}{6}}$ (C) $\frac{2\pi}{3}$ (D) $\frac{\pi}{3}$

(103) Out of the following pairs of forces, the resultant of which can not be 18N

(A) 11 N, 7 N (B) 11 N, 8 N (C) 11 N, 29 N (D) 11 N, 5 N

(104) $\vec{A} = 3\hat{i} + 2\hat{j} - 5\hat{k}$ and $\vec{B} = \hat{i} + \hat{j} + 2\hat{k}$ Find $|\vec{A} + 2\vec{B}|$

(A) $\sqrt{40}$ (B) $\mathbf{\sqrt{42}}$ (C) $\sqrt{39}$ (D) 2

(105) What is the angle between $\vec{Q}$ and the resultant of $\vec{P}+\vec{Q}$ and $\vec{Q}-\vec{P}$

(A) 90^0 (B) 60^0 **(C) 0** (D) 45^0

(106) $\vec{A} = 2\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{B} = 2\hat{i} - \hat{j} - 2\hat{k}$ Find $3\vec{A} - 2\vec{B}$

(A) $2\hat{i} + 7\hat{j} + \hat{k}$ (B) $2\hat{i} + 8\hat{j} - \hat{k}$

(C) $\mathbf{2\hat{i} + 8\hat{j} + \hat{k}}$ (D) $\hat{i} + 7\hat{j} + \hat{k}$

(107) Linear momentajm of a particle is $(3\hat{i} + 2\hat{j} - \hat{k})$ $kgms^{-1}$. Find its magnitude.

(A) $\mathbf{\sqrt{14}}$ (B) $\sqrt{12}$ (C) $\sqrt{15}$ (D) $\sqrt{11}$

(108) $\vec{A} \times \vec{B} = \vec{C}$, Then $\vec{C}$ is perpendicular to

(A) $\vec{A}$ only (B) $\vec{B}$ only

(C) $\vec{A}$ and $\vec{B}$ both when the angle between them is ...

(D) $\vec{A}$ and $\vec{B}$ both whatever to be the angle between them

(109) If $\vec{A} \cdot \vec{B} = 0$ then

(A) $|\vec{A}|$ must be zero (B) $|\vec{B}|$ must be zero

(C) either $\vec{A} = 0, \vec{B} = 0$ or $\theta = 0$ (D) either $\mathbf{\vec{A} = 0, \vec{B} = 0}$ or $\mathbf{\theta = \frac{\pi}{2}}$

(110) y component of $\vec{A} \times \vec{B}$ is ....

$\vec{A} = Ax\hat{i} + Ay\hat{j} + Az\hat{k}$

$\vec{B} = Bx\hat{i} + By\hat{j} + Bz\hat{k}$

(A) AxBy – AyBx (B) AzBx – AxBz (C) AxBz – AzBx (D) AzBy – AyBz

(111) If $\vec{A} \times \vec{B} = 0$ then $\vec{A} \cdot \vec{B}$ = ...

(A) AB (B) $\frac{A}{B}$ (C) $\frac{1}{2}AB$ (D) 0

(112) If $\vec{A} = 4\hat{i} + 3\hat{j} - 2\hat{k}$ and $\vec{B} = 8\hat{i} + 6\hat{j} - 4\hat{k}$ the angle between $\vec{A}$ and $\vec{B}$ is

(A) 45^0 (B) 0 (C) 60 (D) 90

(113) $\vec{A} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{B} = 8\hat{i} + 6\hat{j} - 4\hat{k}$ then $|\vec{A} \times \vec{B}| = ...$

(A) 28 (B) 14 **(C) 0** (D) 7

(114) If $\vec{A} = 2\hat{i} + 5\hat{j} - \hat{k}$ and $\vec{B} = 3\hat{i} - 2\hat{j} - 4\hat{k}$ the angle between $\vec{A}$ and $\vec{B}$ is ...

(A) 0 (B) $\boldsymbol{\frac{\pi}{2}}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

(115) Which statement is true ?

(A) $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$

(B) $\boldsymbol{\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}}$

(C) $\vec{A} \cdot \vec{B} = -\vec{B} \cdot \vec{A}$

(D) $\vec{A} \cdot \vec{B} = AB$

(116) Which from the following is true ?

(A) $\cos\theta = \frac{|\vec{A} \times \vec{B}|}{AB}$

(B) $\sin\theta = \frac{\vec{A} \cdot \vec{B}}{AB}$

(C) $\boldsymbol{\tan\theta = \frac{|\vec{A} \times \vec{B}|}{\vec{A} \cdot \vec{B}}}$

(D) $\cot\theta = \frac{AB}{|\vec{A} \times \vec{B}|}$

(117) $(\vec{A} + \vec{B}) \cdot (\vec{A} \times \vec{B}) = ...$

(A) 0 (B) $A^2 + B^2$ (C) $\sqrt{A^2 + B^2}$ (D) A^2B^2

(118) The angle between $\hat{i} + \hat{j}$ and z axis is ....

(A) 0 (B) 45 (C) 90 (D) 180

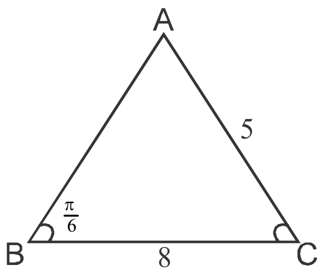
(119) $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{B} = -\hat{i} - 2\hat{j} + 2\hat{k}$ what is the angle between $\vec{A}$ and $\vec{B}$

(A) $\cos^{-1} 0.8888$ (B) $\cos^{-1} 0.4444$ (C) $\sin^{-1} 0.4444$ (D) $\sin^{-1} 0.8888$

(120) $\vec{A} = P\hat{i} - 2P\hat{j} - \hat{k}$ and $\vec{B} = -3\hat{i} + 2\hat{j} + -14\hat{k}$ are perependcular to each other. Then p = ...

(A) 3 (B) 4 (C) 2 (D) 1

(121) In the above triangle AC = 5, BC = 8 and B = $\frac{\pi}{6}$ Find the value of angle A.



(A) $\sin^{-1} 0.6$ (B) $\sin^{-1} 0.8$ (C) $\sin^{-1} 0.12$ (D) $\sin^{-1} 0.4$

(122) $A = -\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{B} = 2\hat{i} - \hat{j} + \hat{k}$ Find the unit vectior in direction of $\vec{A} \times \vec{B}$

(A) $\frac{1}{\sqrt{23}}(-\hat{i} - 5\hat{j} - 2\hat{k})$

(B) $\frac{1}{\sqrt{35}}(-\hat{i} + 5\hat{j} - 3\hat{k})$

(C) $\frac{1}{\sqrt{29}}(-\hat{i} - 5\hat{j} - 3\hat{k})$

(D) $\boldsymbol{\frac{1}{\sqrt{35}}(-\hat{i} - 5\hat{j} - 3\hat{k})}$

(123) What is unit vector along $\hat{i}+\hat{j}$?

(A) $\frac{\hat{i}+\hat{j}}{2}$ (B) $\frac{\hat{\mathbf{i}}+\hat{\mathbf{j}}}{\sqrt{\mathbf{2}}}$ (C) $\frac{\hat{i}+\hat{j}}{\sqrt{3}}$ (D) $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$

(124) Unit vector of $\vec{A}\times\vec{B}$ is $\hat{k}$. Unit vector of $\vec{A}$ is $\hat{i}$ Then what is the unit vector of $\vec{B}$

(A) $\hat{j}$ (B) $-\hat{j}$

(C) any unit vector in xy plane (D) any unit vector in xz plane

(125) Find a unit vector in direction of $\hat{i}+2\hat{j}-3\hat{k}$

(A) $\frac{1}{\sqrt{7}}\left(\hat{i}+2\hat{j}-3\hat{k}\right)$ (B) $-\frac{1}{2}\left(\hat{i}+2\hat{j}-3\hat{k}\right)$

(C) $\frac{\mathbf{1}}{\sqrt{\mathbf{14}}}\left(\hat{\mathbf{i}}+\mathbf{2}\hat{\mathbf{j}}-\mathbf{3}\hat{\mathbf{k}}\right)$ (D) $\frac{1}{\sqrt{5}}\left(\hat{i}+2\hat{j}-3\hat{k}\right)$

(126) Find a unit vector perpenduicular to both $\vec{A}$ and $\vec{B}$

(A) $\frac{\vec{A}\cdot\vec{B}}{AB}$ (B) $\frac{\vec{\mathbf{A}}\times\vec{\mathbf{B}}}{\mathbf{AB\sin\theta}}$ (C) $\frac{\vec{A}\times\vec{B}}{AB\cos\theta}$ (D) $\frac{\vec{A}\cdot\vec{B}}{AB\sin\theta}$

(127) If resultant of $\vec{A}=2\hat{i}+\hat{j}-\hat{k}$, $\vec{B}=\hat{i}-2\hat{j}+3\hat{k}$ and $\vec{C}$ is unit vector in y direction, then $\vec{C}$ is

(A) $-\hat{j}$ (B) $\mathbf{3\hat{i}-2\hat{j}+2\hat{k}}$ (C) $\hat{j}$ (D) $2\hat{i}+3\hat{k}$

(128) $\vec{A}$ and $\vec{B}$ are two vectors $\hat{U}_A=\hat{U}_B$ Now find the true option.

(A) $\vec{A}$ and $\vec{B}$ equal vectors (B) $\vec{A}$ and $\vec{B}$ are in opposite direction

(C) $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ are in same direction (D) $\vec{A}\perp\vec{B}$

(129) Unit vector in direction of $\vec{A}$ is

(A) $|\vec{A}|$ (B) $\frac{\vec{\mathbf{A}}}{|\vec{\mathbf{A}}|}$ (C) $|\vec{A}|\vec{A}$ (D) $\frac{|\vec{A}|}{\vec{A}}$

(130) $\frac{2}{3}\hat{i}+\frac{2}{3}\hat{j}+p\hat{k}$ is a unit vector so p = ...

(A) $\frac{2}{3}$ (B) $-\frac{\mathbf{1}}{\mathbf{3}}$ (C) 1 (D) $\frac{1}{9}$

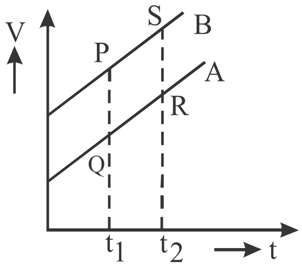
(131) Find a unit vector from the followings.

(A) $\hat{i}+\hat{j}$ (B) $\hat{i}-\hat{j}$ (C) $\frac{\mathbf{1}}{\mathbf{2}}\hat{\mathbf{i}}+\frac{\mathbf{1}}{\sqrt{\mathbf{2}}}\hat{\mathbf{j}}$ (D) $\frac{1}{\sqrt{2}}\hat{i}-\frac{1}{2}\hat{j}$

(132) Train A is 56 m long and train B 54 m long. They are travelling in opposite direction with velocity $15\frac{m}{s}$ and $5\frac{m}{s}$ respectively. The time of crossing is.

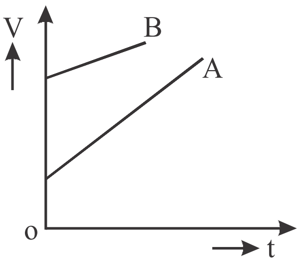
(A) 12 s (B) 6 s (C) 3 s (D) 18 s

(133) Graphs of velocity $\rightarrow$ time for two cars A and B moving in a straight line are given in the fig. The area covered by PQRS gives.



(A) distance from A to B at time t_2
(B) distance from A to B at time t_1
(C) distance from A to B in time interval $t_2 - t_1$
(D) change in distance from A to B in time interval $t_2 - t_1$

(134)



Graphs velocity $\rightarrow$ time is given for cars A and B moving in a straight line in same direction. At time t = 0 they are moving in the direction from A to B, then.

(A) They will meet once
(B) They will never meet
(C) They will meet twice
(D) none of above is true

(135) Velocity of particle A with respect to particle B is $4\frac{m}{s}$ while they are moving in same direction. And it is $10\frac{m}{s}$ while they are in opposite direction. What are the velocities of the particles with respect to the stationary frame of reference.

(A) 7 ms^{-1}, 3 ms^{-1}
(B) 4 ms^{-1}, 5 ms^{-1}
(C) 7 ms^{-1}, 4 ms^{-1}
(D) 10 ms^{-1}, 4 ms^{-1}

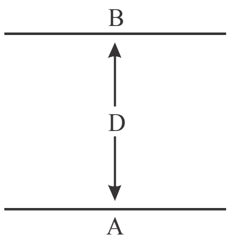
(136) Stone A is thrown in horizontal direction with velocity of 10 ms^{-1} at the same time stone B freely falls vertically in downword direction. Calculate the velocity of B with respect to A after 10 second.

(A) 10 ms^{-1}
(B) $\sqrt{101}$ ms^{-1}
(C) $10\sqrt{101}$ ms^{-1}
(D) 0

(137) A car moves horizontally with a speed of 3 ms^{-1}. A glass wind screen is kept on the front side of the car. Rain drops strike the screen vertically. With the Velocity of 5 ms^{-1} Calculate the velocity of rain drops with respect to a ground.

(A) 6 ms^{-1}
(B) 4 ms^{-1}
(C) 3 ms^{-1}
(D) 1 ms^{-1}

(138) A man crosses a river through shortest distance D as given in the figure. $\vec{V}_R$ is velocity of water and $\vec{V}_m$ is velocity of man in still river water. If $\vec{V}_{mR}$ is relative velocity of man w.r.t. river, then find the angle made by swimming man with the shortest distance AB



(A) $\tan^{-1}\dfrac{V_R}{V_m - V_R}$ (B) $\tan^{-1}\dfrac{V_m}{\sqrt{V_{R^2} - V_{m^2}}}$

(C) $\tan^{-1}\dfrac{V_R}{\sqrt{V_{m^2} - V_{R^2}}}$ (D) $\tan^{-1}\dfrac{V_R}{\sqrt{V_{R^2} - V_{m^2}}}$

(139) A particle has initial velocity $\left(2\hat{i}+3\hat{j}\right)ms^{-1}$ and has acceleration $\left(\hat{i}+\hat{j}\right)ms^{-2}$. Find the velocity of the particle after 2 second.

(A) $\left(3\hat{i}+5\hat{j}\right)ms^{-1}$ **(B) $\left(4\hat{i}+5\hat{j}\right)ms^{-1}$**

(C) $\left(3\hat{i}+2\hat{j}\right)ms^{-1}$ (D) $\left(5\hat{i}+4\hat{j}\right)ms^{-1}$

(140) Motion of a body in x - y plane is described by $\vec{r}=\left[2t\hat{i}+\left(5t^2+6t\right)\hat{j}\right]m$ Then find velocity of the body at t = 1 second.

(A) $\sqrt{144}ms^{-1}$ (B) $\sqrt{148}ms^{-1}$ (C) $\sqrt{150}ms^{-1}$ (D) $\sqrt{260}ms^{-1}$

(141) A particle moves in x - y plane. The position vector of the particle is given by $\vec{r}=\left(3t\hat{i}-2t^2\hat{j}\right)m$ Find the rate of change of θ at t = 1 second. Where θ is the anghe betheen direction of motion and x

(A) $\dfrac{16}{25}$ (B) $\dfrac{12}{25}$ (C) $-\dfrac{12}{25}$ (D) $\dfrac{16}{9}$

(142) x and y co-ordinates of a particle moving in x-y plane at some instant are $x = 2t^2$ and $y=\dfrac{3}{2}t^2$ Calculate y co-ordinate when its x coordinate is 8m.

(A) 3 m **(B) 6 m** (C) 8 m (D) 9 m

(143) A particle in xy plane is governed by x = $A\cos\omega t$, $y = A(1-\sin\omega t)$. A and ω are constants. What is the speed of the particle.

(A) $A\omega t$ (B) $A\omega^2 t$ **(C) $A\omega\cos\omega t$** (D) $A^2\omega\sin\dfrac{\omega t}{2}$

(144) A particle is moving in a xy plane with y = 2x and Vx = 2 – t. Find Vy at time t = 3 second.
(A) 2 ms^{-1} (B) –3 ms^{-1} (C) +3 ms^{-1} (D) –2 ms^{-1}

(145) t_1 and t_2 are two values of time of a projectile at the same height $t_1 + t_2 = ...$
(A) Time to reach maximum height (B) fight time for the projectile
(C) $\frac{3}{4}$ time of the fight time. (D) $\frac{3}{2}$ time of the fight time.

(146) Eequetion of a projectile is given by $y = Ax - Bx^2$. Find the range for the particle.
(A) $\mathbf{\frac{A}{B}}$ (B) $\frac{A}{4B}$ (C) $\frac{A}{2B}$ (D) $\frac{2A}{B}$

(147) Angle of projection of a projectile with horizonal line is θ at time t = 0, After what time the angle will be again θ ?
(A) $\frac{V\cos\theta}{g}$ (B) $\frac{V\sin\theta}{g}$ (C) $\frac{V_0\sin\theta}{2g}$ (D) $\mathbf{\frac{2V_0\sin\theta}{g}}$

(148) A particle is projected with initial speed of V_0 and angle of θ. Find the horizontal displacement when its velocity is perpendicular to initial velocity.
(A) $\mathbf{\frac{V_0^2}{g\tan\theta}}$ (B) $\frac{V_0^2}{g\sin\theta}$ (C) $\frac{V_0\sin\theta}{g}$ (D) $\frac{V_0^2}{\tan\theta}$

(149) Intial anlge of a projectile is θ and its initial velocity is V_0. Find the angle of velocity with horizontal line at time t.
(A) $\sin^{-1}\left[1 - \frac{g}{V_0\cos\theta}t\right]$ (B) $\tan^{-1}\left[1 - \frac{g}{V_0\cos\theta}t\right]$
(C) $\mathbf{\tan^{-1}\left[\tan\theta - \frac{g}{V_0\cos\theta}t\right]}$ (D) $\sin^{-1}\left[\tan\theta - \frac{g}{V_0\cos\theta}t\right]$

(150) A stone is projected with an angle θ and velocity V_0 from point P. It strikes the ground at point Q. If the both P and Q are on same horizontal line, then find average velocity.
(A) $\mathbf{V_0\cos\theta}$ (B) $V_0\sin\theta$ (C) $V_0\cos\frac{\theta}{2}$ (D) $V_0\sin\frac{\theta}{2}$

(151) An object is projected with initial velocity of 100 ms^{-1} and angle of 60. Find the verticle velocity when its horizontal displacement is 500 m. (g = 10 ms^{-1})
(A) 93.35 ms^{-1} **(B) –93.35 ms^{-1}** (C) –8.65 ms^{-1} (D) 98 ms^{-1}

(152) Angle of projection of a projectile is changed, keeping initial velocity constant. Find the rate of change of maximum height. Range of the projectile is R.
(A) $\frac{R}{4}$ (B) $\frac{R}{3}$ **(C) $\mathbf{\frac{R}{2}}$** (D) R

(153) A cartasian equation of a projectile is given by $y = 2x - 5x^2$. Calculate its initial velocity.
(A) $\sqrt{10}ms^{-1}$ **(B) $\mathbf{\sqrt{5}ms^{-1}}$** (C) $\sqrt{2}ms^{-1}$ (D) 4 ms^{-1}

(154) A body travelling in a circle at constant speed.

(A) has a constant velocity (B) is not accelerated

(C) has an outward radial acceleration (D) has an inward radial acceleration

(155) The speed of a particle moving in a circle of radius r = 4 meter is 10 ms^{-1}. What is its radial acceleration ?

(A) 25 ms^{-2} (B) 20 ms^{-2} (C) 10 ms^{-2} (D) 15 ms^{-2}

(156) If f is the frequency of a body moving in a circular path with constant speed. a is its centrifugal acceleration, so.

(A) $a \propto f$ (B) **$a \propto f^2$** (C) $a \propto f^3$ (D) $a \propto \frac{1}{f}$

• Following question is Assertion - Reason type question. choose

(A) If both Assertion - Reason are true, reason is correct explanation of Asserton.

(B) If both Assertion - Reason are true but reason is not correct explanation of Asserton. (C) If Asserton is true but Reason is false.

(D) If Reason is true but Asserton is false.

(157) Asserton :

At the highest point of projectile motion the velocity is not zero.

Reason : Only the verticle component of velocity is zero. Where as horizontal component still exists.

(A) a (B) b (C) c (D) d

Match coloum type question.

(158) A balloon rise up with constant net acceleration of 10 ms^{-2}. After 2 second a particle drops from the balloon. After further 2 s match the following (take g = 10 ms^{-2})

Table - 1	Table 2
(A) Hight of the particle from ground	(P) zero
(B) Speed of particle	(Q) 10 SI unit
(C) Displacement of particle	(R) 40 SI unit
(D) Accelereation of the particle	(S) 20 SI unit

(A) A - P, B - Q, C - R, D - S

(B) A - Q, B - R, C - S, D - P

(C) A - R, B - P, C - S, D - Q

(D) A - R, B - S, C - P, D - Q

Comprehensions type questions.

A particle is moving in a circle of radius R with constant speed. The time period of the particle is T Now after time $t = \frac{T}{6}$.

(159) Average speed of the particle is

(A) $\frac{\pi R}{6T}$ (B) $\frac{2\pi R}{3T}$ (C) $\frac{2\pi R}{T}$ (D) $\frac{R}{T}$

(160) Average velocity of the particle is

(A) $\frac{3R}{T}$ (B) $\frac{6R}{T}$ (C) $\frac{2R}{T}$ (D) $\frac{4R}{T}$

(161) Range of a projectile is R and maximum height is H. Find the area covered by the path of the projectile and horizontal line.

(A) $\frac{2}{3}RH$ (B) $\frac{5}{3}RH$ (C) $\frac{3}{5}RH$ (D) $\frac{6}{5}RH$

KEY NOTE

1	A	32	B	63	B	94	A	125	C
2	C	33	A	64	A	95	C	126	B
3	A	34	C	65	B	96	C	127	B
4	D	35	D	66	B	97	C	128	C
5	B	36	C	67	C	98	D	129	B
6	A	37	C	68	B	99	A	130	B
7	A	38	A	69	C	100	B	131	C
8	D	39	B	70	D	101	C	132	B
9	C	40	B	71	B	102	B	133	C
10	C	41	A	72	B	103	D	134	A
11	C	42	B	73	C	104	B	135	A
12	A	43	C	74	C	105	C	136	C
13	C	44	C	75	B	106	C	137	B
14	D	45	D	76	B	107	A	138	C
15	B	46	B	77	D	108	D	139	B
16	B	47	C	78	B	109	D	140	D
17	B	48	A	79	C	110	B	141	C
18	C	49	B	80	B	111	A	142	B
19	D	50	C	81	A	112	B	143	C
20	A	51	D	82	B	113	C	144	D
21	C	52	C	83	C	114	B	145	B
22	B	53	A	84	B	115	B	146	A
23	A	54	D	85	A	116	C	147	D
24	B	55	D	86	C	117	A	148	A
25	C	56	A	87	D	118	C	149	C
26	C	57	A	88	B	119	B	150	A
27	A	58	B	89	A	120	C	151	B
28	C	59	B	90	B	121	B	152	C
29	B	60	B	91	C	122	D	153	B
30	B	61	B	92	B	123	B	154	D
31	A	62	A	93	A	124	C	155	A
								156	B
								157	A
								158	C
								159	C
								160	B
								161	A

HINT

(9) Pathlenth is always greater or equal to displacement

(18) Average speed $= \frac{2V_1V_2}{V_1 + V_2}$

(23) $h = \frac{V_0^2}{2g}$ speed $= \frac{2V_0^2}{2g \times 6}$

(24) $V = \frac{dx}{dt}$ and $a = \frac{dv}{dt}$

(25) Find $\frac{\text{change in velocity}}{\text{time}}$

change in velocity is the area covered by the graph.

(30) $h_2 - h_1 = \frac{1}{2}g(t+1)^2 - \frac{1}{2}gt^2 = 45$

(31) $V = \frac{ds}{dt} = 2 + 10t$

(32,33) $h = V_0t - \frac{1}{2}gt^2$

$\therefore \frac{1}{2}gt^2 - V_0t + h = 0$

$\therefore t^2 + \frac{2V_0}{g} + \frac{2h}{g} = 0$

There are two real values of t.

(35) slope is $\frac{V_0}{x_0}$

(37) Aera covered by $a \to t$ graph gives change in velocity.

(42) acceleration = slope = $\tan\theta$

(44) $\frac{da}{dt} = \text{constant}$

$\therefore \frac{da}{dv} \cdot \frac{dv}{dt} = k \quad \therefore \frac{da}{dv} = \frac{k}{a}$

$\therefore \int a\,da = \int k\,dv$

$\therefore \frac{a^2}{2} = kv$

(45) $a = \frac{d^2x}{dt^2}$

(48) If maximum velocity is V.

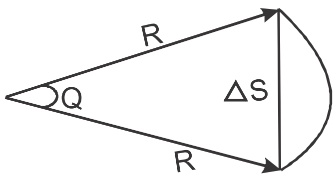
$V = a_1t_1$ and $V = a_2t_2$

$$T = t_1 + t_2 = \frac{v}{a_1} + \frac{v}{a_2}$$

$$V = \frac{a_1a_2T}{a_1 + a_2}$$

(59) $h = \frac{1}{2}gt_1^{\,2}$ and $(h + 3h) = \frac{1}{2}gt_2^{\,2}$

(61)



$$\Delta S = \sqrt{R^2 + R^2 - 2R^2 \cos\theta}$$

$$\Delta S = \sqrt{2R^2\text{-}2R^2\text{Cos}\theta} = \sqrt{2R^2(1\text{-Cos}\theta)}$$

$$= 2R\sin\frac{\theta}{2}$$

(65) stopping distance $ds = \frac{V_0^{\,2}}{2g}$

(66) $V = V_0 + at$

$$d = V_0t + \frac{1}{2}at^2$$

(69) $H = \frac{1}{2}gt^2 \quad H \,\alpha\, t^2$

(70) At time t velocity V = gt

(70) $y = V_0t + \frac{1}{2}gt^2$

$$y = gt \times \frac{t}{2} - \frac{1}{2}g\left(\frac{t}{2}\right)^2$$

(73) $V_1 + V_2 = 5$

$V_1 - V_2 = 1$ So $2V_1 = 6$

$V_1 = 3\text{m/s}$

(74) $V = (A + y)^{\frac{1}{2}}$

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$\therefore a = \frac{dv}{dt} = \frac{dv}{dy} \cdot \frac{dy}{dt}$

(75) $s = \frac{v^2}{2a}$

(81) $V = Ax + B$

$a = Av$

$a \alpha V$

(82) $\frac{dx}{dt} = c$ and $\frac{dx^2}{dt^2} = 0$

$y = Ax^3 + B$

$\therefore \frac{dy}{dt} = 3Ax^2 \frac{dx}{dt}$

and $\frac{d^2y}{dt^2} = 6Ax \frac{dx}{dt} \times \frac{dx}{dt}$

$\therefore \frac{d^2y}{dt^2} = 6Axc^2$

Now $\vec{a} = \frac{d^2x}{at^2} \hat{i} + \frac{d^2y}{dt^2} \hat{j}$

(95) $\vec{C} = \vec{A} + \vec{B}$

$C^2 = A^2 + B^2 + 2AB \cos\theta$

(116) $\vec{A} - \vec{B} = AB\cos\theta$

$|\vec{A} \times \vec{B}| = AB\sin\theta$

(127) $\vec{A} + \vec{B} + \vec{C} = \hat{j}$

(130) $\sqrt{\frac{4}{9} + \frac{4}{9} + p^2} = 1$

(131) Velocity of A wrt ground

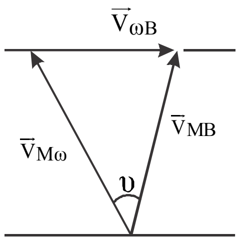
$\overrightarrow{V_{AG}} = 10 \hat{1}$

Velocity of B w.r.t. ground

$\overrightarrow{V_{BG}} = -gt \hat{j}$

$\overrightarrow{V_{BA}} = \overrightarrow{V_{BG}} + \overrightarrow{V_{GA}}$

(138)



$\vec{V}_{MW} + \vec{V}_{WB} = \vec{V}_{MB}$

$\vec{V}_{MW}$ = Velocity of man w.r.t. water

$\vec{V}_{WB}$ = Velocity of water w.r.t. Bank

$\vec{V}_{MB}$ = Velocity of man w.r.t. Bank

$\tan\theta = \dfrac{V_{WB}}{V_{MB}}$

(141) $\vec{r} = \left(3t\hat{i} - 2t^2\hat{j}\right)$

$\vec{V} = \dfrac{\overrightarrow{dr}}{dt} = 3\hat{i} - 4t\hat{j}$

$\tan\theta = \dfrac{-4}{3}t$

(142) $x = 2t^2 = 8$

$\therefore t = 2s$

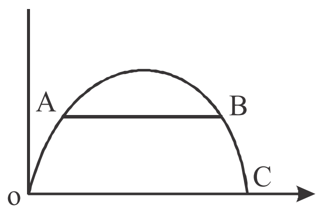
$y = \dfrac{3}{2}t^2 = \dfrac{3}{2}(2)^2 = 6m$

(143) $x = A\cos wt \qquad y = A\ (i - \sin wt)$

$V\alpha = \dfrac{dx}{dv} = -A\omega \sin wt \quad Vy = -A\,\omega \cos wt$

$V = \sqrt{Vx^2 + Vy^2}$

(145)



$t_1 = t\ (0A) = t\ (BC)$
$t_2 = t\ (0B)$
$t_1 + t_2 = t\ (0A) + t\ (0B)$
$t_1 + t_2 = t\ (BC) + t\ (0B)$

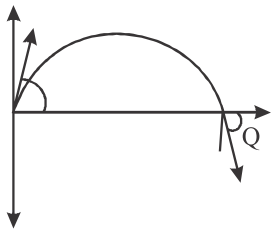
(146) $y = Ax - Bx^2$

$$\therefore \frac{dy}{dx} = A - 2Bx$$

At maximum height $A - 2Bx = 0$

$$\therefore x = \frac{A}{2B}$$

(147)



(148) $\overrightarrow{V_0} = V_0\cos\theta\hat{i} + V_0\sin\theta\hat{j}$

$$\vec{V} = V_0\cos\theta\hat{i} + (V_0 sm\theta - gt)\hat{j}$$

$$\overrightarrow{V_0} \cdot \vec{V} = 0$$

$$\therefore t = \frac{V_0}{g\sin\theta} \text{ Now find x}$$

(149) At time t $V_x = V_0 = V_0\cos\theta$

$$V_y = Vi\sin\theta - gt$$

$$\tan\alpha = \frac{Vy}{Vx} = \frac{V_0\sin\theta - gt}{V_0\cos\theta}$$

(150) Range $R = \frac{V_0^2\sin 2\theta}{g}$

Flight time $t_f = \frac{2V_0\sin\theta}{g}$

Average velocity $= \frac{R}{t_f}$

(156) Cenrifugal acceleration

$$a_r = \frac{v^2}{r} = \left(\frac{2\pi r}{T}\right)^2 \frac{1}{r} = 4\pi^2 r f^2$$

(161) $A = \int_0^R y\,dx$ take $y = x\tan\theta - \frac{gx^2}{2V_0 x\cos\theta}$