PHYSICS

BOOKS - PRADEEP PHYSICS (HINGLISH)

KINEMATICS

Sample Promlem

1. A man walks for 1minute at a speed of $1 ms^{-1}$ and then runs for 1 min at a speed of $3 ms^{-1}$ along straight track, What is the average speed of the man?

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2. A cyclist moving on a circular track of rakies $200 m$ completely is 5 minutes. What his (a) average speed (b) average velocity in one full revolution?

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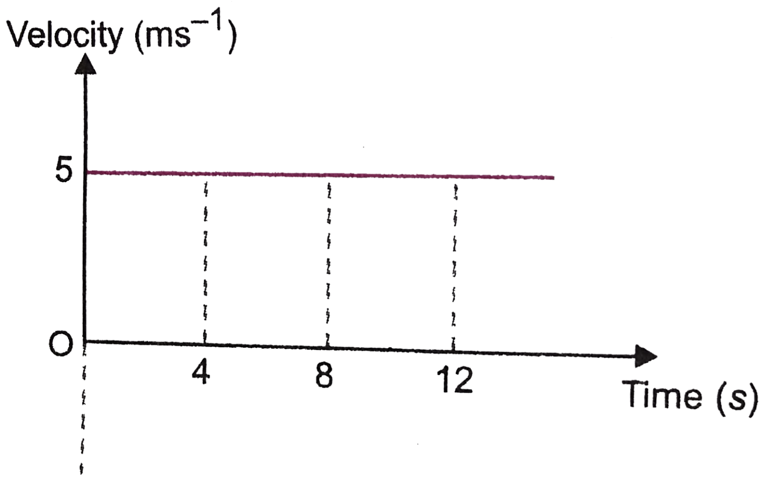
3. The velocity time graph of a uniform motion of a partcile along a st. line id shown in Fig. 2 (a).20. What is the dispacement of the particle in time interval $8s$ to 12 s`?



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4. The displacement (in metre) of a particle moving along x-axis is given by $x = 18t + 5t^2$. Calculate (i) the instantaneous velocity $t = 2s$ (ii) average velocity between $t = 2s$ to $t = 3s$ (iii) instantaneous acceleration.

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5. A particle is moving with a uniform acceleration $4ms^{-2}$ for time 2 second and then $5ms^{-20}$ for time 3 seconds`. What is the average acceleration of particle during motion.

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6. A particle starts with an initial velocity $3.0ms^{-1}$ along the positive x - direction and it accelerates uniformly at the rate of $0.60ms^{-2}$.(a) Find the distance traveled by it in the first three seconds. (b) Hew much time does it take to reach the velocity $9.0m/s$ (c) How much distance will it cover in reaching the velocity $9.0ms^{-1}$?

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7. A particle having initial velocity $5m/s$ moves with a constant acceleration $2ms^{-2}$, for time 10 secondalong a straight line. Find the displacement of the particle in the last one second and the total distance traveled in 10 seconds`.

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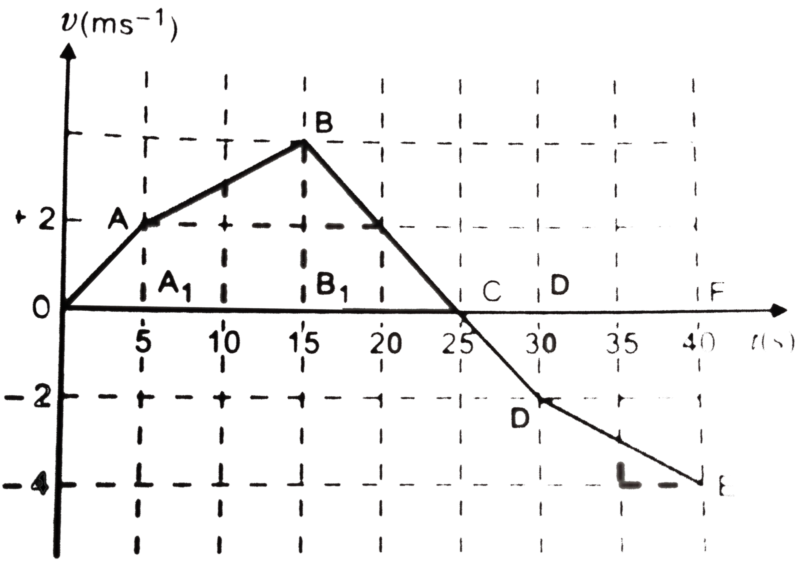
8. The velocity-time graph line motion is shown in Fing. 2 (b).7. Find (a) the distance travelled and (b) displacement, between 5 and $40s$. (c) Acceleration betwwn `15 to 25 seconds.



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9. Two forces $20N$ and $5N$ are acting at an angle of 12^0 between them.

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10. Two forces F and $2F$ newton act on a particle. If the first force be doubled and the second force be increased by 16 newtons, the direction of the resultant remains unaltered. Find the value of F.

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11. A bob weighing 50 gram hangs vertically at the end of a string $50cmlong$. If 20 gram force is applied horizontally, by how much distance the bob is pulled aside from its initial position when it reaches in equilibrium position?

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12. A river $500m$ wide flows at a rate at a rate of $4kmh^{-1}$. A swimmer who can swim at $8kmh^{-1}$. In still water, wishes to cross the river straight. (i) Along what direction must he strike? (ii) What should be his resultant velocity. (iii) What is the time of crossing the river?

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13. A man is walking on a level road at a speed of $3.2km^{-1}$. Rain drops fall vertically with a speed of $4.0kmh^{-1}$. Find the velocity of the raindrops with respect to the man. In which direction, the man should hold his umbrella to protect himself from rain ?

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14. A mass of $2kg$ lies lies on a plane making an anged 30^{0} to the horizontal. Resolve its weight along and perpendicular to the plane. Assume $g = 10ms^{-2}$.

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15. A $50N$ boy hangs from it, as shown in Fig. 2 (c) .35 (a). Find the senstion in the two parts of the rope.

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16. If $\vec{A} = 2\hat{I}$ - $5\hat{k}$, find (i) | vec A| and (ii) the direction cositnes of the vector $\vec{A}$.

A. $\cos\alpha = \frac{A_x}{A} = \frac{2}{\sqrt{45}}, \cos\beta = \frac{A_y}{A} = \frac{4}{\sqrt{45}}\Bigg)$ and cosgamma =A_(z)/A = (-5)/(sqrt4)

B. $\cos\alpha = \frac{A_x}{A} = \frac{2}{\sqrt{2}}, \cos\beta = \frac{A_y}{A} = \frac{4}{\sqrt{45}}\Bigg)$ and cosgamma =A_(z)/A = (-5)/(sqrt45)

C. $\cos\alpha = \frac{A_x}{A} = \frac{2}{\sqrt{45}}, \cos\beta = \frac{A_y}{A} = \frac{4}{\sqrt{45}}\Bigg)$ and cosgamma =A_(z)/A = (-5)/(sqrt45)`

D. $\cos\alpha = \frac{A_x}{A} = \frac{2}{\sqrt{45}}, \cos\beta = \frac{A_y}{A} = \frac{4}{\sqrt{45}}\Big)$ and cosgamma =_(z)/A =

(-5)/(sqrt45)

Answer: C

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17. A constant force $\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$ mewton pewton produces a desplacement of $\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$ metre. What is the word done?

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18. If the magnitudes of two vectors are 2 and 3 and the magnitude of their scalar product is $3\sqrt{2}$, then find the angle between the vectors.

A. 45

B. 60

C. 120

D. 150

Answer: A

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19. Calculate the area of the parallelogram whose two adjacent sides are formed by the vectors `vec A xx 4 hat I + 3 hat j and vec B =- 3 hati +6 hat j.

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20. Find the magnitude of torque of a force $\vec{F} = \big)$ - $3\hat{i} + \hat{j} + 5\hat{k}\big)$. Newton acting at the point $\vec{r} = \left(7\hat{j} + 3\hat{j} + \hat{k}\right)metre.$

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21. If the position vector of a particle is given by $\vec{r} = (4\cos 2t)\hat{j} + (6t)\hat{k}m$, calculate its acceleration at $t = \pi/4second$.

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22. A football player kicks a ball at ball at an angle of 30^0 with the horizontal with an initial speed of $20m/s$. Assuming that the ball travels in a vertical plane, calculate (a) the time at which the ball reaches the highest point (b) maximum height reached (c) the horizontal range of the ball (d) the time for which the ball is in air. $g = 10m/s^2$.

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23. Calculate the angular speed of the flywheel making 240 revlocutions per minute.

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24. A storne tied to the end of a string $2m$ long is whirled in a horizontal circle with constant speed. If the stone makes 10 revolutions in $20s, caluatethemagnitude$ and $directionof$10$revolutions \in$ 20 s`, calculate the magnitude and direction of accelertion.

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25. A motor car travelling at $30m/s$ on a circular road of radius $500m$. It is increasing its speed at the rate of $2ms^{-2}$. What its accleratopm ?

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1 SolvedExamples

1. A body travels from $A \rightarrow B$ at $40ms^{-1}$. And from $B \rightarrow A$ at 60 ms^(-1)`. Calculate the average speed and average velocity.

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2. In a journey, a car travels at the rate of $20kmh^{-1}$ for minutes and then at $30kmh^{-1}$ for $20 \min utes$. Find (i) the total distance traveled by the car and (ii) the average speed of the car during the journey.

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3. A particle moves along a circle of radius `R. It starts from (A) and moves in antilockwise direction. Calculate the distance travelled by particle (a)one complete revolution. Also calcuate the magnituede of displacement in each case. Fig. 2 (a) .28.

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4. A car is moving along a straight (OP). It moves from $O \text{to} P$ in $18 \text{sec} onds$ and returns from $P \text{to} Q$ in 6 seconds, where $OP = 360m$ and $OQ = 240m$ What are the car the average velocity and average speed of the car in going (a) from $O \text{to} P$ and back to Q?

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5. A man walks on a straight road from his home to a moardet $3km$ away with a speed of$6km/h$. Finding the market closed, he instantly turns and walks back with a speed of $9km/h$. What is the (a) magnitude of average velocity and (b) averge speed of the man, over the interval of time (i) $0 \rightarrow 30$ min , (ii) $0 \rightarrow 50$ min , (iii) $0 \rightarrow 40$ min ?

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6. On a $80km$ track, a train travels $40km$ with a uniform speed of $30kmh^{-1}$. How fast must the train travel the next $40kmh^{-1}$ as to have average speed $40kmh^{-1}$ for the entire trip?

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7. A particle travels along a straight line. It covers halg the distance with a speed (v). The remaining part of the distance was covere with speed v_1

for half the time and with speed v_2 for the other half the time . Find the average speed of the particle over the entire motion.

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8. A man starts from his home at 8.00 am to his office. He walks with a speed of $2ms^{-1}$ on a road upto his office $3.0km$ away from his home. He stays in the office upto $4.00 \pm$ and returns to his home by which moves non-stop with a speed of $10ms^{-1}$. Calculate

(i) the time taken by man to reach his office and

(ii) time taken by man to reach his home. Also plot $x - t$ graph of his motion.

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9. A man wants to climb to the top of a vertical pole height $11m$. He climbs $5m$ in $2s$ and then slips $3m$ in $2s$. This process repeats. Plot $x - t$ graph of the motion of the man. Find the time taken by the man to reach the top of the pole and total distance covered by man.

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10. A car (A) is moving at $60kmh^{-1}$ on a straight road, is ahead of car (B) moving in the same direction at $10ms^{-1}$. Find the velocity of (A) relative to (B) and vice versa.

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11. Two railway trailway trachs are parallel to west-east direction. Along one track, train (A) moves with a speed of $30ms^{-1}$ from west to east, wile along the second track, train (B) moves with a speed of $48ms^{-1}$ Form east to west. Calculate

(i) relative speed of `B w.r.t. (A) and (ii) relative speed of ground w.r.t. (B).

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12. Two parallel rail tracks run north-south Train A moves north with a speed of $54kmh^{-1}$ and train B moves south with a speed of $90kmh^{-1}$.

What is the

a. relative velocity of B with respect to A?

b. relative of a monkey running on the roof of the train A against its motion (with its velocity of $18 kmh^{1}$ with respect to the train A) as observed by a man standing on the ground?

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13. A jet plane is flying horizontally with a velocity $600 kmh^{-1}$. The burnt gases are injecting from the rear of the get plane with the velocity $2000 kmh^{-1}$. With respect to the jet plane. Find the velocity of burnt gases with respect to a person on the ground.

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14. A motor boat covers the distance between the two sport on the river in $9h$ and $13h$ down stream and upstream respectively. Find the time required by the boat to cover this distance in still water.

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15. Four particles A, B, C and D are situated at the cornerst of a square $ABCD$ of side $aatt$ - 0. Each of particles moves with constant speed (v). A always has its velocity along AB, B along BC, C along $CB\sim$ and D along DA. At what time will these particles meet each other ?

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16. An insect crect crawling up a wall crawls $6cm$ upwards in the first minute but the slides $4cm$downwards in the next minute. If again crawls up $6cm$ upwards in the third minute but again slides $4cm$ downwards in the forth minute. How long will the insect take to reach a crevice in the wall at a height of $22cm$ from a starting point ?`

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17. A long belt is moving horizontally with a speed of $5kmh^{-1}$. A child runs on this belt to and fro with a speed of $9km/h$ (w.r.t. bett) between his father and mother located $50m$ apart on the belt. For an observer on a stationalry plateform outsied, what is the

(a) speed of the chils runningin the derection of motion of the belt, (b) speed of thechaild runing opposite to thedirection of the belt, and (c) time taken by the child in cases (a) and (b) ? Which of theanswers change, if motion is viewed by one of the parents ?gt

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2 SolvedExamples

1. A car moving along a straight highway with a speed of $72kmh^{-1}$ is brought to a stop within the distance of $100m$. What is the retardation of the car and how long does it take for the car to stop ?

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2. A body covers $10m$ in 4 second and $15m$ in 16 second of its uniformly accelerated motion. How far will it travel in the next 3 seconds?

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3. A ball is thrown vertically upwards with a velcotiy of $20ms^{-1}$ from the top of a multi-storey building. The height of the point fromwher the ball is thrown if 25-0m from the ground. (a) How high the ball will rise ? And (b) how long will it be before the ball hits the ground ? Take. $g = 10ms^{-2}$.

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4. A driver of car takes $-20s$ (which is the reaction time of dricer) to apply the brkes after he sees an obstruction at a distance of $25m$ from him . If he is driving car at a speed of $54kmh^{-1}$ and the brakes cause a deceleration of `6.0 km h^(-2), predict whether he will avert collistion or not.

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5. On a foggy day, the two cars are approaching each other on a straight road, with speeds $72kmh^{-10}$ and $54kmh^{-1}$. The drivers of the cars spot other when they were 60 meres apart. Both of them applied brakes, retarding their cars at of $6ms^{-1}$. Predict whether they will avert collision or not.

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6. A body travels a distance of $2m$ in 2 seconds and $2.2m$ next $4seconds$. What will be the velocity of the body at the end of 7 the second from the start?

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7. A motor car starts from rest and accelerates uniformly for $10s$ to a velocity of $30ms^{-1}$. It then runs at a constant speed and is finally brought

to distance covered is $830m$. Find the value of acceleration, retardation and total time taken.

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8. A man $16m$ behind the door of a train when it starts it starts moving with an acceleration $a = 2ms^{-1}$.The man runs with a msximum constant speed to get into the train. How for does he have to run and after what time does he get the train ? What is his maximum constant speed ?

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9. Two buses A and B are at positions $60m$ 160 mothe or $ig \in attime$t=0 $. They \star tmov \in g \in thesamedirectionsi\mu < a \neq ouslywithun$ if or $mspeed$ 54 km h^(-1) and 36 km h^(-). Derermine the time and positiona t which $AovertakenB.$

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10. Prove that the distances traversed during equal intervals of time by a body falling from rest, stand to one another in the same fatio as the odd mumbers beginning with unity [namely 1: 3: 5: ....].

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11. Form the top of a tower $100m$ in height a ball is dropped and at the same time another ball is projected vertically upwards from the ground with a velcoity of $25ms^{-1}$. Find when and where the two balls will meet.

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12. A tennis ball is dropped on to the floor from a height of $4.00m$. It rebounds to a height of $3.00m$. If the ball was in contact with the floor for $0.010\sec$, what was its average acceleration during contact?

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13. A parrachutist bails out from an aeropane and after dropping through a distance of $40m$ opens the parachute and decelerates at $2ms^{-2}$. If he reaches the ground with a speed of $2ms^{-1}$, how lowg he in the air ? At what height did he bail out from the plane ?

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14. A body is dropped from rest at a height of $150m$ and simultanceously, another body is dropped from rest from a point $100m$ above the ground. What is the difference between heights after theymave fallen for (i) $3s(ii)5s$. Consider that the body on reaching fround remains there and acceleration due to gravity be $10m/s^2$.

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15. A balloon starts rising from the ground with an acceleration $2ms^{-2}$. After

$5second, as \rightarrow \ne isre \le asedomtheball\infty on. F \in dthetimetakenbythes \rightarrow \ne \rightarrow$

$5\sec ond, as \rightarrow \ne isre \le asedomtheball\infty on. F \in dthetimetakenbythes$
$\ne reachestheground. Take$

g==10 ms^(-2)`.

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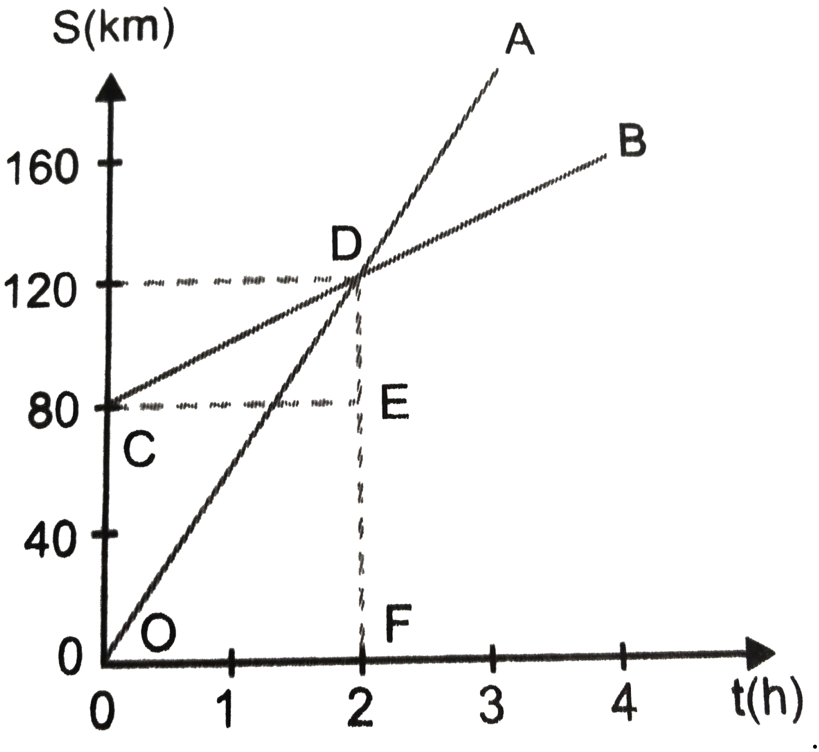
16. Fig. 2 (b). 12` shows thae distance (S) -time (t) graphs of two trains, which start moving simultaneously in the same direetion. From the graphs, find:



(a) How much (B) is ahead of (A) when motion starts

(b) What is the speed of (B) ?

(c) What and where (A) will catch (B) ? `

(d) What is the differnce in speeds of (A) and (B) ? lt

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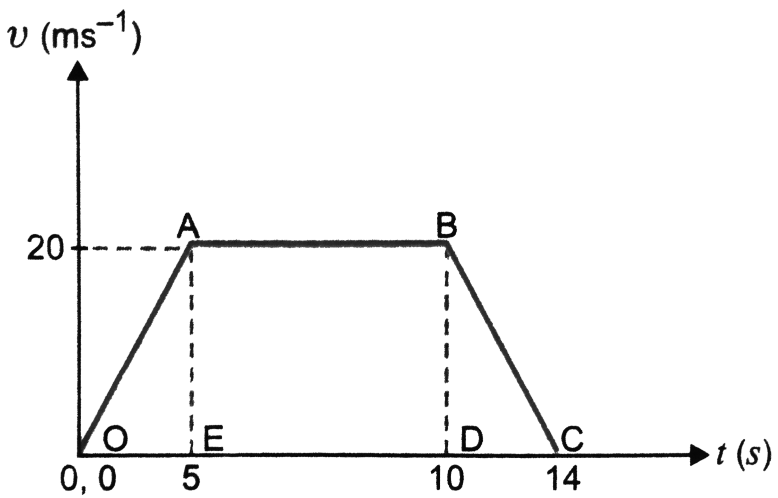
17. Velocity (v) time (t) graph of a car starting from rest is shown in Fig. 2(b). 13. Draw acceleration (a) -time (t) graph for the motion of the car and find total distance travelled by car.



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18. A body starting from rest acclerates uniformly along a st. line , at the rate of $10ms^{-2}$ for 5 s. $Itmovesf$ or 2 $swithun$ if or $mvelocotyof$50 ms^(-1) . $Theitr\eta rdsun$ if or mly and $comes \rightarrow rest \in 3s.$ Draw velocity-time graph of the and find the total distance travelled by body.

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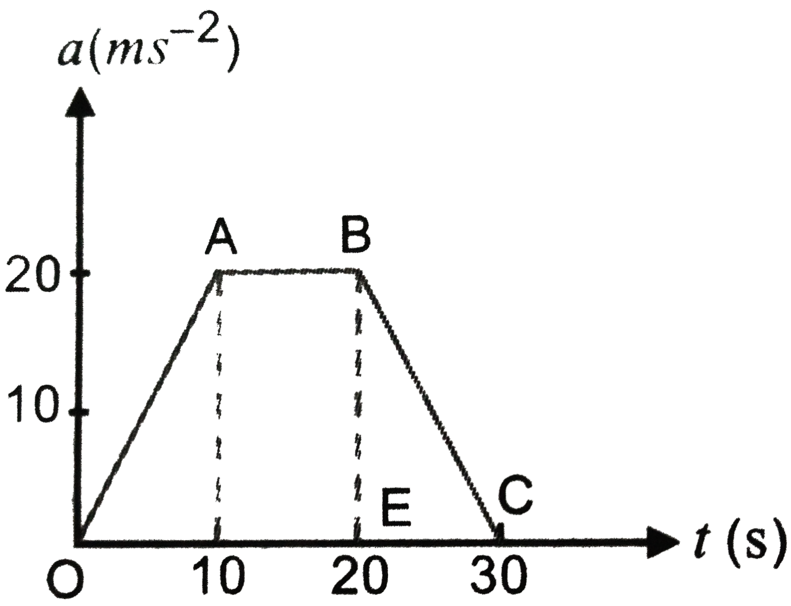
19. Fig. 2 (b) .16 shows the time-acceleration graph for a particle in rectillinear motion. Find the averate acceleration in first twenty seconds.



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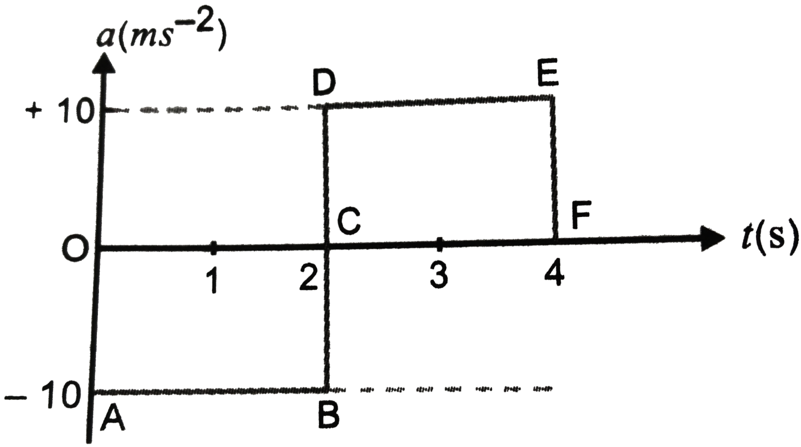
20. A particle starts from rest at time $t = 0$ and moves on a straight line with acceleration a (ms^-2) as plotted in Fig. 2 (b) .17. Find the time at which the speed og the particle is maximum. Also calculate the displacement of theparticle from starting point after $4s$.



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21. A ball is thrown upward with an initial velocity of $80ms^{-1}$. After how much time will it return to ground ? Draw velocity-time graph for the ball and find from the graph

(a) the maximum height attained by ball and

(b) height of the ball after $12s$. Take $g = 10ms^{-2}$.

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22. The distance travelled by a particle moving along a st. line is given by $x = 4t + 5t^2 + 6^3$ mette.

Find (i) the initial velcity of the particle (ii) the velcoty at the end of $4s$ and (iii) the acceleration of the particle at the end of `5 second.

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23. The velocity of a particle is given by $v = u_0 + gt + \frac{1}{2}at^2$. If its position is $x = 0$ at $t = 0$, then what is its displacement after $t = 1s$?

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24. The position of an object moving along x-axis is given by $x = a + bt^2$ where $a = 8.5m$, $b = 2.5ms^{-2}$ and t is measured in seconds. What is its velocity at $t = 0s$ and $t = 2.0s$. What is the average velocity between $t = 2.0s$ and $t = 4.0s$?

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25. The distance (x) particle moving in one dismension, under the action of a constant force is related to time (t) by equation $t\sqrt{x} + 3$ where (x) is in vettres and (t) in seconds. Find the displacement of the particle when its velcity is zero.

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26. An object , moving with a speed of $6.25m/s$, is decelerated at a rate given by :

$\frac{dv}{dt} = -2.5\sqrt{v}$ where v is the instantaneous speed . The time taken by the object , to come to rest , would be :

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27. A bird flies for $4s$ with a velcoty `v=t (-2) ms^(-1) in a stralght line. Calculate the displacement of the bird ans distance travelled by the bird.

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28. A particle is moving in a straight line with constant acceleration. If x,y and z be the distances described by a particle during the pth, qth and rth second respectively, prove that

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29. A juggler throws ball into air. He throus one whenever the previus one is at its highest point. How high do the balls rise if he throus (n) balls each second. Acceleration the to gravity=g`.

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

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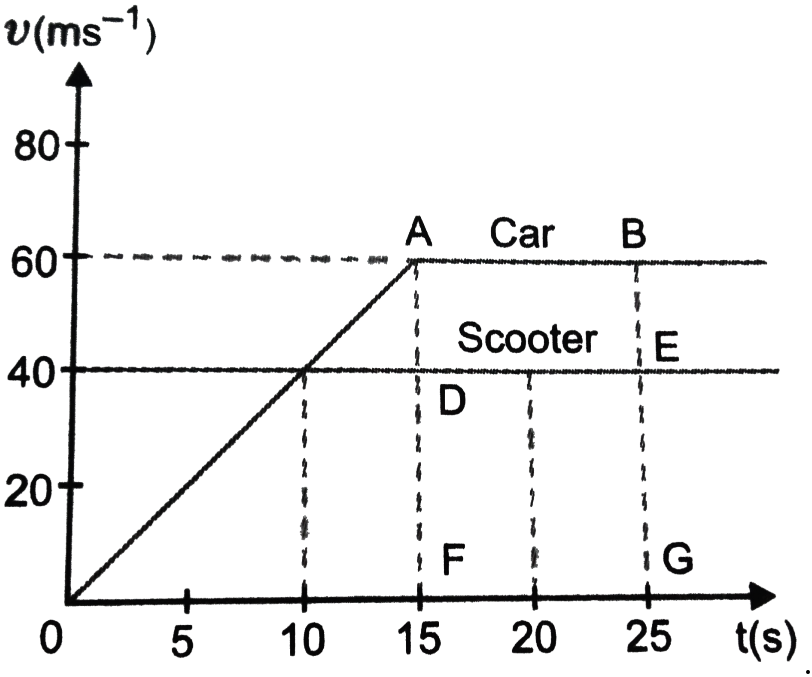
31. As soon as a car starts from rest in a certain dirction, a scooter moving with a uniform speed overtakes the car. Their velcity-time graphs are shown in Fig. 2 (b) .19. $Calcutate(a)thed \Leftrightarrow erencebetweenthedistancestravel \leq dbythecar$ and $thesc\infty ter$

25 s`.

(b) the time when car will catch up the secooter.

(c) the distance of the car and scooter from the starting point at the meeting point.



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3 SolvedExamples

1. Calculate the angle between$20N$ force and a $30N$ force so thea ther resultant is $40N$.

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2. In an open ground, a motorist follows a track that turns to his left by an angle 60^0 after every $200m$. Starting from a given turn, covered at the ceons, and the total path turn.

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3. A man walks $10m$ towards east and then turns at an angle of 30^0 to the north of east and walks 10 m`. Calculate the net displacement of the man. Also find the direction of net displacement.

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4. A motor boat is racing towards North at $25km/h$ and the water current in that region is $10km/h$ in the direction of 60^{00} East of South. Find the resultant velocity of the boat.

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5. Tow forces F and $2F$ newton act on a paricle. If the first force be doubled and the secon force be increased by $20N$, the direction of resultant is unaltered. Find the value of bigger force.

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6. The greatest and least resultant of two forces acting at a point is $10N$ and $6N$,respectively. If each force is increased by $3N$, find the resultant of new forces when acting at a point at an angle of 90° with each other .

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7. Two forces whose magnitudes are in the ratio $3:5$ give a resultant of 28N. If the angle of their inclination is 60°, find the magnitude of each force.

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8. Tow forces acting on a paritcle in opposite directions have a resultant $1N$. If they act at right angle to each other, the resultant is $5N$. Find the values of two forces.

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9. The greatest and least resulatant of two forces acting at a point are $25N$, and $5N$ respectively. If each force is incresasd by $5N$, find the resultant of two new forces acting at right angles to other.

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10. The sum of the magnitudes of two forces acting at a point is 18 and the magnitude of their resultant is 12. If the resultant is at 90° with the force of smaller magnitude, What are the magnitudes of forces?

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11. A person rows a boat in a water with a speed of $4ms^{-1}$. Water in the river is flowing with a speed of $2ms^{-1}$. If the person rows the boat perpendiculat to thedirection of flow, find resultant velcity of the boat and time taken by boat to cross the river if widthe of the river is $400m$.

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12. A man can swim at the rate of $5kmh^{-1}$ in still water A. One km wide river flows at the rate of $3kmh^{-1}$. The man wishes to swim across the river directly opposite to the starting point. How much time will be take to cross the river

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13. A river $600m$ wide wide flows at the rate of `8 km h^(-1). Still water, wishes to cross the river straight (i) Along what direction must be strike ? What will be his resultant velcity ? (ii) How much time he will take to cross the river ?

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14. Derermine the horizontal force required to displace a mass of $0.03kg$ suspended by a string until the string makes an angle 30^0 with the vertical.

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15. The position of of a particle is given by $\vec{r} = 3.0t\hat{I} + 2.0t^2\hat{j} + 5.0\hat{k}$ wher (t) in seconds and the coefficients mave the proper units for ver to ber in metres. Find the velocity and acceleration of the particle in magnitude and direction at time $t = 3.0s$

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16. Rain is falling vertically with a speed fo $35ms^{-1}$. Winds starts blowing after sometime with the speeds of $12ms^{-1}$ in east to west direction. At what angles with the vertical should a boy waiting at a bus stop hold his umbrella to protect himself from rain?

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17. A car travelling at a speed of $30ms^{-1}$ due north along the highway makes a left turn on to a sied road which heads towards due west. It takes $40s$ for the car to complere the turn. At the end of $40s$, the caar has a speed of $20ms^{-1}$ along the side road. Derermime the magnitude of average acceleration over the $40second$ interval.

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18. Rain is falling vertically with a speed fo $35ms^{-1}$. Winds starts blowing after sometime with the speeds of $12ms^{-1}$ in east to west direction. At what angles with the vertical should a boy waiting at a bus stop hold his umbrella to protect himself from rain?

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19. To a person going westwards with a speed of $6kmh^{-1}$, rain appears to fall vertically downwards with a speed of $8kmh^{-1}$. Find the actual speed of the rain and its direction.

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20. A train is moving due East and a car is moving due North, both with the same speed $30kmh^{-1}$. What is the observed speed and diredction of motion of car to the passsenger in the train ?

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21. A person standing on a road has to hold his umbrella at 60^{0} with the verticcal to keep the rain away. He throws the umbrella an starts running at $20ms^{-1}$. He finds that rain drops are hitting his head vertically. Find the speed of the rain drops wigh respect to (a) the road (b) the moving person.

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22. To a person going East in a car with a velocity of $50kmh^{-1}$, a bus appears to move towards North with a velcity and direction of motion of the bus ?

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23. A tran is moving with a velcoty $72kmh^{-1}$ in the Noth-East direction. If abither train is moving with a vleocity $54kmh^{-1}$ in the North-West direction, then what is the relative velcoity of the secons train w.r.t. the first train ?

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24. A force is inclened at 60° to the horizontal . If its horizontal coponent in the horizonal direction is $60N$ find themagitude of theforce and its vertical componet.

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25. A ball is acted upon by the following velocities. (i) $3ms^{-1}$ due East 9ii) $11ms^{-1}$ due South and (iii) $5\sqrt{2}ms^{-1}$ due North-East. Find the magnitude and direction recultant velocity.

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26. What is the distance travelled by a point during the time $oita$ if it moves in $X - Y1plance, a$ or $d \in g \rightarrow therelation$x= a sin omega t and $y = a(1 - \cos\omega t)$?

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27. Give $vrcA = 2jati - \hat{j} + 3\hat{k}$ and vec B =3 hat I -2 hat j -2 hat k $. F \in dtheunit \rightarrow rof(i)\left(\vec{A} + \vec{B}\right)$.

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28. A vector $\vec{C}$ when added to the resultant of the vectors $\vec{A} = 3\hat{i} - 4\hat{j} + 5\hat{k}$ and vec B = 2 vec 2 hat I + 3 hat j -4 hat k $givesaunit \vec{\rightarrow} ralongy - a\xi s. F \in dthemagnitudeof$vec C`.

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29. If $\vec{A} = 3\hat{I} + 4\hat{j}$ and $\vec{B} = 7\hat{I} + 14\hat{j}$, find a vector having the some magnitude as $\vec{A}$ and parallel to $\vec{B}$.

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30. If the magniude of two vectors are $6N$ and 3 N and $magnitudeoftheirdit \prod uctis$9 N` theb find the angle between the two vectors.

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31. For what value of (m), the vector $\vec{A} = 2\hat{I} + 3\hat{j} - 6\hat{j}$ is perpendicular to $\vec{B} = 3\hat{i} - m\hat{j} + 6\hat{k}$?

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32. If $\vec{A} = 4\hat{I} + 6\hat{j} - 3\hat{k}$ and $\vec{B} = -2\hat{I} - 5\hat{j} + 7\hat{k}$, find the angle between $\vec{A}$ and $\vec{B}$.

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33. Find the component of a vector $\vec{A} = 3\hat{I} + 4\hat{j}$ along the direction of $2\hat{I} - 3\hat{j}$.

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34. If vectors $\vec{A}$, $\overrightarrow{}$ B and $\vec{C}$have magnitudes $5, 12$ and $13 units$ and vec A + vec B =vec C, $f \in dthe \angle between$ vec B and vec C\`.

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35. If $\vec{A} + \vec{B} = 3\hat{I} + 6\hat{j} + 2\hat{k}$ and vec A - vec B = 6 hat I + 3 hat j - hat k $. F \in dthemagnitudeof$ vec A and vec B $\text{ and } theirscalar \prod uct$vec A . Vec B`.

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36. Unit vector $\hat{P}$ and $\hat{Q}$ are inclined at an angle θ. Prove that $\left|\hat{P} - \hat{Q}\right| = 2\sin(\theta/2)$.

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37. Find the angle between force $\vec{F} = \left(3\hat{I} + 4\hat{j} - 5\hat{k}\right)$ and displacement $\vec{d} = \left(5\hat{I} + 4\hat{j} + 3\hat{k}\right)$ unit. Also find the projection of $\vec{F}$ and $\vec{d}$.

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38. Find the scalr and vector products of two vectors $\vec{a} = \left(3\hat{I} - 4\hat{j} + 5\hat{k}\right)$ and vec b = (-2 hat I + hat j- 3 hat k).

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39. Show that vectors

$\vec{A} = 2\hat{I} - 3\hat{j} - \hat{k}$ and vec vec B =- 6 hat I + 9 hat j + 3 hat k\` are paaralel.

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40. Calculate the area of a paralleleogram whose two adjacent sides are formed by the vectors

$\vec{A} = 3\hat{I} + 5\hat{j}$ and $\vec{B} = -3\hat{I} + 7\hat{j}$.

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41. The diagonals if a parallele-gram are representde by $\vec{d}_1 = 2\hat{I} + 3\hat{j} - 5\hat{k}$ and $\vec{d}_2 = 6\hat{I} + 5\hat{j} - 3\hat{k}$. Find the area of the parallelogram.

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42. Determine the sine of the angle between the vectors .

$2\hat{I} + 3\hat{j} - 4\hat{k}$ and (hat i-2 hat k).

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43. Determine a unit vector whoch is perpendicular to both

$\vec{A} = 2\hat{I} + \hat{j} + \hat{k}$

and $\vec{B} = \hat{I} - \hat{j} + 2\hat{k}$.

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44. The edges of a parallelopiped are geven by the vectors $\left(2\hat{I} + 3\hat{j} + 4\hat{k}\right)$, $4\hat{j}$ and (5 hat j + mhat k). What shold be the value of m in order that the volume of the paralelopiped be 24`,

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45. A paarticle starts from origin at $t = 0$ with a vction 5.0 hat I m//s and $moves \in x - y$ plane under action of a force which produces a constant acceleration of $\left(3.0\hat{I} + 2.0htj\right)m/s^2$.

(a) What is the y-cordinate of the particle at the instant its x-coordinate id `84 m ? (b) What is the speed of the particle at this time?

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46. If $\vec{A} = \hat{I} + 2\hat{j} - 3\hat{k}$,

vec B =2 hat I -hat j + hat k and vec Chat I -3 hat j + 2 hat k, $thenf \in d$ vec A xx (vec B xx vec C).

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4 SolvedExamples

1. Two tall buildings face each other and are at a distance of $180m$ from wach other. With what velocity must a ball be thrown borixontall y from a window $55m$ above the fround in one building, so that it enters a window $10.9m$ above the ground in second window . $g = 9.8m/s^{-2}$

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2. A hiker stands on the edge of horizontally with an initial speed if $15ms^{-1}$. Negkectubg aur resustabce, find the time taken by the stone to reach the ground, and the speed with which it hits the ground. Take $g = 9.8m/s^2$.

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3. A body is projected horizontally from the top of a cliff with a velcoityof $19.6ms^{-1}$. What time elapses before horizontal and vertical velocities become equal.

*Take*g=9.8 ms^(-2)`.

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4. A ball is projected horizontallu from a top of tower with a velocity of $10ms^{-1}$. Find the velocity of the ball after $0.5s$. *Take* g= 10 ms^(-2)`.

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5. A particle is fired horizontally with a velocity of $100ms^{-1}$ for the top of a hill $400m$ high. Find (i) the time taken to reach the ground (ii) thedistance of the target from the hill and (iii) the velocity with which the projectile hits the ground. Take $g = 10ms^{-2}$.

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6. A body is thrown horizontally from the top of a tower and strikes the ground after three seconds at an angle of 45° with the horizontal. Find the height of the tower and the speed with which the body was projected. (Take $g = 9.8m/s^2$)

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7. A fighter plane flying horizontally at an altitude of $1.5km$ with speed of $720kmh^9 - 10$ passes directlu overhead an anticraft gun. At what anle fro the gun with muzzle speed $400ms^{-1}$ to hit the plane in shortest time ?`

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8. Find the angle of projection at which horizontal range and maximum height are equal.

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9. A bullet fired at an angle of 30° with the horizontal hits the ground $3\sqrt{3}km$ away. Can wr hit a target at a distance of $6\sqrt{2}km$ by adjustion its angle of projection?

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10. How much hight above the ground a mancan throw a ball if he is able to throw the same ball upto maximum distance of `60 m?

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11. Calculate the horizontal distance travelled by a ball throw with a velcoity $20\sqrt{2}ms^{-1}$ without hitting the ceiling of an anditorium of heith $20m. Use$ g= 10 ms^(-2)`.

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12. One body is thrown at an angke θ with the horizontal and another similar body is thrown at an angle θ with the vertical direction from the same point with same velocity$40ms^{-1}$. The second body reaches 50 metrea higher than the first body. Deteramine their individual heights. Take $g = 10ms^{-2}$.

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13. A projectile has a range of $60m$ and reaches a maximuum height of $12m$. Calculate the angle at which the projectile is fired and initial velcity of projection of projectile. Given $g = 10ms^{-2}$.

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14. A ball is kiched at an angle 30° with the verical. If the horizontal componet of its velocity is $20ms^{-1}$, find the maximum hight and hrizontal range. Use $= 10ms^{-2}$.

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15. A cricket ball is thrown at a speed of $28ms^{-1}$ in a direction 30° above the horizontal. Calculate (a)the maximum height (b) the time taken by ball to return ti the same level, and (c)the distance from the thrower to the point wher the ball restance from the throwrt to the point where the ball returns to the same level.

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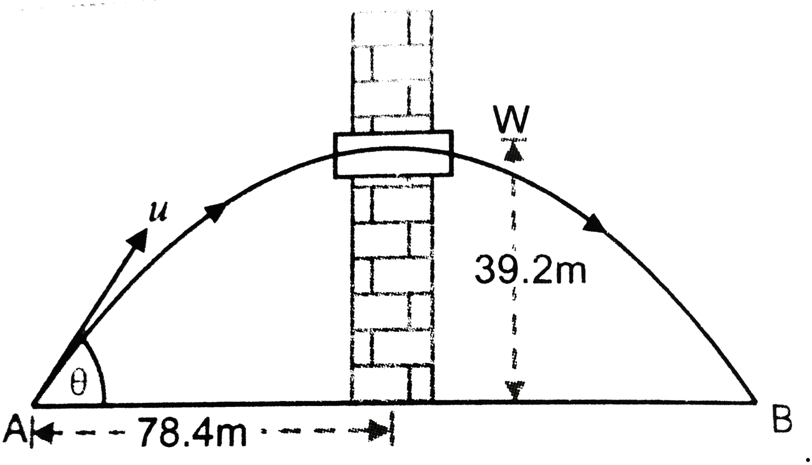
16. A body stans at $78.4m$ from a building and throws a ball which just enters a window $39.2m$ above the ground. Calculate the velocity of projection of the ball. Fig. 2 (d) . 22.



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17. From a pint on the ground at a distance $15m$ from the foot of a vertical wall, a ball is thrown at an angle of 45° which just clears the top of the wall and afterwards strikes the ground at a distance $5m$ on the other side. Find the height of the wall.

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18. At what angle should a body be projected with a velocity $20ms^{-1}$ just to pass over the obstacle $12m$ high at a horizontal distance of $24m$? Take $g = 10^{-2}\big)$.

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19. A body is projected with a veocity of $40ms^{-1}$. After $2s$ it fcrosses a vertical pole of height $20.4m$ Find the angle of projection and horizontal range of projectile. (g = 9.8 ms^(-2)`.

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20. A hunter aims his fun and fires a bullet directly at a monkey on a tree. At the instant the bullet leaves the gun, the monkey drops. The bullet

A. cannot hit the monkey

B. may hit the monkey if its weight is more than $30kg$

C. may hit the monkey if its weight is less than $30kg$

D. hits the monkey irrespective of its weight

Answer: D

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21. The maximum height attain by a projectile is increased by 10% by increasing its speed of projection, without changing the angle of projection. What will the percentage increase in the horizontal range.

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22. For the top of a tower $156.8m$ high, a projectile is thrown up with a velcity of $39.2ms^{-1}$, makingan angle $30\%(\circ)$ with borizontal direction. Find the distance from the foot of tower wher it strikes the ground and the time taken byit do so.

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23. A machine gun is mounted on the top of a tower $60m$ At what angle showld the gun be inclined to cver a vaximu range of firing on the groun below? The muzzle speed of the bullet is $90ms^{-1}$ take $g = 10ms^{1}$.

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24. An insect trapped in a circular groove of radius $12cm$ moves along the groove steadily and completes 7 revolutions in $100s$. (a) What is the angular speed , and the linear speed of the motion ? (b) Is the acceleration vector a constant vector ? What is its magnitude?

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25. Find the magnitude of the centripetal acceleration of a particle on the tip of a blade, 0.30 metre in diameter, rotating at 1200 revolution per minute.

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26. The rakius of theearths or $hitaroundthesun$1.5 xx 10 ^(11) m . $Calc\underline{a}tetheang\underline{a}rvelcity$ and $l \in earvelcoityoftheearth. Throughhow\mu ch\angle doesthe$

2 days`, ?

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27. A body of mass $2kg$ revolves in a circle of diameter $40cm$, making 12 0` revolutions per minute. Calculate its linera velcity and centripetal avveleration.

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28. Calculate the magnitude of linear acceleration of a particle moving in a circle of radius $0.5m$ at the instant when its angular velocity is $\frac{2}{5}rads^{-1}$ and its angular acceleration is $6rads^{-2}$.

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29. A pariicle is projected horizontally with a speed (u) from top of a plance inclined at anangle θ with the horizontal direction. How far from the point of projection will the particle strike the plane ?

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30. A football is kicked at a speed of $20m/s$ a projection angle of 45°. A receiver on the goal line 25 metres away in the direction to the kink runs the same instant to meet the ball. Befrom it hits the ground?

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31. A stone is thrown by a student from the bottom of a hill with a velocity $30ms^{-1}$ making an angle of 60° with the horizontal. If the slpe of the hill is 30° with the horizontal. Find the distance from the student to a point at which the stone fals on hill, use $g = 10ms^{-2}$.

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1 Conceptual Problems

1. Can an object be at rest as well as in motion at the same time ? Explain with illustration.

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2. State in the following cases, whether the motion is one, two or three dimensional motion is one, two or three dimesional motion: (a) a dite fluing onwindy day (b) a speeding car on a long straight high way (c) a carrom coin rebounding from the side if the board (d) a plane revolving around its star.

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1 Con ceptual Problems

1. An object is in unifrom motion along a straight line . What will be position-time graph for themotion of the object if

(a) $x_{0_{=}} + ve, v = + ve (b) x_0 = + ve, v = -ve (c)$ x_(0) =- ve, v= + ve and (d) both x_0 and v are negative ? The letters x_0 and v position of theobject at time $t = 0$ and $v representpositu ionoftheobjectattime$ t=0` and uniform velocity of theobject respectively.

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2. A drunkard man walking in a narrowlane takes (5) steps forward and 3 steps backward each stepe of (1) m ling, per second and os on. Determine how long the drunkard takes to fall in a pot $15m$ away from the start.

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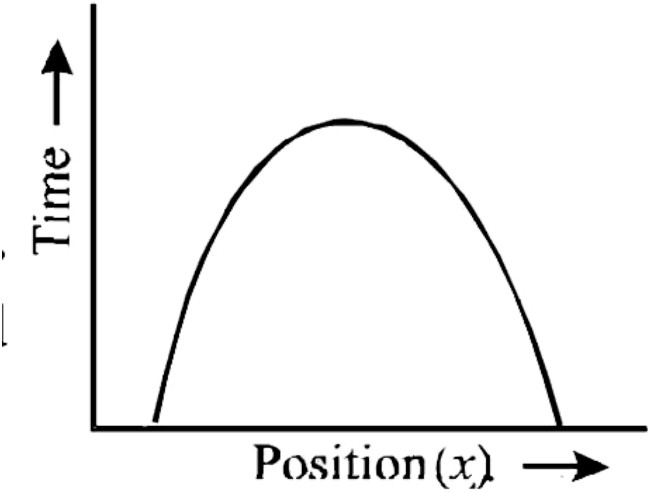
3. Answer the following giving reasons in brief :

Is the time variation of position , shown in the figure observed in nature ?



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4. A body covers one-therd of its jurney with spdd v_1, next onw=third with speed v_2 and last one-third with speed v_3. Calcuate the average dpeed of the during the entire journey.

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5. If the displacement of a body is zero is the distance covered by it necessarily zero ? Explain with suitable illustration.

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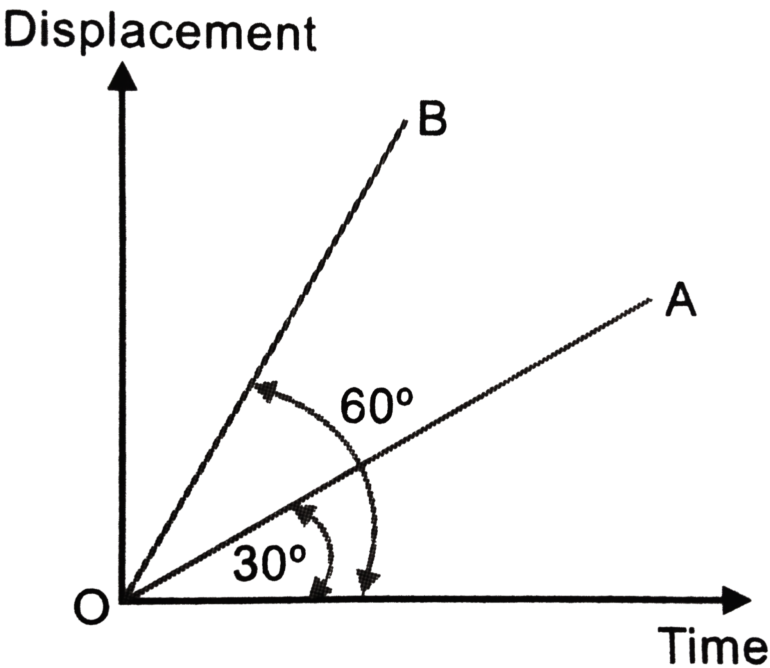
6. Two straight lines drawn on the same displacement-time graph make anles 30° and60° with time-axis respectiv ely Fig. 2 (a) .36, Which line repersents greater veloc ity ? What is the ratio of two velocities?



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7. Usually average speed means the rationof total distace travelled to the total time elapsed. However, sometimes thephrase ` average speed can vean the magnitude of the average velocity. Are the two same ? Discuss.

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8. A body covered a distance of l metre along a semicircular path. Calculate the magnitude of displacement of the body, and the ratio of distance to displacement.

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9. For ordinary terrestrial experiments, which of the observer below are inertial and which are non-inertical ? (a) a child revolving in a giant wheel. (b) driver in a sports car moving with a constant high speed of $200 km/h$ on a straight road. (c) the pilot of an aeroplane which is taking off. (d) a cyclist train which is slowing sown to stop at a station.

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10. A person goes to post-offce slowly and purchases post rards. Then he comes back steadily. Draw the time-velocity an time-displacement graphs for the person.

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11. Draw position-time graphs for two objects having zero relative velocity.

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12. A car travelling with a velcity of $60kmh^{-1}$ on a straight road is ahead of a motor cycle travelling with a speed of $76kmh^{-1}$. How would the relative velcity be alterd if motor cucle is ahead of car?

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13. When a person is standing on earth, the treesand houses appera stationary to mim. However, when he is sitting in a running train all these obects appear to move in bakward direction. Why?

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14. Wind is blowing west to east along twoparallelracs. Two trais moving with the same speed in opposite directions on these tracks have the steam tracks. If one stream track isdouble than the other, what is the speed of each train ?

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2 Con ceptual Problems

1. The direction in which an obect moves is given by thedirection of velocity of the object and bot by the direction of acceleration. Explain this staement with suitable exmple.

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2. From top of a huilding a ball is dropped while another is frpjected horizontally at the same tme . (a) Which ball will strike the ground first ? (b) Which ball will strike the ground with more speed.

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3. A body travels along a straight line with uniform acceleration a_1 for time t_1 and with uniform acceleration a_2 for time t_2 for time t_2. What is the average acceleration?

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4. The driver of a train moving at a speed v_1 sights another train at a disane d, ahead of him moving in the same direction with a shower speed

v_2. He applies the brakes and gives a constant teradation a to his train. Show that here will be no collision if $d > (v_1 - v_2)^2 / 2a$.

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5. Two ends of a train moving with a constant acceleration pass a certain point with velcities u and v. Show that the velocity with which the middle point of the train passes the same point is `sqrt(9u"^(2) +v^(2)//2).

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6. A passenger is standing d metres away from a bus. The bus begins to move eith constat acceleration `a. To catch the bus the passenger runs at a constant speed (v) towards the bus, What must so that he may catch the bus.

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7. In a car race, A takes a time of t s, less than car B at the finish and passes the finishing point with a velocity v more than car B. Assuming that the cars start from rest and travel with constant accelerations a_1 and a_2. Respectively, show that $v = \sqrt{a_1 a_2} t$.

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8. How is the position-time graph of uniformly accelerated motion id one dimension helpful in studying the motion of the object ?

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9. How is thevlocity-time graph of uniformly accelerated motion helpful in studying the motion of the object in one dimension?

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10. An object has a uniformly acclerated motion. The object always slows down before the time, when its velcity becomes zero. Establish this statement graphiclly when (i) both initial veocity (u) and acceleration (a) are positive(iii) 9u) is positive and (a) is begative and (iv) both (u) and (a) are negativ e.

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11. A ball is dropped vertically from a height d above the ground . It hits the ground and bounces up vertically to a height $(d)/(2)$. $Neg \leq ct \in g \subset sequentmotion$ and $airresis\tan ce, itsvelocity$v $varieswiththeheight$h` above the ground as

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12. Two boys are standing at the ends A and B of a ground, where $AB = a$. The boy at B starts running in a direction perpendicular to AB with velocity v_1. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t, where t is :

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13. If the initial velocity of aparticle is (u) collinera acceleration at any time (t) is at, calculate the velocity of the paraticle after time (t).

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14. The dirver of a car travelling at a velcituy (v) suddenly sees a broad wall in front of mim at a distance r. Is it better to brake or to turn sharply ?`

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15. The acceleration. If v_0 is themagnitude the engine is cut off, is given by $\frac{dv}{dt} = -kv^2$, wher (k) is a constant. If v_0 is the magnitude of the velocity at cut off, find the magnitude of the velocity at time (t0 after the cut off.

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3 Con ceptual Problems

1. Can two equal vects $\vec{a}$ and $\vec{b}$ at different locations in space necessarilly have identical physical effects ?

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2. Can three vectors not in one phane giv e a zero resultant ? Can four vectors do ?

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3. What is the magniude and direction of $\left(\hat{I}+\hat{j}\right)$?

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4. We can order events in time and ther is a sende of time, distinguishing past, present and future. Is therfore, time a vector ?

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5. What is the efferct on the magniude of the resultant of two vectors when the anle θ between them is increased from $0^\circ \rightarrow 180^\circ$?

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6. Is $\left|\vec{A}+\vec{B}\right|$ greater than or less than $\left|\vec{A}\right|+\left|\vec{B}\right|$? Explain.

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7. Is $\left|\vec{A}-\vec{B}\right|$ greater than or less than $\left|\vec{A}\right|+\left|\vec{B}\right|$? Explain.

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8. Two vectors $\vec{a}$ and $\vec{b}$ are such that $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$. What is the angle between $\vec{a}$ and $\vec{b}$?

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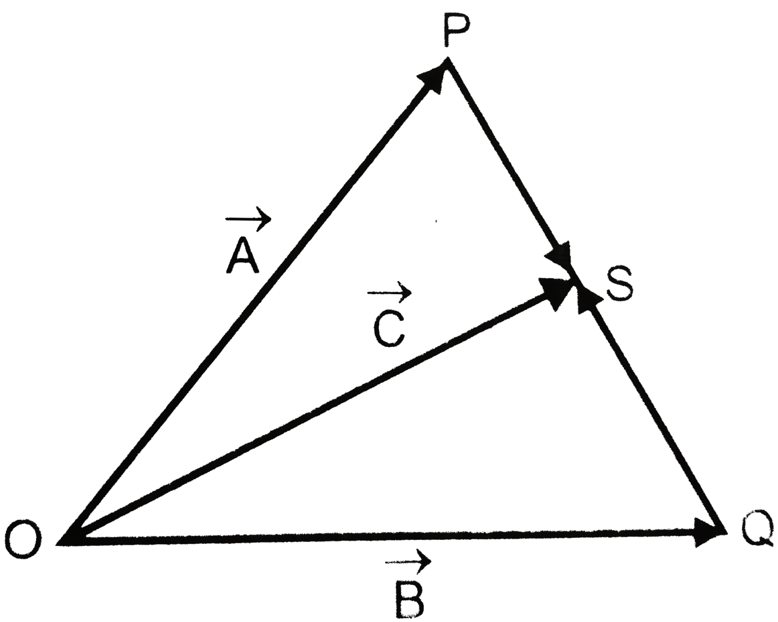
9. The three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ are repesented in magnitude and direction by $\overrightarrow{OP}, \overrightarrow{OQ},$ show that (S) is the mid point of ` (PQ).



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10. Show that the displacement vector does not depend upon the choece of the coordinate axes.

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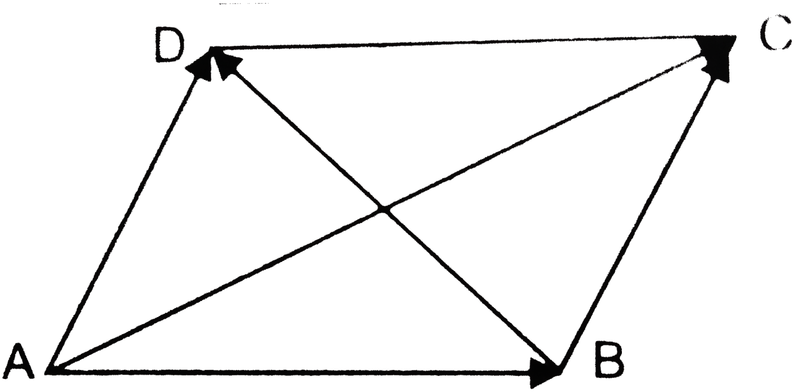
11. $ABCD$ is a parallelogram Fig. 2 (c) .64. AC and $(BD) are its diagonals. Show t$ (a) vec (AC) +vec (BD) =2 vec (BC)(b)vec (AC) - vec (BD) =2 vec (AB)`



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12. The greatest resultant of two vectors $\vec{P}$ and $\vec{Q}$ is (n) times their least reast resultant. Fiven

$\left|\vec{P}\right| > \left|\vec{Q}\right|$. When θ is the angle between the two vectors, their resultant is half the sum of the two vectors. Show that,

$\cos\theta = -\left(n^2 + 2\right)/\left(nn^2 - 1\right).$

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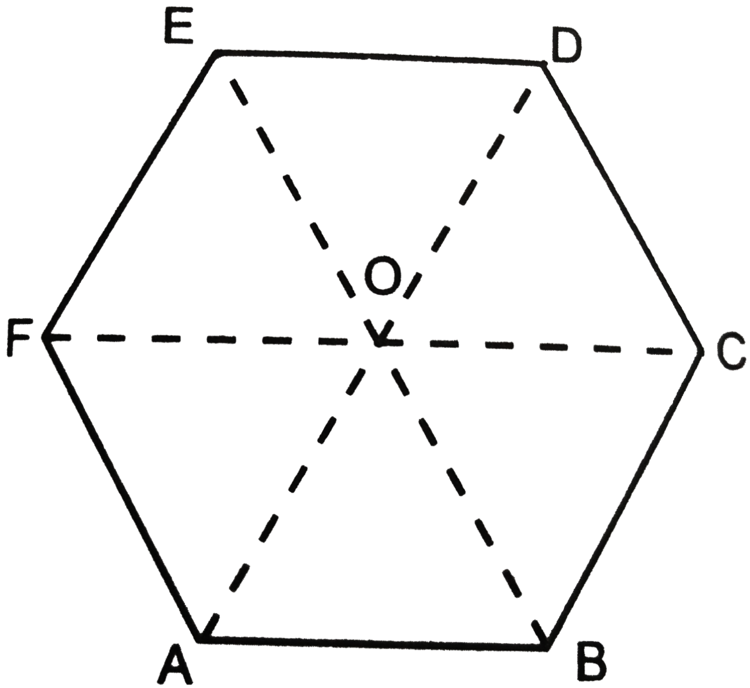
13. $ABCDEF$ is a regular hexagon, Fig. 2 (c) .65. What is the value of

$\left(\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF}?\right.$



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14. Can a rectangular component of a vector be greater than the vector itself ?

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15. Can a flight of a bird be an example of composition of vectors ?

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16. A room has dimensions `3 m xx 4 m xx5 m. A fly starting at one cronet ends up at the diametrically opposite corner. (a) What is the magnitude of its displacement ? (a) What is the magnitude of its displacement ? (b) If the fly wer to walk, what is the length of the shortest pothe it cantake ?

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17. A vecto $\vec{A}$ has magnitude 2 and another vector $\vec{B}$ has magnitude 3. They are perpendicular to each other. By vector diagram, find the magnitude of $\vec{A} + \vec{B}$ and dhow its direcction in the diagram.

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18. A man directly crosses a river in time t_1 and swims down the current a distance equal to the width of the river I time t_2. If u and v be the speed of the current and the man respectively, show that $t_1 : t_2 : : \sqrt{v+u} : \sqrt{v-u}\big)$.

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19. An aeroplane takes off at an angle or 30° to the horizontal. If the component of its velocity along the horizontal is $240 kmh^{-1}$. What is the actual velocity. ? Also find the vertical component of its velocity ?

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20. A plane is travlling eastward at a speed of $400 kmh^{)} - 1\big)$. Wind is blowing southward at a speed of $80 kmh^{-1}$ What is the direction of the place relative to the ground ?

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21. A weight mg is suspended from the middle of a rope whose ends are at the same level. The rope is no longer horizontal. Find the minimum tenstion required to completely straighten the rope.

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22. If $\vec{A}. \vec{B} = \vec{A}. \vec{C}$, is it correct to conclude that $\vec{B} = \vec{C}$?

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23. Three vector $\vec{A}$,$\vec{B}$, $\vec{C}$ satisfy the relation $\vec{A} \cdot \vec{B} = 0$and $\vec{A}. \vec{C} = 0$. The vector $\vec{A}$ is parallel to

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24. If $\vec{A} \times \vec{B} = \vec{A} \times \vec{C}$, is it correct to conclude that vec B =vec C` ?

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25. If $\vec{A} \times \vec{B} = \vec{C} \times \vec{B}$, show that $\vec{C}$ need not be equal to vec A`.

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26. If three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ are such that

$\vec{A}.\vec{B} = \vec{A}.\vec{C}, \vec{A} \times \vec{B} = \vec{A} \times \vec{C}$, vec A!= vec 0$then prove t^{\wedge}$ vec B =vec C`.

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27. In an ΔABC as showin in Fig. 2 . (2) .71 (a) prove

that $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{C}{\sin C}$.

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4 Conceptual Problems

1. A body slides down a smooth inclind placne when released form the tip, whille another body fall freely the same point . Which on will strike the ground earlier ?

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4 Con ceptual Problems

1. A stone drope from the window of a stationary bus takes 4 seconds to reach the ground. In what time the stone will reach the groun when the bus is moving with (a) constant velocity of 108 km h^(-1) $(b) constant a e \leq ration of$ 2 km h&(-2)`.

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2. When a rifle is fired at a distant target, the barrel is not lined up exactly on the target. Why ?

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3. A trains is moving on horizonatal rails with a uniform acceleration $a.A$ passsenger sitting in a boggie drops a stone inside the boggie. What will be the acceleration of stone (i) w.r.t. ground and (ii) w.r.t. the boggie ?

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4. A helicopter on a flood relief mission flying horizontally with a speed u at an altitude h, has to drop a food packet for a victim standing on the ground. At what distance form the victim should the food packet be dropped.

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5. A stone is dropped from the window of a stationary bus. It takes 4 seconds to reach the ground. In what time the stone will reach the ground when the bus is moving with (a) constant velcity of $72 kmh^{-1}$ (b) constant acceleration $4 kmh^{-1}$?

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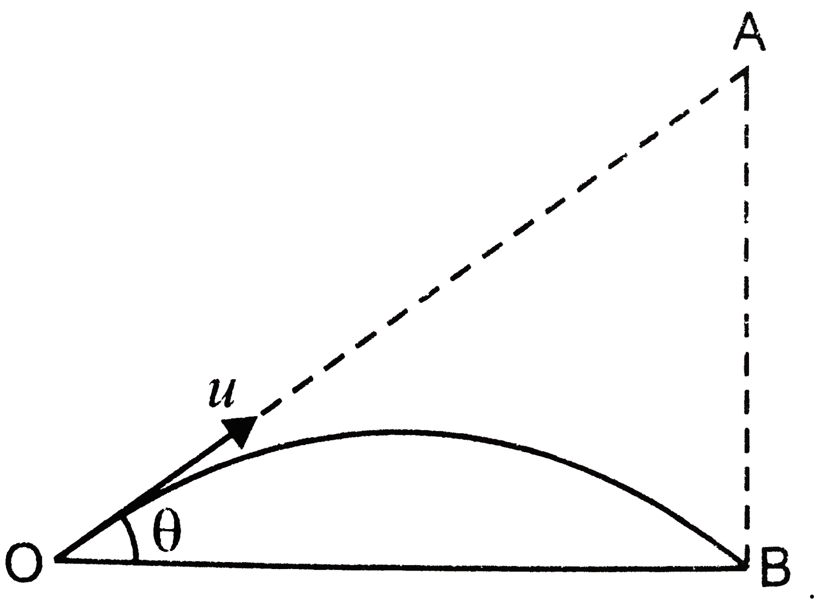
6. A projectile is fired at an angle θ with the horizontal direction from o Fig. 2 (d). 30. Neglection the air friction, it hits the grond at (B) after 3 seconds. What is the heith of point (A) from groun? [Use g=10 m//s^(2)]`



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7. In long jump, does it matter how height you jump ? What factors determine the span of the jump ?

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8. What are the two angles of projection of a projectile projected with velocity of $30m/s$, so that the horizontal range is $45m$. Take, $g = 10m/s^2$.

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9. Prove that the maximum horizontal range is four times the maximum height attained by the projectile, when fired at an inclination so as to have maximum horizontal range.

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10. Show that there are two values of time for which a projectile is at the same height. Also show mathematically that the sum of these two times is equal to the time of flight.

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11. If a projectile has a constant initial speed and angle of projection, find the relation between the chages in the horizontal range due to change in accelertion due to grvity.

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12. For given value of u, there are two angles of projection for which the horizontal range is the same. Show that the sum of the maximum heights for these two angles is independent of the angle of projection.

Watch Video Solution

13. A particle is projected with a velcity (u) so that its horizontal range isthrice the greatest heitht attained. What is its horizontal range?

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14. A bob hung from the ceileng of a room by a string is performing simple harmonic oscillations. What will be the trajectory of the bob, if the string is cut. When bob is (i) at one of its extreme positions (ii) at its mean position ?

Watch Video Solution

15. Show that the motion of one projectile as seen from another projectile will always be a straight line motion.

Watch Video Solution

16. A projectille can have the same range$R$ for two angles of projection. If t_1 and t_(2)$bethetimeofflight \in thetwocases, thenf \in dtherelationbetween$ t_(1), t_(2) and R\` .

Watch Video Solution

Watch Video Solution

17. Can a particle accelerate if its speed is constant ? Can it accelerate if its velocity is constant ? Explain.

Watch Video Solution

18. A stone tied at the end of string is whirled in a circle. If the string break, the stone flies away tangentially . Why ?

Watch Video Solution

19. Uniform circular motion is an acceleration motion. Comment.

Watch Video Solution

20. When a body is in a uniform circular motion, what will be its direction of linear velcity wht will be its direction of linear veoclity, angular velcity an daccleration at any instant.

Watch Video Solution

21. In a non-uniform circular motion, what is the direction of acceleration ? Discuss.

Watch Video Solution

22. Discuss whether or not , angular displacement is a vector quantity ?`

Watch Video Solution

1 Very short

1. Mention the condition when on object in motion (a) can be considered point object (b) cab bot considered point object.

Watch Video Solution

2. Can earth be regarde as a point object when it is describing its yearly journey around the sum ?`

Watch Video Solution

3. Can a body a constant speed an dstill have a varying velcity ?

Watch Video Solution

4. Can the speed of a body will be negative ?

Watch Video Solution

5. Which speed is measured by the speedometer of your scooter?

Watch Video Solution

6. Why is the speed in general, greater than the magniude of the velcity ?

Watch Video Solution

7. what does slope of prosition-time graph represeent for a unitorm motion?

Watch Video Solution

8. Can a prticle in one- dimensional motion have zero speed and a non-zero velocity ?

Watch Video Solution

9. What dies the tangent at apoint to the position-time graph for an object in non-uniform motion along a straight line represent?

Watch Video Solution

10. What will be bature of velocity-timegraph for a uniform motion?

Watch Video Solution

11. What will be nature of velocity-time graph for a uniform motion?

Watch Video Solution

12. If the displacement-time of a particle is parallel to (b) displacement axis (b) the time axis,

what will be the velcity of the particle ?

Watch Video Solution

13. The average velocity of a particles is equal to its displacement-time graph ?

Watch Video Solution

14. Can position-time graph have negative slope ?

Watch Video Solution

15. What do you understand by positive an dbegative time.

Watch Video Solution

16. Can a body have a constant velocity but a varying speed ?

Watch Video Solution

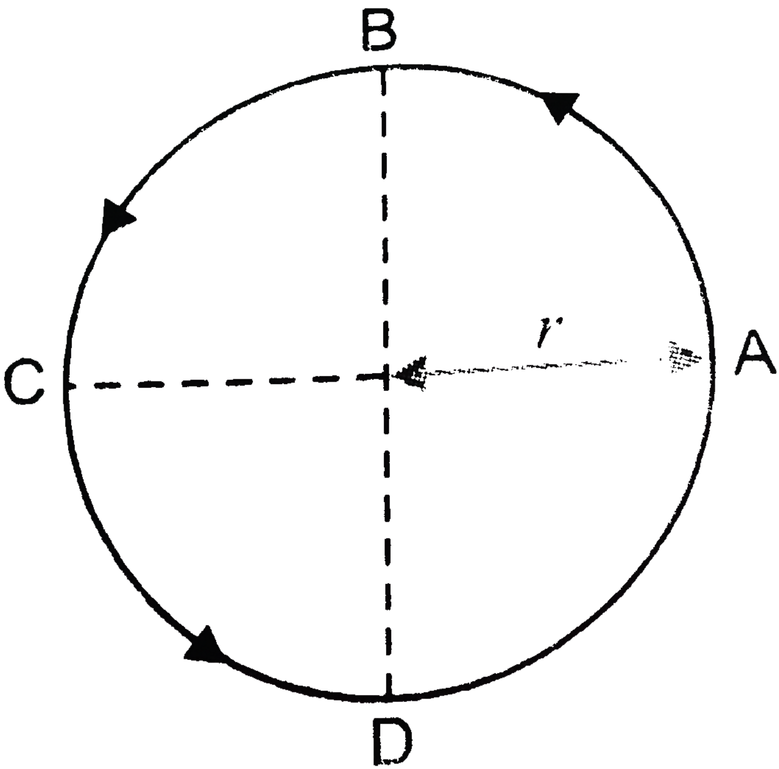
17. Under what condition is the average velocity equal to instantaneous velocity ?

Watch Video Solution

18. The body travels a distance s_1 with velcity v_1 and s_{92}) with velcity v_(2)` in the same directin. Calculate the average velocity of the body .

Watch Video Solution

19. A cyclist moves on a circular track form (A) to (D) in time (t) as shown in Fig. 2 (a). 41. What is the average speed an average velcity of the cyclist.



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20. Can the relative velcity ot two bodies be greater than the absolute velcity of either body.

Watch Video Solution

21. A train of $150m$ length is going toward north direction at a speed of $10ms^{-1}$. A parrot flies at a speed of $5ms^{-1}$ toward south direction parallel to the railway track. The time taken by the parrot to cross the train is equal to.

Watch Video Solution

22. A body wlaks to his school at a distance of $6km$ with constant speed of $2-5kmh^{-1}$ and walks bach with a constant speed of $4kmh^{-1} \sim W\hat{i}savn \geq speedf$ or $theroundtrip \in kmh^{-1}$?

Watch Video Solution

23. Though the rain is falling vrrtically down-wards, the fromt screen ot a moving car gers wet while the back screen remains dry. Whay ?

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2 Very short

1. Can the direction of velcity of a body change, when accleration is constant?

Watch Video Solution

2. Lift travels in straight line at a constant speed of $310^8 m/s$. What is the acceleration of lift ?

Watch Video Solution

3. A ball is thrown vertically upward. At the highest point of its pathe, what will be its (i) instantaneous velcity and (ii) instan-tanceous accekeratuib ? Conmment.

Watch Video Solution

4. Unit of time occurs twice in unit of acceleration. Why ?

Watch Video Solution

5. Is the acceleration of a car greater when when the accelerator is pushed to the floor or when brake is pushed hard ?

Watch Video Solution

6. Which of the two , velcity and acceleration, gives the direction of motion of the body . Explain it with the help of an illustration.

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7. Two balls of different masses (one lightre an other heavier) are thrown vertically upward with same initial speed. Which one will rise to greater height ?

Watch Video Solution

8. A stone is thrown vertically upwards from the velcity and accleration of the stone (a) on its way (b) on its way down.

Watch Video Solution

9. Is it possible to have a constantrate of change of velcity when velcity changes both in magniude and direction ?

Watch Video Solution

10. Is it possible that the brakes of a car are so perfect that the car stops instantaneously ?

Watch Video Solution

11. A player throwsa a ball upwards with an initial speed of $29.4ms^{-1}$.

(i) What is the direction of acceleration during the upwared motion of the ball?

(ii) What are the velocity and acceleration of the ball at the highest point of its motion?

(iii) Choose the x=0 and t=0 to be the location and time of the ball at its highest point, vertically downward direction to be the positive direction of X-axis, and give the signs of positive, velocity and acceleration of the ball during its upward, and downward motion.

(iv) To what height does the ball rise and after how long does the ball return to the player's hand?(Take $g = 9.8ms^{-2}$, and neglect air resistance).

Watch Video Solution

12. A trains is moving on borizonatal rails with a uniform acceleration $a. A$ passsenger sitting in a boffie drops a stone indide the boggie. What will be the acceleration of stone (i) w.r.t. boggie and (ii) w.r.t. the rails ?

Watch Video Solution

13. If the acceleration of the paarticle is constant in magnitude but not in direction, what type of path does the body follow ?

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14. How can the distance travelled by calculated from velcity-time graph in a unitor motion ?

Watch Video Solution

15. What is wrong with the speed time graph as shown in Fig.2 (b) .25.

Watch Video Solution

16. A ball is thowon vertically upwards. Draw its velcity-time curve.

Watch Video Solution

17. What does the area under acceleration-time graph for any interal of time represents when the accleration of the moving body is varing with time ?

Watch Video Solution

18. What does the slope of a speed-time graph indicate ?

Watch Video Solution

19. What is the nature of the displacement time curve of a body moving with constant acceleration ?

Watch Video Solution

20. What is the ration of the sistance travelled by constan a body falling freely from frest in the first, second , an dthird sconds of its fall.

Watch Video Solution

21. Can we use equations of kinematics to find the height attained by a body projected upwares with any velocity ?

Watch Video Solution

22. The displacement of a body is gives to be proporticonal to the cube of time elapsed. What is the nature of the acceleration of the body ?

Watch Video Solution

3 Very short

1. Give an example of a physical quantity (i) which has neither unit nor direction (ii) has a direction but both a vector (iii) can be either a vector or a scalar.

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2. Is dubruw eirRUIB cwxrie ?

Watch Video Solution

3. Consider a vector $\vec{F} = 4\hat{i} - 3\hat{j}$. Another vector that is perpendicular to $\vec{F}$ is

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4. Is poosseion of magnitude and direction sufficient for calling a quantity a vector ? Explain.

Watch Video Solution

5. State the most basic condition for the addition of vectors.

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6. Is pressure a vectror ? Explain.

Watch Video Solution

7. Vectors can not added algebraically. Why?

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8. Does it make a sense to call a physical quantity a vector, when its magnitude is zero ?

Watch Video Solution

9. Two equal vector have a resultant equal to either of them, then the angle between them will be:

Watch Video Solution

10. Are the magnitude and direction fo $\left(\vec{A} - \vec{B}\right)$.

same as that of $\left(\vec{A} - \vec{B}\right)$?

Watch Video Solution

11. Are the magnitude and direction fo $\left(\vec{A} - \vec{B}\right)$.

same as that of $\left(\vec{B} - \vec{A}\right)$?

Watch Video Solution

12. Can two vectors of different magitudes be combind to give zero resultant ?

Watch Video Solution

13. Give two necessary conditions for a given quantity to be a vector.

Watch Video Solution

14. What is the property of two vectorsx if.

$\vec{A} + \vec{B} = \vec{A} - \vec{B}$?

Watch Video Solution

15. Are the commutative law and associtive law applicable to vectors subtraction.

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16. If $\vec{A} = \vec{B} + \vec{C}$, and the magnitudes of $\vec{A}, \vec{B}, \vec{C}$ are 5,4, and 3 units, then the angle between $\vec{A}$ and $\vec{C}$ is

Watch Video Solution

17. Find the vector sum of N coplanar forces, each of the magnitude F ,when each force makes an angle of $2\pi/N$ with that preceding it.

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18. Is $\hat{i} - \hat{j}$ a unit vectror ? Exolain.

Watch Video Solution

19. Under what condition, the three vectors (i) cannot giv zero resultant (ii) can give zero resultant ?

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20. When is the sum of the two vectors maximum and when minumum ?

Watch Video Solution

21. Can the magnitude of the reultant vector of two given vectros be less than the magitude of any of the given vector ?

Watch Video Solution

22. Under what conditions the directions of sum and differnce of two vectros will be the same.

Watch Video Solution

23. What are minmum number or unequal fores whose vector sum is zero ?

Watch Video Solution

24. What are the minimum number of froces (all mumerically equal0 whose vector sun can be zero ?

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25. Can a rectangular component of a vector be greater than the vector itself ?

Watch Video Solution

26. A unti bvlurd og a and b are 0.6 and 0.8 respectively find the value od (c),

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27. A vector $\vec{A}$ is exparessed as $\vec{A} = A_x \hat{I} + A_y \hat{j}$ where $\vec{A}$ and $\vec{B}$ are its components along x-axis and y-axis respectively. If vector $\vec{A}$ makes an angle theat with x-axis, then theta is given by which expressinon ?

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28. What are the maximum muber of (i) rectangular component vectors (ii) componet vectrs, component vectors, into which a vector can ve resolved in a plane ?

Watch Video Solution

29. The magnitude of vectros vec A, vec B and $\vec{C}$ are 12, 5 and 13 units respectively and $\vec{A} + \vec{B} = \vec{C}$, find the angle between $\vec{A}$ and $\vec{B}$.

Watch Video Solution

30. Can a vector be multiplied with both dimensional and non-dimensional scalr ?

Watch Video Solution

31. If a vector is added or subtravted from a vector, the resultant is a vector . Is this also true in case of multiplication to two vectros ?

Watch Video Solution

32. What is the angle made by vector,

$\vec{A} = 2\hat{I} + 2\hat{j}$ with x-axis ?

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33. A boat is moving with a velocity $3\hat{i} + 4\hat{j}$ with respect to ground. The water in the river is moving with a velocity $-3\hat{i} - 4\hat{j}$ with respect to ground. The relative velocity of the boat with respect to water is.

Watch Video Solution

34. Rain is falling vertically with a speed of $10\sqrt{3}ms^{-1}$. A woman rides a bicycle with a speed of $10ms^{-1}$ in east to west direction. What is the derection in which she shold hold her umbrella to protect from rain ?

Watch Video Solution

35. If $\vec{A}, \vec{B}$ and $\vec{C}$ are non-zero vectors and $\vec{A}.\vec{B} = 0$ and $\vec{B}.\vec{C} = 0$, then find out the value $\vec{A}.\vec{B}$

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36. The sum and difference of two vectors are perpendicular to each other. Prove that the vectors are equal in magnitude.

Watch Video Solution

37. Can the scalar produt of two vectors be begative ?

Watch Video Solution

38. If $\vec{A}, \vec{B}$ and $\vec{C}$ are mutually perpendicular vectors, then find the value of $\vec{A}. \vec{B} + \vec{C}$.

Watch Video Solution

39. If $\vec{A} \times \vec{B} = \vec{C} \times \vec{B}$, show that $\vec{C}$ need not be equal to vec A`.

Watch Video Solution

40. What is the angle between (vec A+ vec B) and (vec A xx vec B) ?`

Watch Video Solution

41. Find the value of $\hat{I}.\left(\hat{j}\times\hat{k}\right)$.

Watch Video Solution

42. What is the angle between the v ectprs `(vec A xx vec B) and (vec Bxx vec A) ?

Watch Video Solution

43. show that $A=\left(\vec{A}.\vec{A}\right)^{1/2}$.

Watch Video Solution

44. If $\vec{A}.\vec{B} = \left|\vec{A} \times \vec{B}\right|, f \in dthevalueof \angle between$ vec A and vec B`.

Watch Video Solution

45. A vector $\vec{A}$ prints vertically upward and vec B $p \oint s \rightarrow wards. W\hat{i}sthedirectionof$ vec A xx vec b` ?

Watch Video Solution

46. What is the angle between $\vec{A}$ and $\vec{B}$, if $\vec{A}$ and $\vec{B}$ are the adjacent sides of a parallelogram drawn from a common point and the area of the parallelogram is $AB/2$?

Watch Video Solution

4 Very short

1. Is the rocket in flight is an illustration of projectile ?

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2. Why does a projectile fired along the horizontal not follow a straight line path ?

Watch Video Solution

3. Can there be a motion in two dimensions with an acceleration only in one direction?

Watch Video Solution

4. A body projected horizontallt moves with the same horizontal velocity throughout the motion although it is under the effect of forec of gravity. Why ?

Watch Video Solution

5. A body is thrown horizontally with a velocity (v) from a towr H metre high .After how much time and at what distance from the base of the towrt will the body strike the ground ?

Watch Video Solution

6. A projectile os shot in air with velocity (v) at an angle θ with the horizontal. Neglecting the air resistance, what are the vertical acceleration and horizontal acceleration at the highest of its fligh ?

Watch Video Solution

7. Is the maximum height attained byprojectile is largest when its horizontal range is largest when its norizontal range is maximum ?

Watch Video Solution

8. A ball is thrown upwards and returns to the ground describing praraboleic path. Which of the quantities remain constant throufgout the motion.

Watch Video Solution

9. Two bodies are projected at angle θ and `(90%(@) -theta) to the horizontal with the same speed. Find the ration of their time of flight.

Watch Video Solution

10. A body is projected with a speed (u) at an angle to the horizontal to have maximum range. What is its velocity at the highest point ?

Watch Video Solution

11. The direction of the oblique projectile becomes horizontal at the maximum height. What is the cause of it ?

Watch Video Solution

12. A bombthrown as projectile with angular projection explodes in mid-air. What is the path traced bythe centre of mass of the fragments assuming the friction to be begligible ?

Watch Video Solution

13. What will be the effect on horixontal range of a projectile when its initial velocity is doubled, keeping the angle projection same ?

Watch Video Solution

14. What will be the effect on maximum height of a projectile when its angle of projection is changed from $30^{\circ} \rightarrow$ 60^(@)`, without changing its initial velocity of projection ?

Watch Video Solution

15. Two bombs of ` 2 kg and 4 kg are thrown from a canon with the same velocity in the same direction. Which bomb will reach the ground first ?

Watch Video Solution

16. A projectile is fired with kinetic energy $1kJ. Iftheran \geq is \max i\mu m, w\hat{i}sits$ K.E. at the highest point ?

Watch Video Solution

17. A body of mass (m) is projected with a speed (v) making an angle θ with the vertical. What is the change in momentum of the body along (i) the X-axis (ii) the Y-axis , between the strting point and the highest point of its path.

Watch Video Solution

18. A projectile of mass (m) is thrown with velocity (u) from the ground at an angle of 60° with the horizontal. What is the magnitude of change in momentum between leaving and arriving back at the ground ?

Watch Video Solution

19. Can a body move on a crved path without having acceleration ?

Watch Video Solution

20. The velocity of a particle is constnt in magnitude but not in a direction. What is the nature of trajectory follwed by the motion of particles ?

Watch Video Solution

21. What will the effect on the centripetal acceleration, it both the speed and the radius of the circular path to a body are doubled ?

Watch Video Solution

22. A body in a unitorm horizontal circular motion possesses a variable velocit. Does it mean that the K.E. of the bodyis also veriable ?

Watch Video Solution

23. What is the angle between velocity vector and acceleration vector in unitorm circular motion ?

Watch Video Solution

24. When a kinife is sharpened with the help of a rotation grinding stone, the speerk always travel tangentiall to it .Why ?

Watch Video Solution

5 Very short

1. Refer to the graphs fig. 2 (EP).5 Match the following.

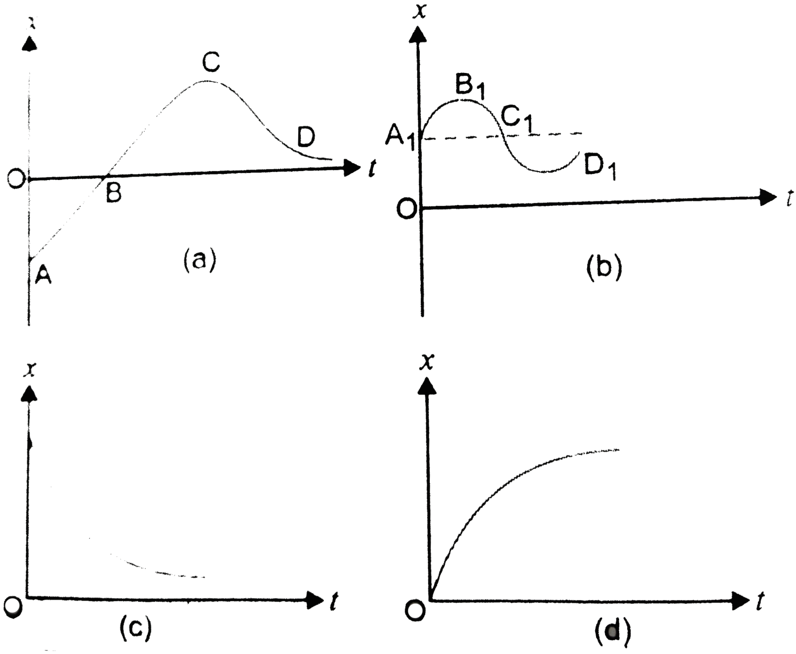
Graph Characteristic

(a) (i) has $v > \text{ and } a < o$ throughout.

(b) (ii) has $x > 0$ throughout and has a point with $v = 0$ and a point with $a = 0$.

(c) (ii) has a point with zero displacement for $t > 0$.

(d) (iv) has $v <$ and $a > 0$.



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2. A uniform moving cricket ball is turned back by hitting it with a bat for a very short time interval. Show the variation of its acceleration with time. (Take acceleration in the back ward direction as positive).

Watch Video Solution

3. Give ezamles of a one-dimenssionl motion wher

(a) the particle moving along positive x-direction comes to rest periodically and forward.

(b) the particle moving along positive x-direction comes to rest periodically and moves backward..

Watch Video Solution

4. Give example of a motion where $x > 0, v < 0, a >$ at a particular instant.

Watch Video Solution

5. An object falling through a fluind is observed to have acceleration given by $a = g - bv$ where ` g= gravitational acceleration and (b) is constant. After a long time of rlease. It is observed to fall with constant speed. What must be the value of constant speed ?

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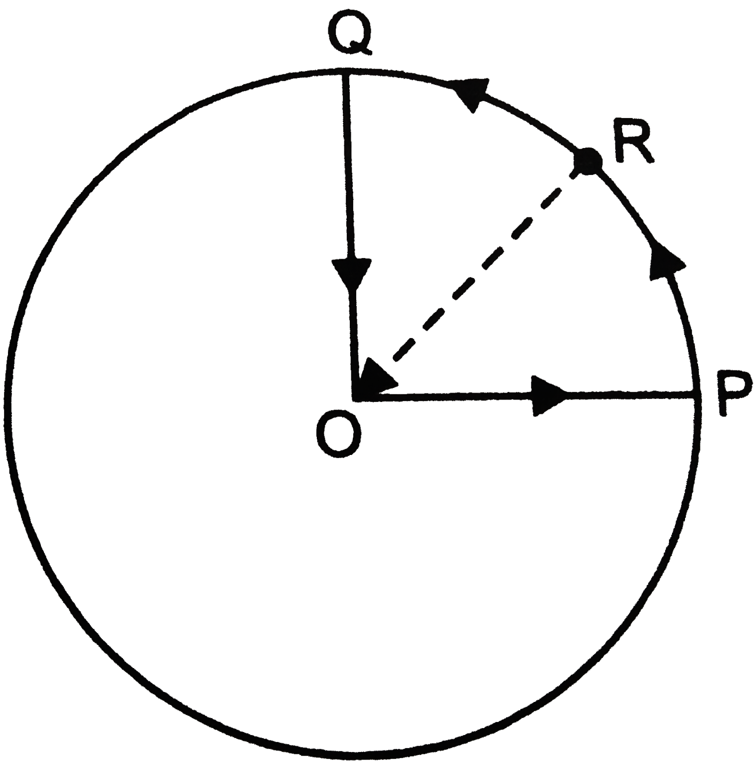
6 Very short

1. A cyclist starts form centre O of a circular park oa radius $1km$ and moves along the path $OPRQO$ as whown Fig. 2 (EP).15. If he maintais constant speed of $10ms^{-1}$, what is his acceleration at point (R)in magnitude and direction ?



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2. A ball is thrown from a roof top at angle of 40° ablve the horizontal. It hits theground a few seconds later. At what point during its motion. Does the ball have

(a) greatest speed (b) smallest speed (c) greatest acceleration ? Explain.

3. A football is kicked into the air vertically upwards. What is its (a) acceleration, and (b) velocity at the highest point ?

4. $\vec{A}, \vec{B}$ and $\vec{C}$ are three non-collinear, non co-planar vectors. What can you say about direction of $\vec{A} \times \overrightarrow{B \times \vec{C}})$?

1 Short answer

1. When can an object be considered as a point object ? Explain in brief.

Watch Video Solution

2. Given below are some examples of motion. State in each case. If the motion is one, two or three dimensions : (i) A flying bird in the sky(ii) A footballkicked by a playes (iii) Earth revolving around the sum (iv) The motion of the bob of a simple pendulum.

Watch Video Solution

3. What are the characteristics of uniform motion ?

Watch Video Solution

4. Is magnitude of the displacement of an object and total distance covered by it in certain time intrval same ? Explain.

Watch Video Solution

5. Distinguish between speed and velocity.

Watch Video Solution

6. Can a particle in one- dimensional motion have zero speed and a non-zero velocity ?

Watch Video Solution

7. Explain that a can have zero average velcoity but not zero average speed.

Watch Video Solution

8. Draw velocity-time graph of a unitorm motion of an object along a straight line. What do you study from this graph ?

Watch Video Solution

9. Distinguish between distance and displacement.

Watch Video Solution

10. Show that avertage velocity of the object over an interval of time is either smaller than or equal to the average speed of the object over the same interval.

Watch Video Solution

11. Two particles are moving with constant speed v such that they are always at a constant distance d apart and their velocities are always equal and opposite. After what time will they return to their initial positions ?

Watch Video Solution

12. Show that the slope of displacement-time graph is equal to the velcoity of unitorm motion.

Watch Video Solution

13. A body travels with velocity $v_1 f$ or $time$ t_(1)se$cond$ and $withvelocity$ v_(2) for time t_(2) second in the same direction, fide the avetage velocity of the body.

Watch Video Solution

14. The displacement x of the body is motion is given by ` x=A sin (omega t+ theta) , Determine the time at which the displacement is maximum.

Watch Video Solution

15. An athelete completes one round of a circular track of radius $R \in 40 seconds$. What will be the displacement at the end of ` 2 min. 20 second ?

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16. A person travels along a straight road for the first half length with a velocity v_1 and the second half length with velocity v_2. What is the mean velocity of the person ?

Watch Video Solution

17. The speedometer of a car moving eastward reads $50 km/h$. It passes another car which travels westward at $50 km/h$. (i) Do both the cars have same dpeed ? (ii) Do they have the same velocity ? (ii) What is the relative velocity of car $Aw.r.t. carB$.

Watch Video Solution

18. When two bodies movie uniformly towards each other, the distance between then decreases by $6 metres/second$. If both the bodies move in the same direction with their same speed, the distance between them increases by 4 metres / second . What are the speeds of the two bodies.

Watch Video Solution

19. Draw position-time graphs for two objects having zero relative velocity.

Watch Video Solution

20. Explain the basic comcepts of statics, kinematics and dynamics.

Watch Video Solution

21. Differentiatde between one, two and three dimensional motion.

Watch Video Solution

22. Difine uniform velocity of an object moving along a straight line. What will be the shapes of position-time and velocitu-time graphs of such a motion ?

Watch Video Solution

23. Discuss the importance of graphcial staudy of the uniform motion of an onject in one dimenstion.

Watch Video Solution

24. What do you understand by non uniform motion ? Explain veariable velocity and instantaneous velocity of an object in one dimensional motion.

Watch Video Solution

25. Define relative velocity of an object w.r.t. another. Draw position-time graph of two objects moving along a straight line, when their relative velocity is (i) zero and (ii) non-zero.

Watch Video Solution

2 Short answer

1. An object can accelerate while travelling at constant speed, but not at constant velocity, Is it true ? Explain.

Watch Video Solution

Watch Video Solution

2. If a speedometer is attached to a freely falling body, then how much would its speed readings incresase with each second of fall ?

Watch Video Solution

3. A man standing on the edge of a cliff throws a stone straight up with initial speed (u) and then throws another stone straight down with same initial speed and from the same position. Find the relation of the speeds. The stones would have attained when they hit ground at the base of the cliff.

Watch Video Solution

4. Acceleration is defined as the rate of change of velocity. Suppose we call the rate of change of acceleration as $SLAP?.(i)\hat{W}istheunitofSLAP$.

(ii) How can we calculate instantaneous SLAP ?

Watch Video Solution

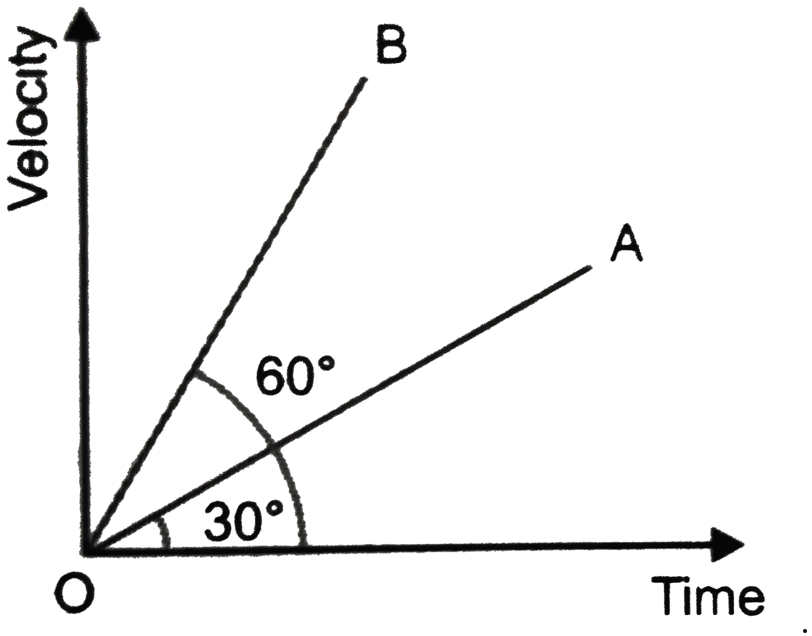
5. Two balls of different masses (one lighter and other heaver) are thrown vertically upwards with the same speed. Which one will pass through the point of projection in the downward direction with greater speed?

Watch Video Solution

6. For a particle in one dimensional motion, the instantaeous speed is always equal to the magnitude of instantaneous velocity. Why ?

Watch Video Solution

7. Two straight lines drawn on the same velocity-time graph make anles 30° and 60° with time axis respectively, as shown in Fig. 2 (b) 1. 27. Which line represents greater acceleration ? What is the ration of the two accelerations ?



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8. Points P, Q and R are in vertical line such that $PQ = QR$. A ball at (P) is allowed to fall freely. What is the ratio of the times of descent through PQ and QR ?

Watch Video Solution

9. A ball is released from the top of a tower of height h metre. It takes T second to reach the ground. What is the position of the ball in $\frac{T}{3}$ second?

Watch Video Solution

10. What do the slopes of $distance$ - $time$ and $velocity$ - $time$ graphs represent ? What do positive and negative values of these slopes imply ?

Watch Video Solution

11. What type of velocit-time graph will you get, for a unitormly accelerated motion when

(i) acceleration is + ve (a gt 0)and $(ii)ae \leq rationis$-ve (a- lt0) ?`

Watch Video Solution

12. How can one determine (i) the distance (ii) the displacement coverd by a uniformly accelerated body from its velocity-time graph ?

Watch Video Solution

13. The distance coverd by an object between times t_1 and t_2 is given by the area under the v - t gaph between t_1 and t_2 Prove this staement for an object moving with negative acceleration and gaving and having a positive velocity at time t_1 and and $\neg ativevelocityattime$t_(2)`.

Watch Video Solution

14. An electron starting from rest has a velocity that increase linearly with time that is $v = kt, wher$ k=2 m//s^(@). $W\hat{w}illbethedistancecovered \in first$ 3 seconds ` of its motion ?

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15. In a case of a motion, displacement is directly proportional to the square of the time elapsed. What do you think about its acceleration i.e., constant or varianle ? Explain why ?

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16. If the velocity of a particle is given by $v = (180 - 16x)^{\frac{1}{2}}\frac{m}{s}$, then its acceleration will be

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17. The distance traversed by a moving particle at any instant is half of the product of its velocity and the time of travers. Show that the acceleration of particle is constant.

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18. The acceleration of a particle, starting from rest, varies with time according to relation , $a = -r\omega^2 \sin omn\eta t$. Find the displacemnt of this particle at a time (t).

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19. A particle exeriences constant acceleration form $20 seco nds after strat \in gom \geq st. If it travels a distance$ S_(1) $\in the first$ 10 seconds and $distance$ S_(2) $\in the \neq xt 10 seconds.$ Find the relation between S_1 and $S_{\circ}$.

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20. An onject is thrown vertically upward with some speed. It crosses 2 points p, q whith are separated by (h) metre. If (t) is the time between (p) and highest point and coming back and t_q is the time between q and highest point and coming back, relate acceleration due to gravity t_p, t_q and h.

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21. A car, starting from rest, accelerates at the rate (f) through a distance (S), then continues at constant speed for some time (t) and then decelerates at the rate $f/2$ to come to rest. If the total distance is $5S$, then prove that

$$S = \frac{1}{2}/ft^{\circ}.$$

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22. Define and explain the term acceleration . Derive the velocity-time relation of a body moving under constant acceleration.

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23. Find the distance travelled by by the uniformly acclerated object moving in one dimension in nth second.

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24. Draw velocity-time graph of a uniformly accelerated in one dimension and explain that the distance travelled is equal to the area under velocity-time graph.

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25. From the velocity-time graph of uniformaccelerated motion deduce the equations of motion in (i) velocity and time (ii) distance and time (iii) disstance and velocity.

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26. Descuss the motion of an object under free fall and draw (a) acceleration-time , (b) velocity-time and (c) position-time graph for this motion .

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3 Short answer

1. Vectros $\vec{A}, \vec{B}$ and $\vec{C}$ sattsfy the equation $\vec{A} + \vec{B} = \vec{C}$, and their magitues related by the equation $A + B = C$. How is the vector $\vec{A}$ oriented with respect to vector $\vec{B}$? Explain your reasoning.

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2. What should be the the angle θ between two vectors $\vec{A}$ and $\vec{B}$ for their resultant $\vec{R}$ to be (i) maximum (ii) minimum ? Give their resultant value.

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3. Do (vec A + vec B) and (vec A-vec B) lien in the same plane. Explain.

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4. Can we add a vector representing a force of $10N$ to a vector of force 2000 dune.

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5. Given $\vec{A} + \vec{B} + \vec{\ } + \vec{D} = 0$, can the magnitude of $\vec{A} + \vec{B} + \vec{C}$ be equal to the magnitude of vec D` Explain.

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6. Two vectors $\vec{A}$ and $\vec{B}$ are of equal lenths (A =B) and mutually perpendicualr. Show by vector diagram that their vector sum (vec A + vec B) and vetor differnce (vec A - vec B) will perpendicular.

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7. Two vectors $\vec{A}$ and $\vec{B}$ are added. Prove that the magnitude of the resultant v ector can bot be greater than (A +B) and smaller than (A - B) or (B -A).

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8. Are the commutative law and associtive law applicable to vectors subtraction.

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9. Suppose you two forces $\vec{F}$ and $\vec{F}$. How would you combine then in order to have resultant force of magnitudes (a) zero $(b)2\vec{F}$ and $\left(c0\vec{F}\right.$.

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10. What is the differnce between the follwing data ? (i) 3 (5 km h^(-1) , west) (ii) 3 hour (5 km h^(-1), west).

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11. There are two displacement vectors,, one of magnitude 3 metres and the other of 4 metres. How would the two vectors be added so that the magnitude of the resultant vector be (a) 7 metres (b) 1 metre and (c) 5 metres.

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12. Mention the importance of writing the physical quantities as vectors.

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13. What is the property of two vectors $\vec{A}$ and $\vec{B}$, if $\left|\vec{A}+\vec{B}\right| = \left|\vec{A}-\vec{B}\right|$.

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14. Given that $\vec{A} + \vec{B} = \vec{R}$ and $A^{20 + B^2 - R^2}$, find the angle between $\vec{A}$ and $\vec{B}$.

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15. Find a vector $\vec{A}$ and its magnitude as well as direction with x-axis having initial point (P) (1,2, -1) and treminal point `Q (3, 2, 2) .

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16. Vector addition is different from scalar addition. Explain.

Watch Video Solution

17. The velocity of a body is $100kmh^{-1}$, 30^(@)` west of south . Find the north ad east components of the vector.

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18. What are the angles made by vector $\vec{A} = \hat{I} + sqer3\hat{j}$ with x-axis and y-axis ?

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19. Two persons are pulling, the ends of a strong in such a way so that the string is stretched horizontally. When a weight of $10kg$ is suspended in the middle of the string. The string does not remanin horizontal. Can the persons maken it horizontal again by pulling it with a greater force ?

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20. The resultant of two vectors $\vec{A}$ and $\vec{B}$ perpendicular to the vector $\vec{A}$ and $itsmagnitudeidequal \rightarrow halfofthemagnitudeofthe \vec{\rightarrow r}$ vec B $. F \in doutthe\angle between$ vec A and vec B`.

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21. A man moving in rain holds his unbrella inclined to the vertical even though the rain drops are falling vertically downwards . Why ?

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22. The dot product of two vectors vanishes when vectors are orthogonal and has maximum value when vectors are parallel to each other. Explain.

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23. If $\vec{R} = \left(\vec{A} = \vec{B}\right), showt^{\wedge}$ R^(2) =A^(2) +B^(20 +2 AB cos theta$wher,$ theta $isthesmal \leq r\angle between$vec A and vec B`.

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24. If $\vec{A} = \vec{B} - \vec{C}$, then determine the angle betwee $\vec{A}$ and $\vec{B}$.

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25. The sum and differnce of two vectors are perpendicular to each other. Prove that the vectors are equal in magnitude.

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26. What do you understand by (i) position vector and (ii) displacement vector. Distinguish them with illustration.

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27. Explain multiplication of a vector by (i) a real number (ii) by a scalar.

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28. What do you understand by resultant vector ? Show that vector addition of two vectors is different from scalar addition of two scalars.

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29. Explain the rules for addition of vectors geometrically with illustrations.

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30. State polugon low of vectors and show that it can be deduced from triangle law if vectrs.

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31. Explain subtraction of two vectors with illustration.

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32. What is relative velocity ? Explain how a man can hold his umbrella while walking on ground in a rain.

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33. What is a zero vector ? How can you obtain zero vectors. Give examples and properties of zero vectors.

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34. What do you understand by resolution of a vector ? Show that there is only one way in which a vector can be resolved into two component vectors along the directions of two given vectors.

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35. Explain rectangular componets of a vectors with illustration. Show that walking of a man is accounted by resolution of vectrs.

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36. Assertion: Pulling a lawn roller is easier than pushing it.

reason: Pulling increases the apparent weight and hence the force of friction.

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37. Explain vectors addition when vectors are in terms of rectangular component vectors.

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4 Short answer

1. What are the assumptions made in the study of a projectile motion ?

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2. A stone is thrown verticallyupwards and then it returns to the thrower. Is it a projectile ? Explain.

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3. A stone is thrown horizontally with a velocity $2\sqrt{gh}$ from the top of a tower of height h. It strikes the ground level through the foot of tower at a distance (x) from it . What is the value of 9x) ?

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4. A projectile is given a horixontal projedctio from a heigh 9h) with velocity (u) What is the nature of trajectory of the projectile ? Draw the accleration- time graph of this trajectory. What does its slope lindicate ?

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5. Prove that ther are two angkes of projection for the samehorixontal range.

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6. Prove that the horizontal range id same when angle of projection is (i) greater than 45° by certain value and (ii) less than 45° by the same value.

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7. Two bodies are thrown with the same initial velocity at angles θ and (90^(@)- alpha) with the horixontal. What will bethe ratio of (ii) maximum heights attained by then and (ii) of horizontal ranges ?

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8. Show that there are two values of time for which a projectile is at the same height. Also show mathematically that the sum of these two times is equal to the time of flight.

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9. Show that a gun will shoot woll shoot three times as hith when elevated at an angle of 60° as when fired at an angle 30° but will have the same horizontal rande.

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10. The greatest height to which a boy can throw a stone is (h). What will be the greatest distance on horizontal surface upto which the boy can throw the stone with the same speed ? Neglect the air friction.

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11. A projectile is projected from horizontal with velocity (u) making an angle 45° with the horizontal direction. Find the distance of the highest point of the projectile from its starting point.

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12. At which point of projectile motion (i) potential energy is maxumum (ii0 kinetec eneragy is maximum (iii) total vechnical energy is maximum.

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13. Find the angle of projection for a projectile motion whose rang R is (n) time the maximum height H.

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14. A body of mass (m) is theown with velocity (u) at an angle 30° to the horixontal and another body B of the sme mass is thrown with velocity (u) at an angke if $45\&(\circ)$ to the horizontal, find the ration of the horizontal range and max. height of A and B.

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15. A ball is projected with velocity (u) at an anle α with horizontal plane. What is its speed when it makes an angle θ whith the horizontal plane ?

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16. A paricle is projected at an anged θ from the horizontal with kinetic energy (T). What is the kinetic energy of the particle at the highest point ?

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17. A ball of mass M is thrown vertically upwards. Another ball of mass 2M is thrown at an angle θ with the vertical. Both of them stay in air for the same period of time. The heights attained by the two are in the ratio

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18. Which is greater , the angular velicty of the hour hand of a watch or angular velocity of earth around its own axis ?

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19. What are the angular velocities of a second hand, minute hand and hour hand of a clock ?

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20. What do you understand by motion in two dimensions ? When an object is moving with uniform velocity in two dimensions, ezplain displacement, velocity and find the equations of motion of the object.

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21. Find the relation for

(i) velocity and time

(ii) displacement and time, when an object is moving with uniform acceleration in two dimensions.

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22. What is a projectile ? Give its examples. How that the path of projectile is a parabolic path when projected horizontally from a certain height.

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23. Define trajectory of a projectile and hence derive equation of motion of the projectile when projected at an angle θ with horizontal direction.

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24. Show that there are two angles of projection for which the horizontal range is the same.

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25. Discuss the general relations for velocity and acceleration for motion of an one dimension in a plane.

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26. What do you understand by angular displacement and angular velocity in a circular motion.

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27. What is a uniform circular motion ? Explain the terms , time period, frequency and angular velocity. Establish relation between them.

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28. The correct relation between linear velocity $\vec{v}$ and angular velocity $\vec{\omega}$ of a particle is

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29. The correct relation between linear velocity $\vec{v}$ and angular velocity $\vec{\omega}$ of a particle is

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30. Explain angular acceleration .Establish its relation with linear acceleration.

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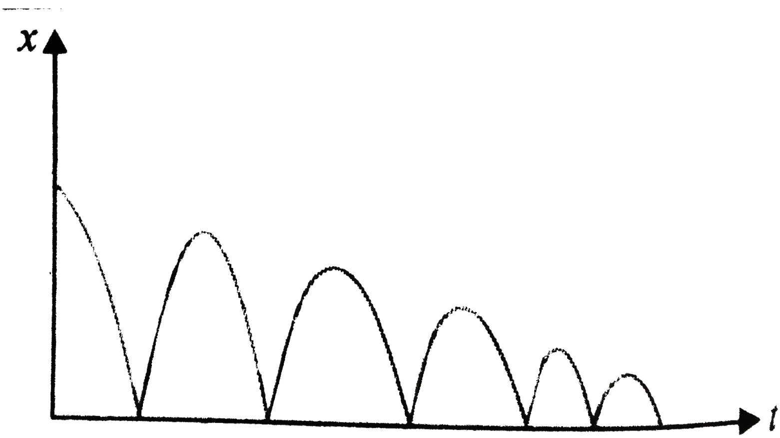
5 Short answer

1. A ball is dropped and its displacement vs time graph is as shown in Fig. 2 (EP) .7 (displacement (x) is grom ground and all quantities are +ve upwards). (a) Plot qualitvely velocity vs time graph). (b) plot qualitatively acceleration vs time graph .



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2. A particle executes the motion described by $x(t) = x_0\left(w - e^{\gamma t}, t > -0, x_0 > 0.\right.$

(a) Where does the particle start and with what velocity ?

(b) Find maximum and minimum values of $x\left(t0, a(t). Show\hat{t}\right.$ x (t) and a (t0 increase with time and $v(t)$ decreases with time.

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3. A bird is tossing (flying to and fro 0 between two cars moving towards each other on a straight road. On car has a speed of $18 km/h$ while the other has the speed of $27 km/h$. The bird starts moving from first caer towards the other and is moving with the speed of $36 km/h$ and when the two cars were separated by $36 km$. What is the total distance comered by the bird ? What is the total displacement of the bird ?

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4. A man runs across the roof-top of a tall building and jumps horizontally with hope of landing on the roof fo the bext building which is at a lower height than the first. If his speed is $9m/s$,the (horizontal) destanc hetween the two buildings is $10m$ and height difference is $9m$, will he be able to land on the bext building ? (taken g=10 m//s^(2)).

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5. A ball A is dropped from a building of height $45m$. Simultaneously another ball B is thrown up with a speed $40m/s$. Calculate the relative speed of the balls as a function of time.

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6. The velocity-displacement graph of a particle is shown in Fig. 2 (EP). 10 .

(a) Write the relationbetween (v) and (x).

(b) Obtain the relation between acceleration and displacement and plot it

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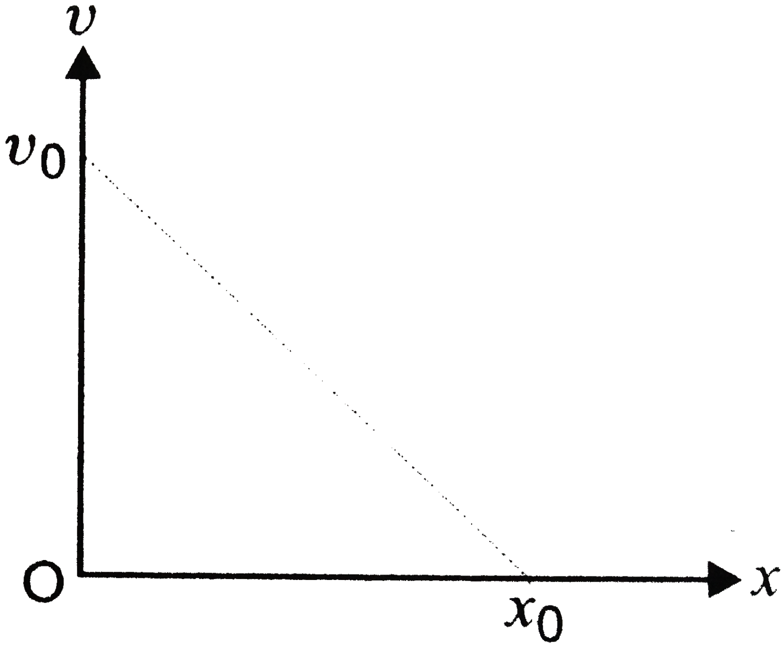

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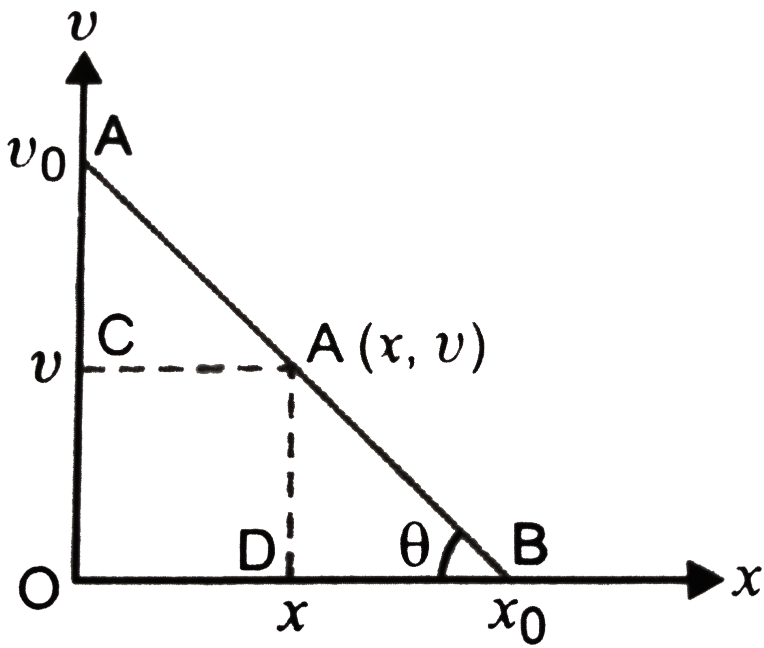

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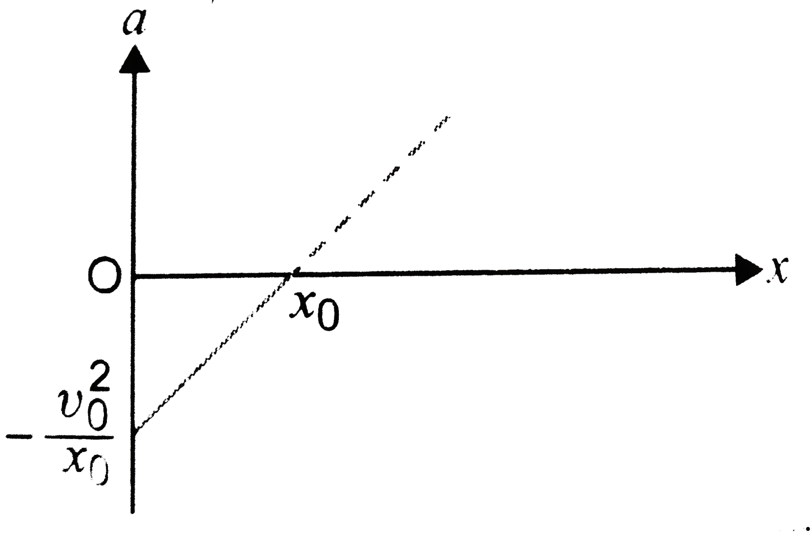

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6 Short answer

1. A boy travelling in an open car moving on a levelled road with constant speed tosses a ball vetically up in the air and catches it back. Shetch the motion of the ball as observed by a boy stanceing on the footpath. Give explanation to support your diagream.

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2. A boy throws a ball in air at 60° to the horizontal along a road with a speed of $10m/s$ (km //h). Another boy sitting in a passing by car observes the ball. Sketch the motion of the ball as observed by the boy in the car, If car has a speed of (18 km //h). Give ezplanation to support your diagravm.

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3. In dealing with motion of projectile in air, we ignore effect of air resistance on motion. This gives trajectory as a parabola as you have studied. What would the trajectory look like it air resistance is included . Sketch such a trajectory and explain why you have drawn it that way.

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4. A fighter plane is flying horizontally at an altitude of 1.5 km with speed $720kmh^{-1}$. At what angle of sight (w.r.t horizontal) when the target is seen, should the pilot drop the bomb in order to attack the target? $\left(Take g = 10ms^{-2}\right)$

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5. (a) Earth can be thought of as a sphere of radius $6400km$. Any object (or a person) is performing circula motion around the axis os earth due to earth

$srotation(period1day). \hat{Wisa}e \le rationoobjectonthesurfaceofthearth9atequa \to r\Big)$

theta $? Howdoesthesea$e $\le rationscomparewith$g=9.8 m//s^2

$?(b)Earthalsomoves \in \circ \underline{ar}$ or $bitaround \sum everyyearwithon$ or $bitalradiusof$

1.5 xx 10 ^(11) m

$. \hat{Wistheae} \le rationofearth($ or $anyobjectonthesurfaceoftheearth) \to wardsthecent$

g=9.8 ms^2 `?

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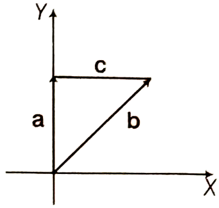
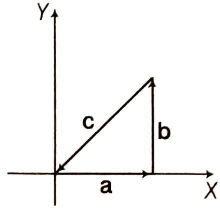
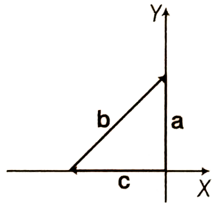
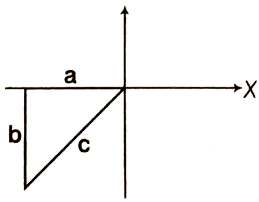
6. Given below in Column I are the relations between vectors a,b and c and in Column II are the orientations of a, b and c in the XY - plane .

Match the relation in Column I to correct orientations in Column II.

Column I	Column II
(a) $\mathbf{a}+\mathbf{b}=\mathbf{c}$	(i) 
(b) $\mathbf{a}-\mathbf{c}=\mathbf{b}$	(ii) 
(c) $\mathbf{b}-\mathbf{a}=\mathbf{c}$	(iii) 
(d) $\mathbf{a}+\mathbf{b}+\mathbf{c}=0$	(iv) 

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7. If $\left|\vec{A}\right| = 2$ and $\left|\vec{B}\right| = 4$, then match the relations in colum I with theange θ between $\vec{A}$ and $\vec{B}$ in column II.

Column I , Column II

(a) $\vec{A}.\vec{B} = 0$, (i) θ =0(b) vec A . Vec B= + 8, (ii) theta =90^@(c) vec A .vec B =4, (iii) theta =180^@(d) vec A .vec B =- 8, (iv) theta =60^@`.

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8. If $\left|\vec{A}\right| = 2$ and $\left|\vec{B}\right| = 4$, then match the relations in column I with the ange θ between $\vec{A}$ and $\vec{B}$ in column II.

Column I, Column II

(a) $\left|\vec{A} \times \vec{B}\right| = 0$, (i) $\theta = 30^{\circ}$

(b) $\left|\vec{A} \times \vec{B}\right| = 0$, (ii) $\theta = 45^{\circ}$

(c) $\vec{A} \times \vec{B} \mid = 4$, (iii) $\theta = 90^{\circ}$

(d) $\left|\vec{A} \times x\vec{B}\right| = 4\sqrt{2}$, (iv) $\theta = 0^{\circ}$.

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1 Long answer

1. Explain distance of closest approach and impact parameter with illustrations.

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2. Define relative velocity of an object w.r.t. another. Draw position-time graph of two objects moving along a straight line, when their relative velocity is (i) zero and (ii) non-zero.

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2 Long answer

1. Explain clearly 9i0 uniformacceleration (ii) variable acceleration (iii) Average acceleration (iv) instantaneous acceleration and show that instantaneous acceleration is the limition vwslue of averate acceleration.

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2. Deduce the following relations analytically for a uniformly accelerated motion along at a line, where terms have their usual meanings

$(i) v = u + at$

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

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

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3. Deduce the equations of unifromly accelerated motion in one dimension by following calculus method.

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3 Long answer

1. Explain (i) Unit vector (ii) Equal vectors (iii) Negative vectors, (iv) Coinitial v ectors (v) Collinear vectors and (vi) Copanar vectors.

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2. State triangle law of vectors addition. Find analytically the magnitude and dirction of resultant vector.

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3. State parallelogram law of vectors addition .Find analytcallly the magnitude and direction of resultant vector, When (i) two vectors are parallel to each other (ii) two vectors are perpendicular to each other.

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4. State the most basic condition for the addition of vectors.

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5. Explain dot product to two vectors. Five examples and properties.

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6. Explain cross prouct of two vectors. Give its examples and properties.

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4 Long answer

1. Find (a) time of flight , (b) Max.height (c) Horizontal range of projectile projected with speed (v) making an angle θ with the horizontal direction from ground.

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2. Find the magnitude and direction to the velocity of an object at any instant during the oblique projection of projectile.

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3. Find (a) time of flight , (b) Max.height (c) Horizontal range of projectile projected with speed (v) making an angle θ with the horizontal direction from ground.

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4. Find (i) the time of flight (ii) maximum height and (iii) horizontal of a projectile given angular projection on an inclined plane where angle of inclination with horizontal is θ_0.

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5. What is centripetal acceleration ? Find its magnitude and direction in case of a uniform circular motion of an object .

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5 Long answer (NCERT)

1. It is a common observation that rain clouds can be at about a kilometer altitude above the ground .

(a) If a rain drop falls from such a height freely under gravity, what will be its speed ? Also calcualte in $km/h\left(g = 10m/s^2\right)$.

(b) A typical rain drop is about 4 mm diameter. Momentum is mass $\times$ speed in magnitude. Estiamate its momentum when its hits ground.

(c) Estimate the time required to flatten the drop.

(d) Rate of change of momentum is force. Estiamate how much force such a drop would exert on you.

(e) Estimate the order of magnitude force on umbrella. Typical lateral separation between two rain drop is 5 cm.

(Assume that umbreaella is circular and has a diameter of 1 m and cloth is not peicreced through.)

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2. A motor car moving at a speed of $72km/h$ can not come to a stop in less than $3.0s$ while for a truch this time interval is $5.0s$ On a highway the car is behind the truck both moving at $72km/h$ The truck geives a signal that it is going to stop at emergency. At what distance the car should be from the truck so that it does bot bump onto (collide with) the truck. Human responde time id $0.5s$.

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3. A monkey climbs up a slippery pole for $3seconds$ and subsequently slips for $3seconda.$ Its velocity at time (t) is given by $v(t) = 2t(3 - t), 0 < t > 3s$ and $v(t) = - (t - 30(6 - t)f$ or $3 < t < 6s \in m/s.$ It repeats thei cycle till it reaches the height of $20s$.

(a) AT wht time is its v elocity maximum ? (b) At what time is its average velocity maximum ? (c) At what time is its accelration maximum in magnitude ? (d) How many cycles (counting fractions) are required to reach the top ?

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4. A man is standing on top of a building 100 m high. He throws two ball vertically, one at $t = 0$ and after a time interval (less than 2 seconds). The later ball is thrown at a velocity of half the first. At $t = 2$, both the balls reach to their and second ball is $+15m$.

Q. The speed of first ball is

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6 Long answer (NCERT)

1. A hill is $500m$ hight. Supplies are to be across the hill using a canon that can hurl packetets at a speed of $125m/s$ pver the hill . The canon is located at a distance of $800m$ from the foot to hill and can be veoved on the ground at a speed of $2m/s$, $sot\hat{i}tsdistanceomthehillcanbeadjusted. W\hat{i}sthesh$ or $testtime \in whichapache$

g= 10 m//s^2`.

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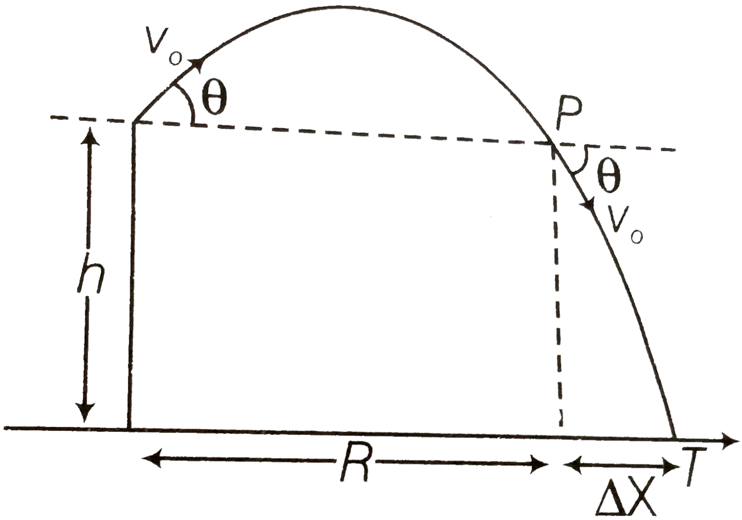
2. A gun can fire shells with maximum speed v_0 and the maximum horizontal range that can be achieved is $R = \frac{v_0^2}{g}$. If a target farther away by distance Δx (beyond R) has to be hit with the same gun, show that it could that it could be achieved by raising the gun to a height at least

$h = \Delta x\left[1 + \frac{\Delta x}{R}\right]$



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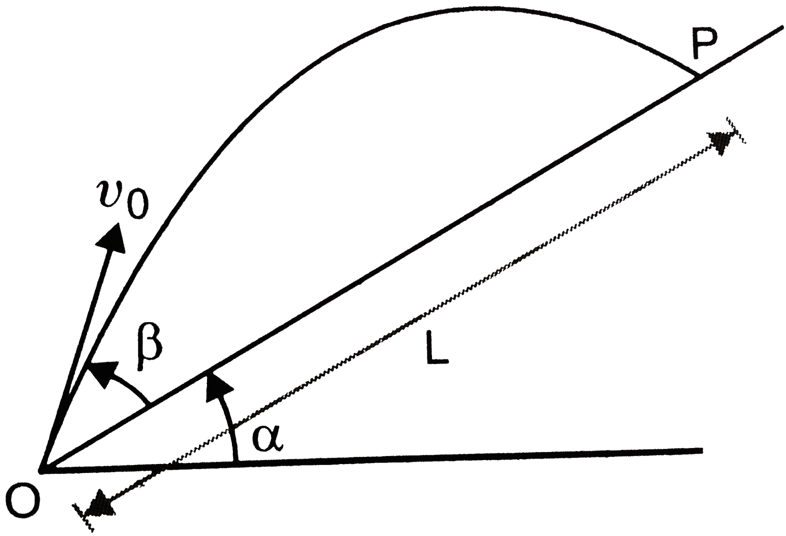
3. A particle is projected in aer an angle β to a surface which itself is inclined at an angle α to the horixonta (Fig. 2 (EP). 26)

(a) Find an ecxpression for range on the plane surface (distanc eon the plance from the point of projection at which particle will hit the surface).

(b) Time of flight. 9c) β at which range will be maximum.



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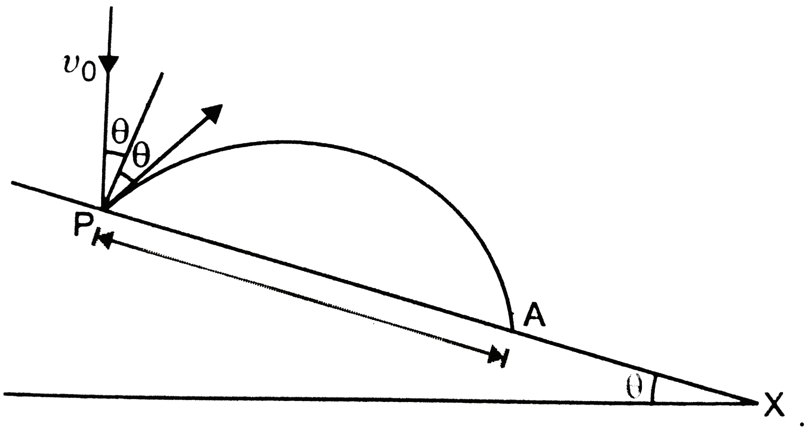
4. A particle falling vertically from a height hits a plane surface inclined to horizontal at an ange θ with speed v_0 and rebounds elastically (Fig. 2 (RP).

28). Find the distance aling the plane where it will hit second time.



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5. A girl riding a bicycle with a speed of $5m/s$ to wards Noth direction, observes rain falling vertically down. If she increases her speed to $10m/s$, rain appeard to meet her at 45° to the vertical . What is the speed ot the rain ? In what direction does rain fall as observed by a ground based observer ?

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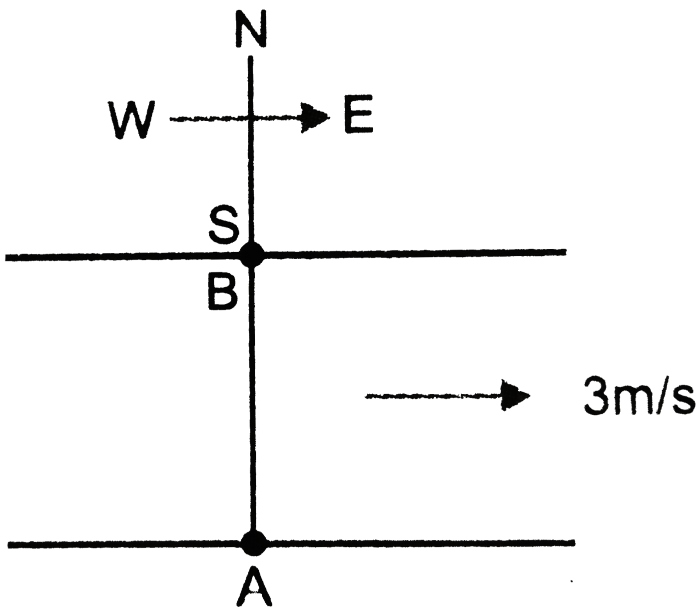
6. A river is flowing due east with a speed $3m/s$ (Fig. 2 (EP) .31).



. (a) If swimmer starts swimming due borth, what will be his resultant velocity (magnitude and direction) ? (b) If he wants to start from point (A) on South bank and reach opposite point (B) on North bank,

(i) Which direction should he swim? (ii) What will be his resultant speed ?

(c) From two differenrent casses as mentioned in (a) and 9b) above, in which casse will he reach opposite bank in shorter time ?

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7. A cricket fielder can throw the cricket ball with a speed v_0. If he throws the ball while running with speed (u) at angle θ to the horizontal, find

(b) what will be time of flight ?

(c) what is the distance (horizontal range) form the point of projection at which the ball will land ?

(d) find θ at which he should throw the ball that would maxmise the horizontal range range as found in (c).

(e) how does θ for maximum range change if $u > v_0, u = v_0, \underline{t}v_0$?

(f) how does θ in (e) compare with that for ` u=0 (i.e., 45^@) ?

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8. Motion in two dimensions, in a plane can be studied by expressing position, velocity and acceleration as vectors in cartesian coordinates $A = A_x\hat{i} + A_y\hat{j}$, where $\hat{i}$ and $\hat{j}$ are unit vector along x and y-directions, respectively and A_x and A_y are corresponding components of A. Motion can also be studied by expressing vectors in circular polar coordinates as $A = A_r\hat{r} + A_\theta\hat{\theta}$, where $\hat{r} = \frac{r}{r} = \cos\theta\hat{i} + \sin\theta\hat{j}$ and $\hat{\theta} =$ - $\sin\theta\hat{i} + \cos\theta\hat{j}$ are unit vectors along direction in which r and θ are increasing.

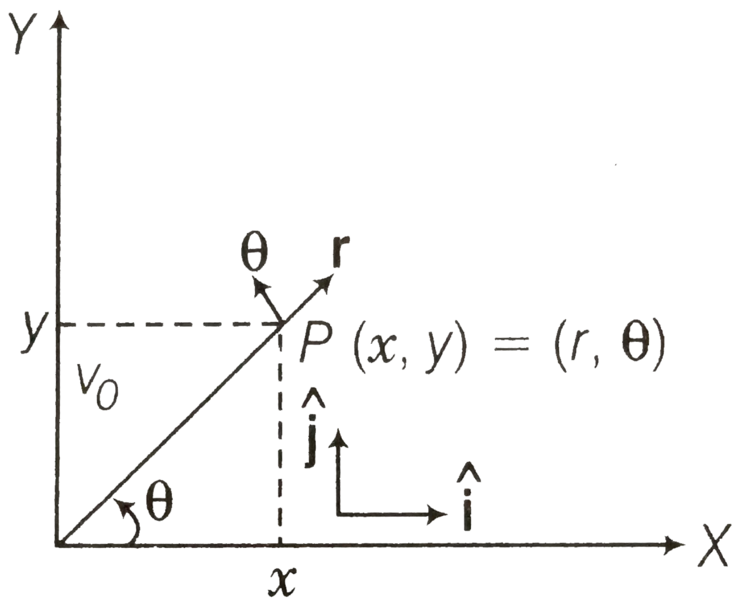
(a) Express $\hat{i}$ and $\hat{j}$ in terms of $\hat{r}$ and $\hat{\theta}$.

(b) Show that both $\hat{r}$ and $\hat{\theta}$ are unit vectors and are perpendicular to each other.

(c) Show that $\frac{d}{dt}(\hat{r}) = \omega\hat{\theta}$, where $\omega = \frac{d\theta}{dt}$ and $\frac{d}{dt}(\hat{\theta}) = -\theta\hat{r}$.

(d) For a particle moving along a spiral given by $r = a\theta\hat{r}$, where a = 1 (unit), find dimensions of a .

(e) Find velocity and acceleration in polar vector representation for particle moving along spiral described in (d) above.



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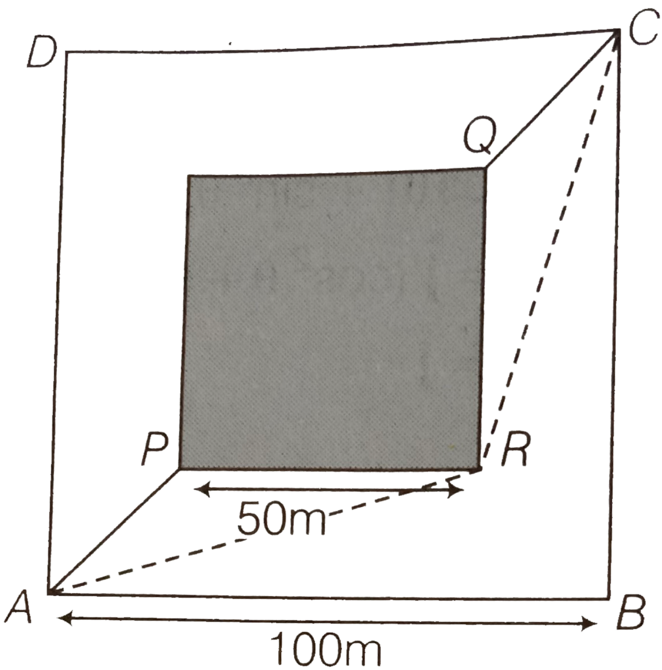
9. A man wants to reach from A to the opposite corner of the square C. The sides of the square are 100 m. A central square of $50m \times 50m$ is filled with sand. Outside this square, he can walk at a speed 1 m/s. In the central square , he can walk only at a speed of v m/s $(v < 1)$. What is smallest value of v for which he can reach faster via a straight path through the sand than any path in the square outside the sand ?



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Advanced Problems

1. The displacement to particle is zero at $t = 0$ and $iszatt = t$. It starts moving in the positive x-direction with a velocity which varies, $v = k\sqrt{x}$, wher (k) is a constant. Find the relation for variation of velocity with time.

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2. A bullet loses ` 1//2th1 of its velocity is passing through a plank. What is the least number of planks required to stop the bullet ?

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3. A balloon is ascending vertically with an acceelration of $0.2ms^{-2}$ .Two stones are dropped from it at an interval fo $2s$, the distance between then when the second stone dropped is (tanke g=9.i8 ma^(-2).

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4. If body travels half of its path in the last second of its fall from rest, find the time and height of its fall.

Watch Video Solution

5. A particle is moving in a plane with velocity $\vec{v} = u_0\hat{i} + k\omega\cos\omega t\hat{j}$. If the particle is at origin at $t = 0$, (a) determine the trajectory of the particle. (b) Find its distance from the origin at $t = 3\pi/2\omega$.

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6. Two masses A and B are moving in the same straight (A) moves with a uniform vlocity 11 ms^(-1). $(B) \star tsomrestatthe \in stantitis$ 52.5 m $aheadof(A)$, and $moveswithaun$ if or $mae \leq ation$ 1 ms^(-2). $Whenwill$ A catch B`? Explain the double answer....

Watch Video Solution

7. A proint moving in a straight line travels in its second, $16m, 28m$ and $52m$ respectively , prove that point is moving with constant acceleration. Aso find the total distance moving by particle in ` 10 seconds.

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8. Two trains are headed towaads each other on the same straight rrach, each vaving a speed of $30kmh^{-1}$. A bird that can fly at $60kmh^{-1}$ flies off one train when they are $60km$ apart and leads firectly form the otjer train, On reaching the other train, tg flies back to the first train and so on.

(a) How many trips can the bird make from one trin to the other train befre they meet ? (b) What is the total distance the bird travels ?

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9. Two cars are moving in the same direction with the same speed $30km/hr$. They are separated by a distance of $5km$, the speed of a car moving in the opposite direction of it meets these two cars at an interval of 4 minutes, will be.

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10. A sports car is passing a police check post at $60kmh^{-1}$, immediately started slowing down uniformly until its speed was $40kmh^{-1}$. It continued to move at the same speed until it was passed by a police car $1km$ from the check post. The police car had started from rest at the check post at the same instant as the sports car had passed the check post. The police car had moved with a constant acceleraation until it had passed sports car. Assuming that the time taken by the sports car in slowing down from $60kmh^{-1}$ to $40kmh^{-1}$ was equal to the time that it travelled at constant speed before passed by the police car, find

(a) the time taken by the police car to reach the sports car

(b) the speed of the police car at the instant when it passed the sports car

(c) the time measured from the check post when the speeds of the two cars were equal.

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11. The retardation fo a moving particle if the relation between time and position is $t = Ax^3 + Bx^2$ where A and B are appropriate constants will be .

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12. A particle moving along the x-axis has a pasition given by $x = 10te^{-1}$ metres where (t) is in seconds . How for is the partile from the origin when it momentarily stops ? (Do no consider its stop at infinity).

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13. A person travelling east wards at the rate of $4kmh^{-1}$ finds that the wind seems to blow directl from the borth . On dubling ins speed, the wind appears to come from 45° north of west. Find the actual velocity of the wind.

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14. A man running on the horizontal road at $8kmh^{-1}$ find the rain appears to be falling vertically. He incresases his speed to $12kmh^{-1}$ and find that the drops make angle 30^2 with the vertical. Fin dthe speed and direction of the rain with respedt to the road.

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15. A bird moves with velocity $20ms^{-1}$ in a direction making an angle of 60° with vertical upward .Represent the velocity vector in a rectangular form.

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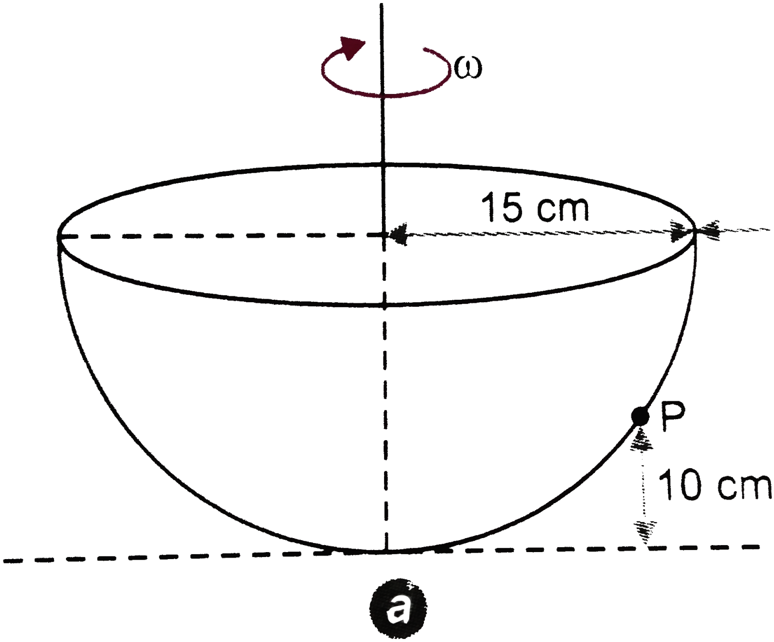
16. A smooth hemispherical bowl $30cm$ diameter, rotates with a constant angular velocity ω, about its vertical axis of symmetry Fig. 2 (APC) . 2 (a) . A particle at (P) of weighing $5kg$ is observed to remain at rest relative to the bowl at a height $10cm$ above the base. Find the magnitude of the force exerted by the bowl on the particle and speed of rotation of the bowl.



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17. A body is projected with a veocity of $40ms^{-1}$. After $2s$ it fcrosses a vertical pole of height $20.4m$ Find the angle of projection and horizontal range of projectile. (g = 9.8 ms^(-2)`.

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18. Two inclined planes (AB) and (BC) are placed as shown in Fig. 2 (ABC).3 A particle is projected from the foot of the plane of angle α along its line witn a velocity just sufficient to carry it to the top after which the particle slides down the other inclined plane. Fing the total time it will take to reach the pont (C).

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19. If the horizontal range of projectile be (a) and the maximum height attained by it is (b) then prove that the velocity of projection is

$$\left[2g\left(b+\frac{a^2}{16b}\right)\right]^{1/2}.$$

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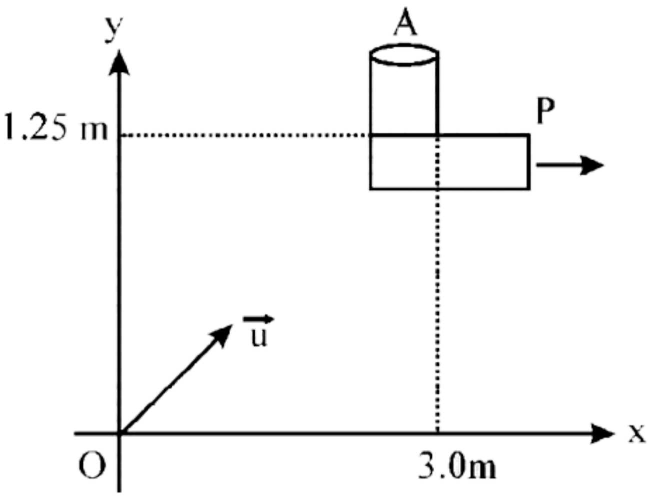
20. An object A is kept fixed at the point $x=3m$ and $y=1.25m$ on a plank p raised above the ground . At time $t=0$ the plank starts moving along the $+x$ direction with an acceleration $1.5m/s^2$. At the same instant a stone is projected from the origin with a velocity $\vec{u}$ as shown . A stationary person on the ground observes the stone hitting the object during its downward motion at an angle $45(\circ)$ to the horizontal . All the motions are in the X - Yplane . Find $\vec{u}$ and the time after which the stone hits the object . Take $g = 10m/s$



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NCRT Exercises

1. In which of the following exmples of motion, can the body be considered approxinmately a point object :

(a) a railway carriage moving without jerks between two two stations.

(b) a mondey sistting on top of a man cycling smoothly on a circulat track. (c) a spinning cricket ball that turns sharply on hitting the round .

(d) a tumbling beake theat has slopped off the edge of a table ?

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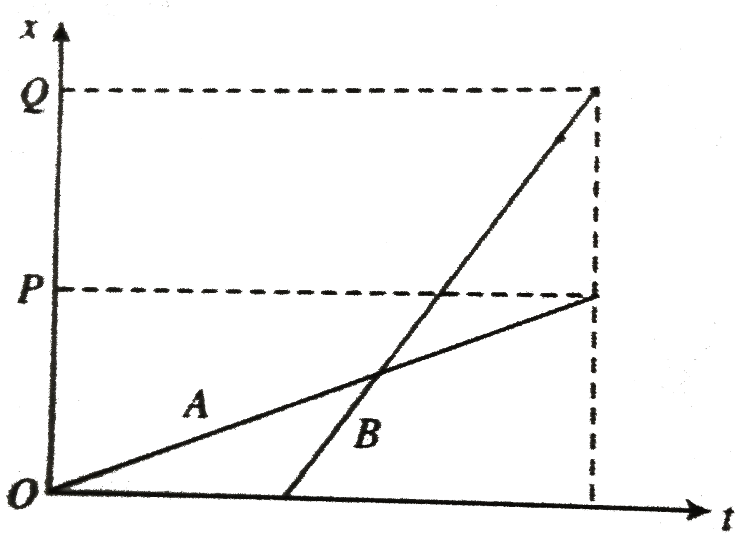
2. The position-time (x-t) graphs for two children A and B returning from their school O to their homes P and Q, respectively, are shown in . Choose the



a.(A/B) lives closer to school than (B/A).

b. (A/B) starts from the school earlier than (B/A).

c. (A/B) walks faster than (B/A).

d. A and B reach home at the (same//differnt) time.

e. (A//B) overtakes on the road (once//twice).

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3. A woman starts from her home at 9.00 a. m., walks with a speed of $5kmh^{-1}$ on straight road up to her office $2.5km$away, stays at the office up to $5.00p.m.$, and returns home by an auto with a speed of $25kmh^{-1}$. Plot the position-time graph of the woman taking home as origin.

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4. A drunkard waking in a barrow lane takes 5 steps forward and 3 steps backward, followed again 5 steps forward and 3 steps backward, and so on. Each step is $1m$long and requires 1 s $.Deter\min ehowlongthedrunkardtakes \rightarrow fall \in a\pi t$ 13 m\` away from start.

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5. A jet airplance travelling at the speed of $500 km^{-1}$ ejects its products of combustion at the speed of $1500 kmh^{-1}$ relative to the jet plane. What is the speed of the later with respect to observer on the ground ?

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6. A car moving aling a straight highway with speed of $126 kmh^{-1}$ is brought to a stop within a distance of $200 m$. What is the retardation of the car (assumed uniform) ans how doest it take fro the car to stop ?

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7. Two trains A and B of length $400 m$ each are moving on two parallel tracks with a uniform speed of $72 kmh^{-1}$ in the same direction with $AaheadofB$. The driver of ` (A) , what was the originaldistance between them ?

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8. On a two lane road , car (A) is travelling with a speed of $36 kmh^{-1}$. Tho car B and C approach car (A) in opposite directions with a speed of $54 kmh^{-1}$ each . At a certain instant , when the distance (AB) is equal to (AC), both being $km, (B) decides \rightarrow overtake$ A before C does , What minimum accelration of car (B) is required to avoid and accident.

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9. Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T min. A man cycling with a speed of $20 kmh^{-1}$ in the direction A to B notices that a bus goes past him every 18 min in the direction of his motion, and every 6 min in the opposite direction. What is the period T of the bus service and with what speed (assumed constant)do the buses ply on the road?

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10. A player throws a ball upwards with an initail speed of 129.4 ms^(-1)

$(a)W\hat{i}sthedirectionofae \leq rationdur \in gtheupwardmotionoftheball?(b)W\hat{a}rethevel$

=x 0 aand $t = 0$ be the loction and time at its highest point, vertically downward direction to be the positve direction of

X - $a\xi s$ and $givethesig \neq ofposition, velocity$ and $aelrationoftheballdur \in gitsupw$

$X - a\xi s$ and $givethesig \neq ofposition, velocity$ and $aelrationoftheballd$

. $(d)Tow\widehat{h}ightdoestheballrise$ and $afterhowlongdoestheballreturns \to t$

s hands. (Take g= 9.8 ms^(-23)` and begleact air resistance)

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11. Read each staremnt below carefully and state with reasons and expamples if it is true or false ,

(a) with zero speed at an instant may have non-zero accelration at that instant

(b) with zero speed may have non-zero velocity

(c) with positive speed must have zero accleration

(d) with positive value of acceleration must be speeding up.

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12. A ball is dropped from a height of a height of 90 m on a floor. At each collsion with the floor , the ball loses one - tenth of its speed . Plot the speed -time graph of its motion between t 0 to 12 s.

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13. Explain clearly, with ezamples, the distaintion between :

(a) magnitude of displacemnt (sometimes called distance) overand interval of time, and the total length of the path coverd by a particle over the same interval.

(b) magnitude of average velocity over an intercal of time , and the average speed ocer the same interval. [Average speed of a particle over an interval of time is defined as the toal path length divided by the time intrval]. Show in both (a) and (b) that the second quantity is either greater than or equal to first. When is the equality sing true ? [For simplocity, consider one- dimensional motion only]

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14. A man walks on a straight road from his home to a market $2.5km$ away with a speed of $5km/h$. Finding the market closed, he instantly turns and walks back with a speed of $7.5km/h$. What is the (a) magnitude of average velocity and (b) average speed of the man, over the interval of time (i) 0 to 30 min `. (ii) 0 to 50 min (iii) 0 to 40 min ?

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15. In abave questions $13 \text{ and } 14$, we have carefully distinguished between average speed and magnitude of average velocity. No such distainction is necessary when we considedr speed and magnitude of velocity. The instantneoud speed if alwary equal to the magnitude of nistantaneous velocity. Why ?

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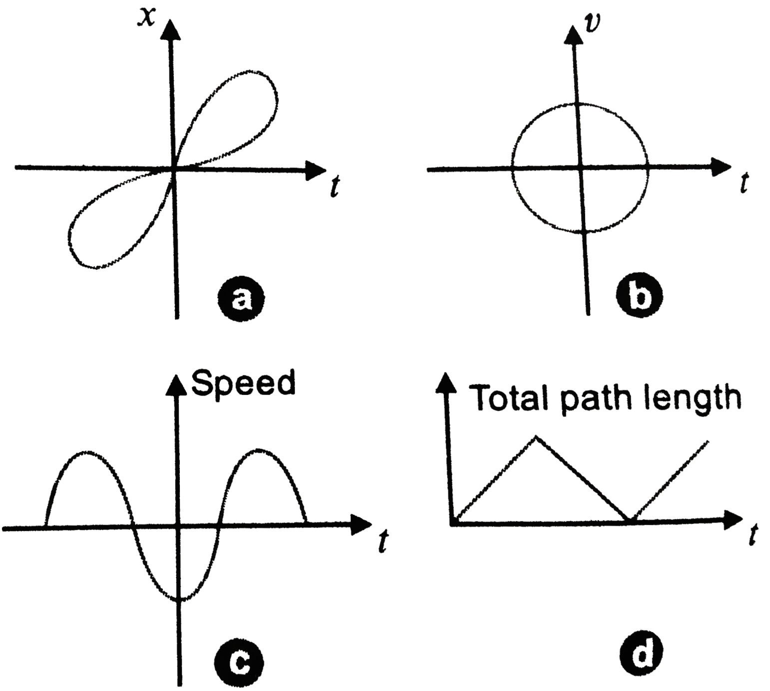
16. Look at the graphs Fig. 2 (NCT) .5.(a) to (d) carefully and state, with reasons, with of these connot possinly represent on edimensional motion of a particle.



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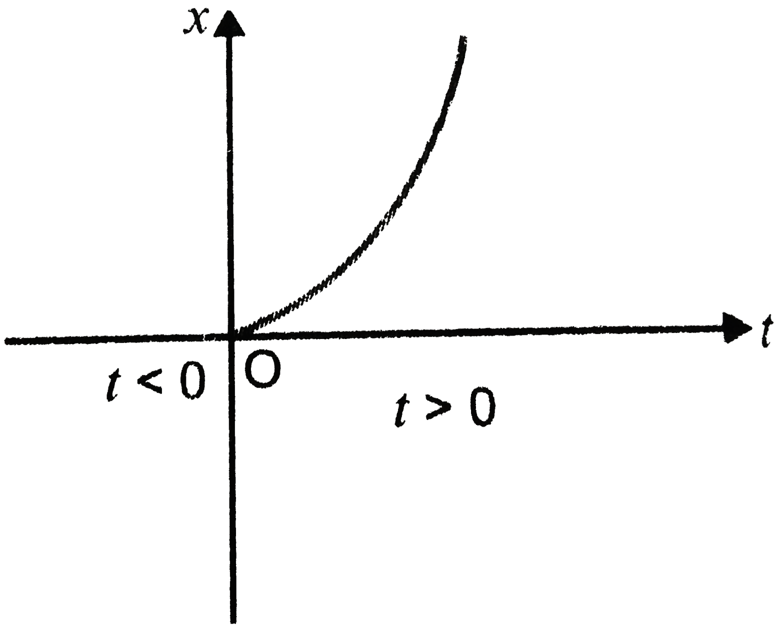
17. Fig. 2 (NCT). 6 shows x - t plot of one dismensional motion a particle. Is it correct to say from the graph that the particle moves in a straight line for $t < 0$and on a parabolic path form $t > 0$? If not, suggest a suitable physical contxt for this graph.



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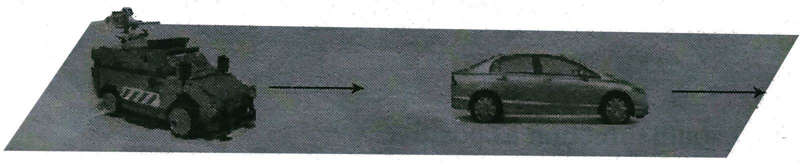
18. A police van moving on a highway with a speed of $30kmh^{-1}$ Fires a bullet at a thief's car speeding away in a same direction with a speed of $192kmh^{-1}$. If the muzzle speed of the buller is $150ms^{-1}$, with what speed does the bullet hit thief's car? .



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19. Suggest a suitable phusical situation for each of the following graph .

Fig. 2 (NCT) .7.

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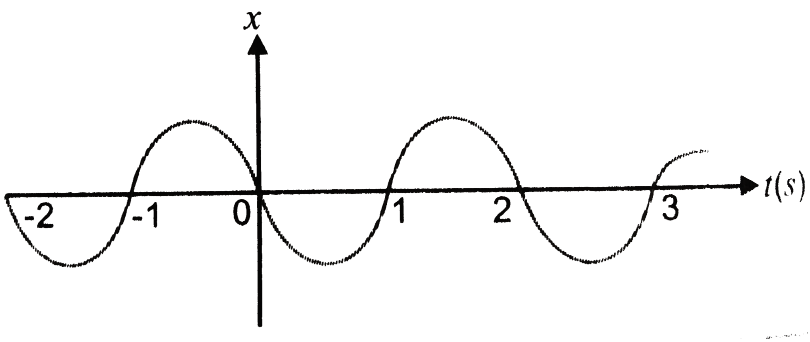
20. Fig 2 (NCT).8 gives the $x - t$ plot of a particle executing one dimensional simle harmonic motion. Give the signs of position, velocity and acceleration variables of the particles at $t = 0.3s, 1.2s, -1.2s$,



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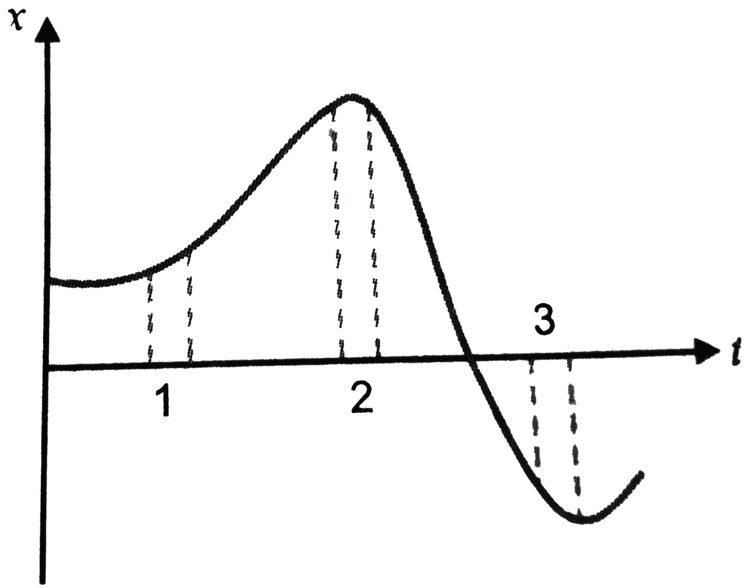
21. Fig. 2 (NCT).9 show the $x - t$ plot of a particle in one dimensional motion. Three different equal intervals of time are shown. In which interval the average speed is greatest and in which it is the least ? Give the sign of average speed for each interval.



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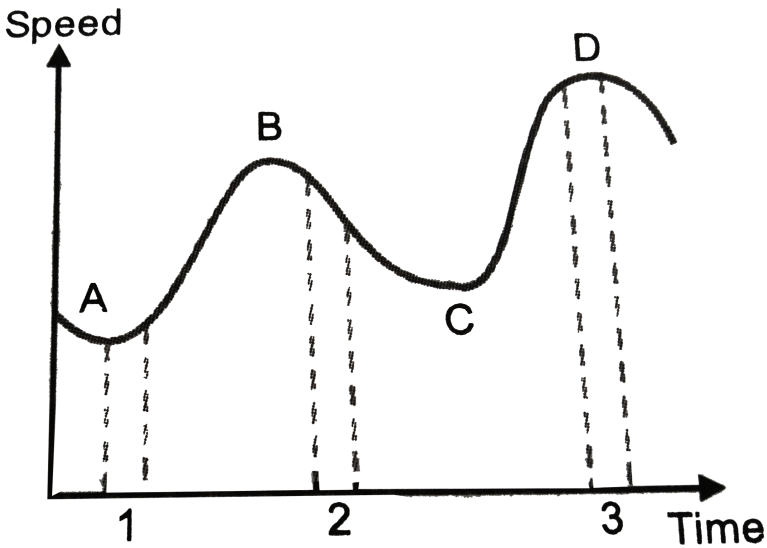
22. Fig. 2 (NCT). 10 . Give a speed-tiem graph of a particle in one dimenstional motion. Three different equal intervals of time are shwon. In which interval is the average acceleration graeatest in magnitude ? In which interval is the average speed greatest ? Choosing the positive direction as the constant direction of motion, give the signs of u and a in the three intervals. What are the acclerations at teh points A, B, C and D

?



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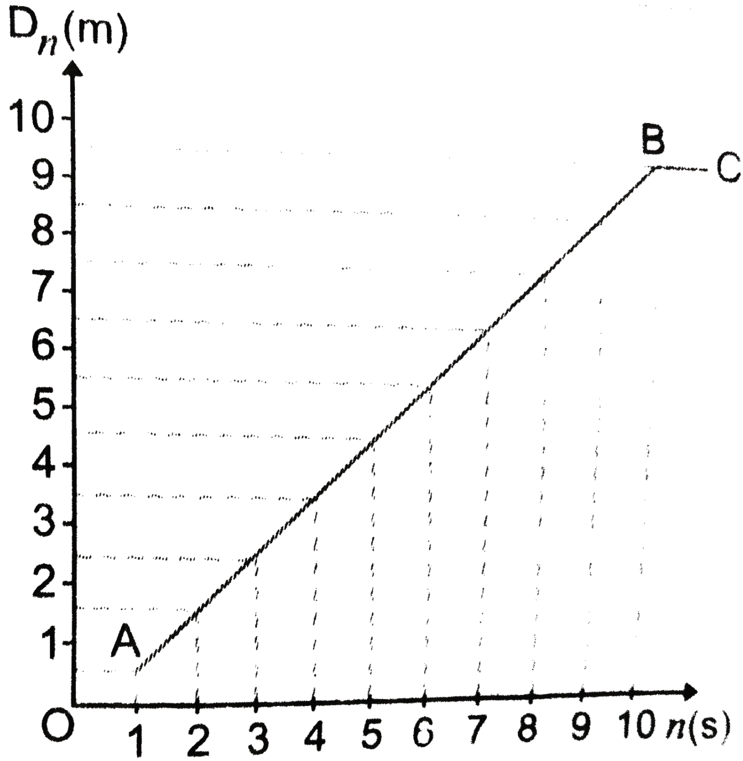
Additional Exercises

1. A three wheeler starts from rest, accelrates uniformly with $1ms^{-2}$ on a straight road for $10s$ and then moves with uniform velocity . Plot a graph between the distance coverd by the vehicle during the nth second (n = 1,2,3, ...) v ersus (n) What do you expect the plot to be during acclerated motion: a straight line or a parabola ?



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2. A boy standing on a stationary lift (open from above) thrown a ball upwards with the maximum initial speed he can, equal to $49ms^{-1}$. How much time does the ball take to return to his hands ? If the lift starts moving up with a uniform speed of $5ms^{-1}$ and the boy again throws the ball up with the maximum speed he can , how hoes the ball take to return to his hands ?

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3. A long belt is moving horizontally with a speed of $5kmh^{-1}$. A child runs on this belt to and fro with a speed of $9km/h$ (w.r.t. bett) between his father and mother located $50m$ apart on the belt. For an observer on a stationalry plateform outsied, what is the

(a) speed of the chils runningin the derection of motion of the belt, (b) speed of thechaild runing opposite to thedirection of the belt, and (c) time taken by the child in cases (a) and (b) ? Which of theanswers change, if motion is viewed by one of the parents ?gt

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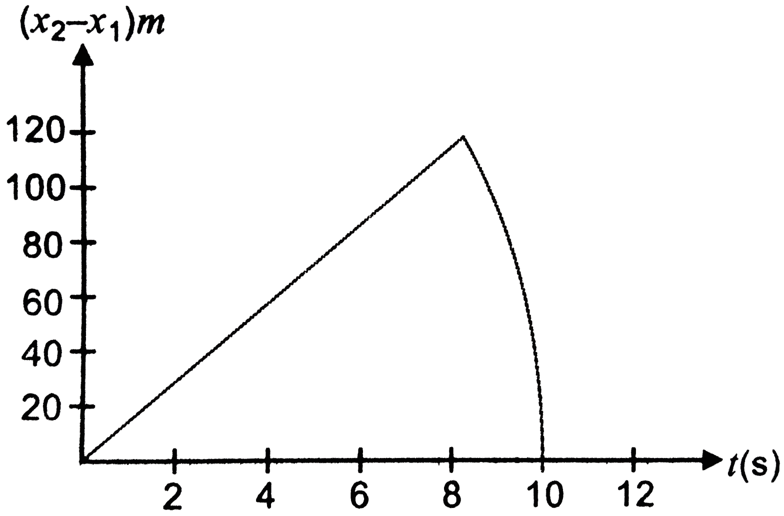
4. Two stones are thrown up simultaneously from the edge of a cliff $200m$ high with initial speeds of $15ms?^{-1}$ and 30^{-1}. Verify that the graph shown in Fig. 2 (NCT). 13 , correctly represents the time variation of the relativ e position of the second stone with respect to the first. Neglect the air resistance and assume that the stones do not rebound after hitting the ground. Taje $g = 10ms^{-2}$.Give equations for the linear and curved parts of the plot.



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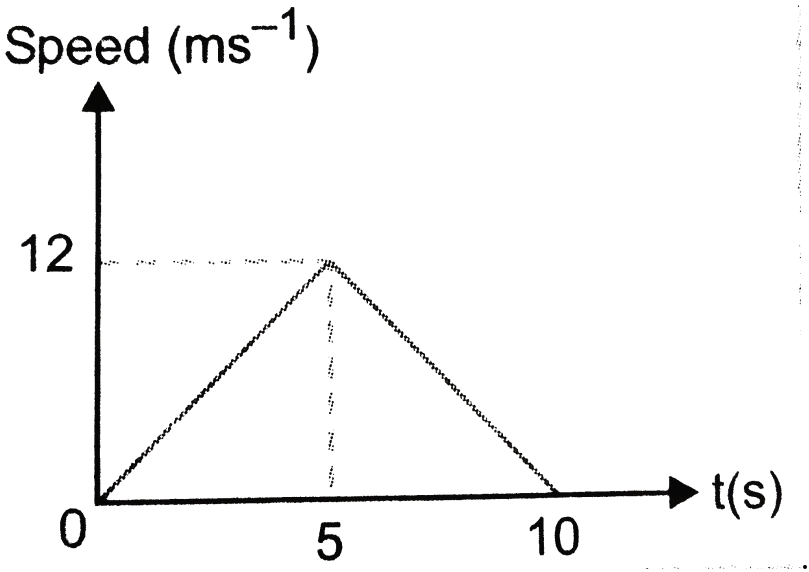
5. The speed -time graph of a particle moving along a fixed direction id shown ifn Fig. 2 (b) . 31. Fid (i) distance travelled by the particle between 0sec to 10sec (ii) average speed between thid interval (iii) the time when the speed was minimum (iv) the time when the speed was maximum.



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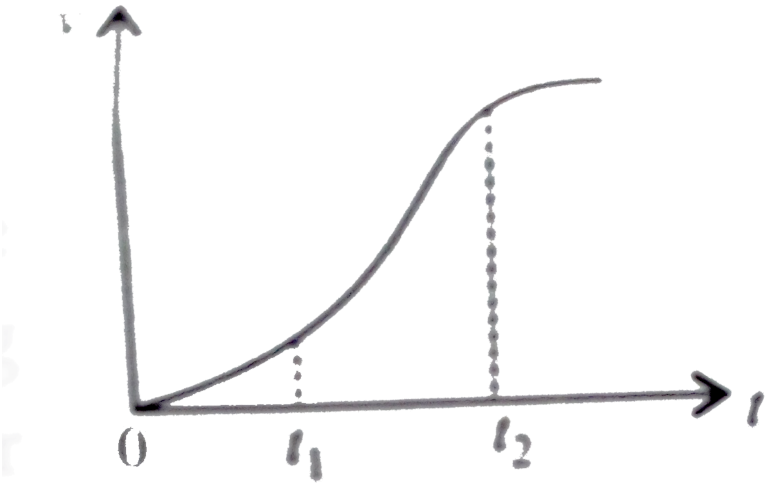
6. The velocity-time graph of a particle in one-dimensional motion is shown in the figure. Which of the following formulae is correct for describing the motion of the particle over the time interval t_1 to t_2?



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7. A vector has magnitude and dirction 9i) Does it have a olocition in the sparce ? (ii) Can it vary with time ? (iii) Will two equal vectors $\vec{a}$ and vec b` different locations in sparc necessarily have identical phusical effects ? Give examples in support of your answer.

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8. A vector has both magnitude and direction. Does that mean anything that has magnitude and direction is necessarily a vector ? The rotation of a body can specitied by the direction of the axis of rotation and the angle of rotation about th axis. Does tha make any rotation a vector ?

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9. Can you associate vectors with (a) the length of a wire bent into a loop (b) a plane area (c) a sphere ? Explain.

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10. A bullet fired at an angle of 30° with the horizontal hits the ground 3.0 km away. By adjusting its angle of projection, can one hope to hit a target 5.0 km away? Assume the muzzle speed to be fixed and neglect air resistance.

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11. A fightre plane flying horizontally at an altitude oa $1.5km$ with speed $720h^{-1}$ passes directly over head an anticraft gun. At what angle from the vertical should the gun be fired from the shell with muzzle speed $600ms^{-1}$ to hit plane. At what minimum altitude showld the pilot fly the plane to avoid being hit ? (Take g= 10 ms^(-2)).

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12. A cylclist is riding with a speed of $27kmh^{-1}$. As he approaches a circular turn on the road of radius $80m$, he applies brakes and reduces his speed at the constant rate of $0.5ms^{-2}$. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn ?

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13. (a) Show that for a projectile the angle between the velocity and the x-axis as function of time is given *by* theta_(t) = tam ^(-1) (9 4 h_m)/R)`

where the sybols have thir usual meanings.

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Motion

1. State, for each of the following physical quantities, if it is a scalar or a verctor. Volume, mass speed acceleration, density, number of moles, velocity, angular frequencey, displacemnt, angular velocity.

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2. Pick out the tw scalar quantity in the follwing lists : force, angular momentum, work, melocity.

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3. Pick out the only vector quantity in the following list : temperature, pressure, impluse, time, power. Total path-length, energy. Gravitational potential, coefficient of friction, charge,

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4. State with reasons, whether the following algebraic operations with scalars and vectors ar meaningful. (a) Adding any scalar. 9b0 multiplying any tow sclars (e) Adding any two vectors (f) Adding a component of a vector to the same vector.

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5. Read each statement below carefully and state with reasons, with it is true or false :

(a) The magnitude of vector is always a scalar. ltBrgt (b) Each component of a vector is alwarys a scalar.

(c) The total path length is always equal to the magnitude of the displacement vector of a particle.

(d) The average speed of a particle (defined as total path length diveked by the time taken to cover the path) is eigther greater or equal to the magnitude of average velocity of the particle over the same interval of time. ltbRgt (e) three vectors not lying in a planc ecan never add up to give a null vector.

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6. Establish the following inequalities geometrically or otherwise ,

(a) | vec A + vec B| -lt | vec A | + |vec B|, | vec A + vec B| gt- ||vec A- | vec B||

(C) | vec A- vec B| -lt | vec A| + vec B|$(d)\left|\vec{A} - \vec{B}\right| > - \left|\left|\vec{A}\right| - \left|\vec{B}\right|\right|$

When does the equality sign above aplly ?

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7. Give $\vec{A} + \vec{B} + \vec{C} + \vec{D}$ =0, $whichofthefollow \in gstatementsarec$ or $rect?(a)$

vec A, vec B ,vec C abd vec C$\mu steachbeavll \vec{r}.(b)Themagnitudeof$ (vec A +

vec C)$equalsthemagnitudeof$ (vec B + vec D0. $< Br >$ $(c)Themagnitudeof$ vec

A$can \neq verbegreaterthanthe \sum ofthemagnitudeof$ vec B , vec C $\text{ and } \vec{D}$.

(d) $\vec{B} + \vec{C}$ must lie in the plance of $\vec{A} + \vec{D}$. $\text{ if } \vec{A} \text{ and } \vec{D}$ are not colliner and in the line of $\vec{A}$ and $\vec{D}$, if they are collinear.

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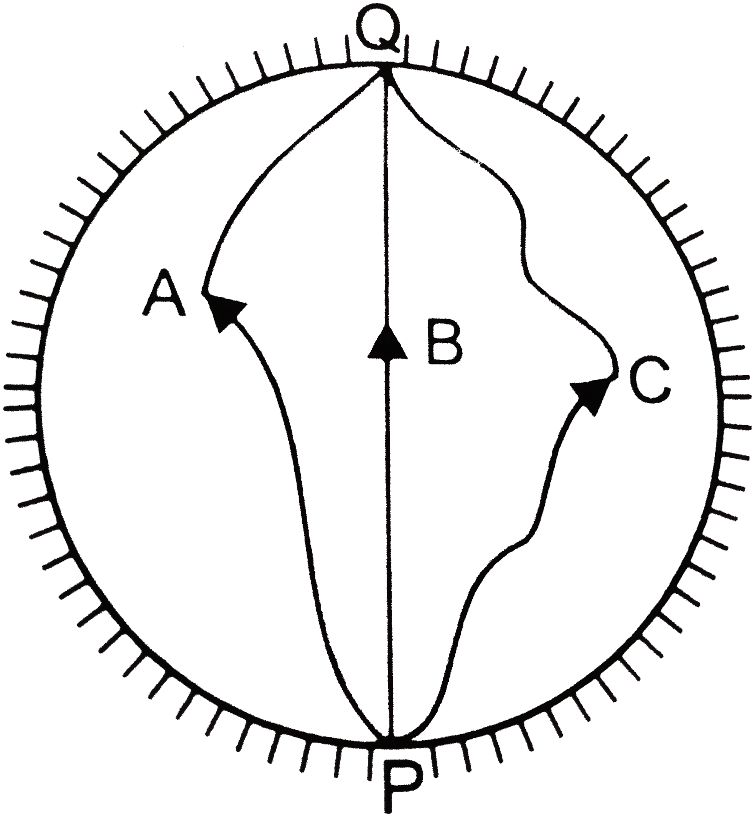
8. Theree girls skating on a circular ice ground of radius $200m$ start from a point (P) on the edge of the ground and reach a point Q diametrically opposite to (P) following different paths as shown in Fig. (NCT) . 17. What is the magnitude of the displacemnt vector for each ? which girl is thsi equal to the actual length of path skated ?



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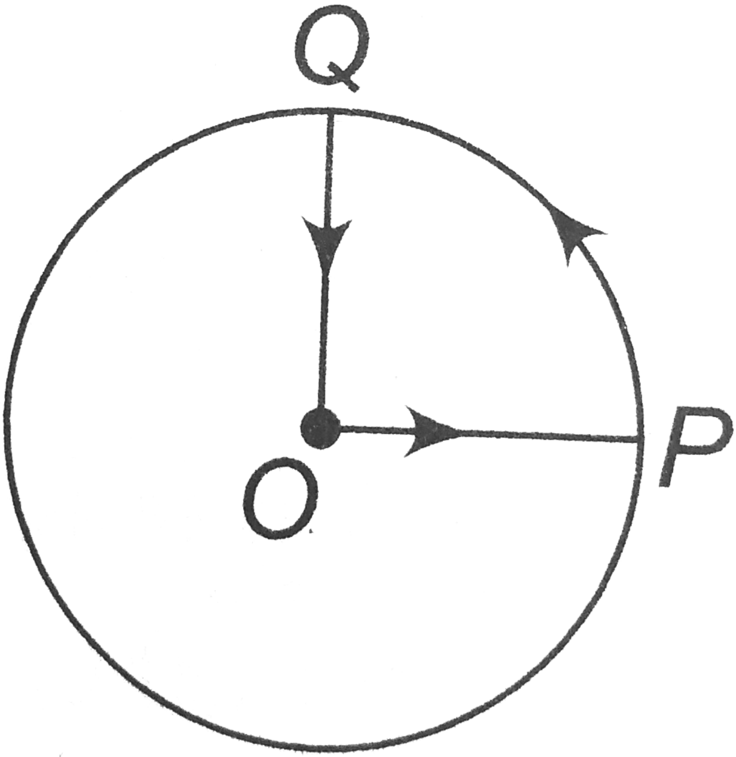
9. A cyclist starts from the centre O of a circular park of radius 1km, reaches the edge P of the park, then cycles along the PQ cicumference and returns to the centre along OQ as shown in fig. If the round trip taken ten minute, the net displacement and average speed of the cylists

(in kilometer and kinetic per hour) is



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10. On an open graound , a motor ist follws a track that truns to his left by an angle of 60° after every $500m$. Starting from a given trun , specify the displacement of the motorist at the third, sizth and eighth turn.

Compare the magniude of the dispalcembt with total path length coverd by the motorist in each case.

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11. A passenger arriving in a new town wishes to go from the station to a hotel located $10km$ away on a straight road from the station. A dishownest cabman takes him along a circuitons path $23km$ long and reaches the hotel in $28 \min mtes$. What is (a) the average speed of the taxi, (b) the magnitude of average velocity ? Are the two equal ?

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12. Rain is falling vertically with a speed of $30ms^{-1}$. A woman rides a bicycle with a speed of $10ms^{-1}$ in the North to South direction. What is the direction in which she should hold her umbrella ?

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13. A man can swim with a speed of $4kmh^{-1}$ in still water. He crosses a river 1km wise that flows steadily at $3kmh^{-1}$. If he makes his strokes normal to the river current, how far down the river does he go when he reaches the other bank?

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14. In a harbour, wind is blowing at the speed of $72km/h$ and the flag on the mast of a boat anchored in the harbiyr flutters along the $N-E$ direction. If the boat starts moving at a speed of $51km/h$ to the North, what is the direction of flag on the mast of the bat ?

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15. The ceiling of a long hall is $25m$ high. What is the maximum horizontal borizontal distance that a ball thrown with a speed of $40ms^{-1}$ can go without hitting the ceiling of the hall ?

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16. A cricketer can throw a ball to a maximum horizontal distance of 100m. With the same speed how much high above the ground can the cricketer throw the same ball?

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17. A stone tied to the end of a string 80 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolutions in 25 seconds, what is the magnitude and direction of acceleration of the stone ?

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18. An air craft executes a horizontal loop of radius $1km$ with s steady speed of $900kmh^{-1}$. Compare its centripetal acceleration with the acceleration due to gravity.

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19. Read each staremnt below crefully and state, with reasons, if it is true or false : (a) The net acceleration of a particle in circular motion is always along the radius of the circle towards the centre.

(b) The velocity vector of a particle at a point is always aling the tagent to the path of the partile at that point. ltbRgt (c) The acceleration vector of a particle in uniform circular motion acraged over one cycle is a null vector.

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20. The position of a particle is given by $\vec{r} = 3.0t\hat{I} - 22 - 0t^{\circ}\hat{j} + 4.0\hat{k}m$, wher 9t) in seconds and the coefficits have the proper units for $\vec{r}$ to be in metres. (a) Fing the $\vec{v}$ and vea of the particle ? (b) What is the magnitude and direction fo velocity of the particle at $t = 2s$?

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21. A particle starts from the origin at $t = 0$ with a velocity of $10.0\hat{j}m/s$ and moves in the X-$ypla \ne withaconstanta \le rationof$ (8.0 hat I + 2. 0 hat j) ms^(-2) . (a) At wht time is the s-coordinate of the particle $16m$? What is the y-coordinate of the particle at that time ? (b) What is the speed of the particle at that time ?

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22. $\hat{i}$ and $\hat{j}$ are unit vectors along x-and y-axes respectively. What is the magnitude and the direction of the vectors $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$? What are the components of a vector $\vec{A} = 2\hat{i} + 3\hat{j}$ along the direction $\hat{i} + \hat{j}$and $\hat{i} - \hat{j}$?

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23. Foe an arbitrary motion in sparce, which ot the following relations are true :

(a0 $\overrightarrow{avera \ge} = \frac{1}{2}\left[\vec{v}\left(t_{10} + \vec{v}\left(t_2\right)\right]\right.$

(b) $\vec{\_}$ $(avera \ge) = \left[\vec{r}9t_2\right) - \vec{r}(t - 10]/\left(t_2 - t_{10}\right.$

(c) $\vec{v}(t) = \vec{v}(0) + \vec{a}t$

(d) $\vec{r}9t\Big) = \vec{r}90\Big) + \vec{v}(0)t + (1/2)\vec{a}t^2$

(e)

$\vec{a}_{avera \geq} = \left[\vec{v}\left(t_2\right) - \vec{v}(t-2)\right]/\left(t_2 - t_1\right)1 Theavera \geq \text{standsf or } avera \geq ofthewuan$

t_1 and t_2].

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24. Read each statement below carefully and state with reason and examples, if it is true or false. A cslar quantity is one that (a) is conserved in a proces (b) can never take negative values (c) must be dimensionless (d) does not vary from one point to another in space (e) has the same value for observers with differnt orientations of axes.

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25. An aurcraft us fluing at a height of $3400m$ above the fround, If the angle subtended at a grond observation point by the aircraft positions

$10s$ apart is 30°, what is the speed of the aircraft ?

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Higher order thinking skills

1. The speed of a projectile (u) rekuces by 50% on reachig maximum hight. What is the range on the horizontal plane ?

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2. One second after the projection, a stone moves at an angle of 45° with the horzontal. Two seconds from the start, it is travelling horizontally. Find the angle of projection with the horizontal. (g=10 ms^(-2))`.

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3. A particle is thrown with velocity 9u) making an angle θ with the vertical. It just crosses the top of two poles each height (h) after $1s$ and $3s$ respectively . Fing the maximum hight of projecile. G= 9.8 ms//s^2`.

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4. Two bodies of masses M and m are allowed to fall from the same height . If air resistance for each body be same , will the two bodies reach the ground simultaneously ?

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5. The deceleration exerienced by a moving motor blat, after its engine is cut-off is given by $dv/dt = -kv^3$, where k is constant. If v_0 is the magnitude of the velocity at cut-off, the magnitude of the velocity at a time t after the cut-off is.

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6. A rectangular box is sliduing on a smooth inclined plane of inclination α, Att=0` the box starts to move on the inclined plane . (A) bolt starts to fall from point (A) .Fig. 2 (HT). 2. Find the time after uhich bolt strikes the bottom surface of the box.

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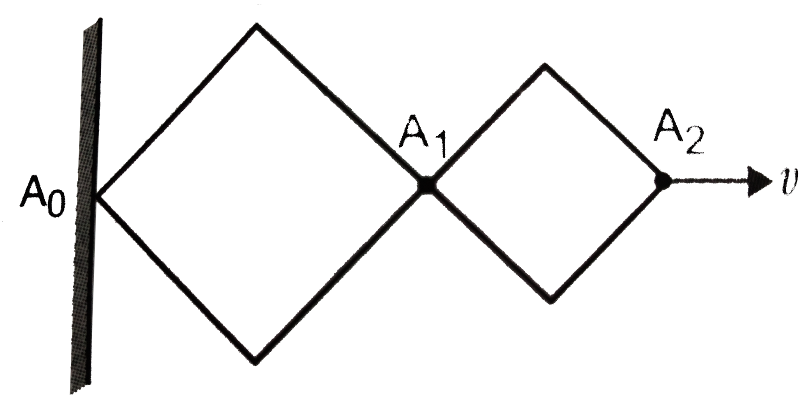
7. The given construction as shown in Fig. 2 (HT) .3, consists of two rhombus with the ration $3:2, Thevetex$A_2 $movesIntheh$ or $izontaldirectionwithavelocity$ v. $F \in dthevelocityof$ A_1`.



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8. A steam boat goes across a lake and comes back : (a) on a wuiet day when the water is still and (b) on a rough day when there is a uniform current so as to help the joruney onward and to impede the journey backward ,. If the speed of launch on bothe days same, in which case will it coplete the journey in lesser time?

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9. A juggler keeps (n) balls going with one hand so that at any instant, (n-1) blls in air in air and one ball in the hand, If each ball rises to a height of 9x) metre, find the time for which each ball stays the hand.

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10. What is the displacement of the point of a wheel initially in contact with the ground when the wheel rolls forward half a revolution? Take the radius of the wheel as R and the x-axis as the forward direction?

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11. A man standing on a road has to hold his umbrella at 30^0 with the vertical to keep the rain away. The throws the umbrella and starts running at 10 km/h. He finds that raindrops are hitting his head vertically. Find the speed of raindrops with respect to a. the road, b. the moving man.

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12. A point moves with a uniform acceleration and $v_1 v_2 v_3$ denote the average velociies in the three succellive intervals of time $\_ 1, t_2$ and t_3`. Find the ration of (v-1 - v_2) and (v_2 - v_3).

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13. A ball proected vetically upwards from (A), the top fo tower reaches the ground in t_1 second. If it is projected vectically downwards from (A) with the same vecoty, it reaches the ground in

$t_2 secons. If it falls seelyom (A), show t \hat{i} two \underline{d} reahc the ground \in$ sqrt t_1 t-2 seconds`.

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14. Two particles, 1 and 2, move with constant velocities v_1 and v_2 along two mutually perpendicular straight lines toward the intersection point O. At the moment $t = 0$ the particles were located at the distances l_1 and l_2 from the point O. How soon will the distance between the particles become the smallest? What is it equal to?

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Value based

1. Every car, you know , is fitted with an odometer, whichn indicates the actual distance travelled by the car, In going from Ambala to Delhi taken was 9 hours, ltbRgt Read the above passage and answer the following questins:

(i) What are the values of avetage speed and avetage velocity over the jouney ?

(ii) What is more relevant : average speed or avetage velocity ? (iii) What are the paracticla mplications of this study ?

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2. While travlling on high ways, many of us have a tendency to overspeed cross the prescribed speed linmit, especially when there are no visible obstacles on the path and the traffic police. We simply forget that speed thrills but kills. ltbRgt (i) What are the dangers and risks of overspeeding ?

(ii) From this study, what values do you learn in day to day life ?

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3. From the top of a builing , a ball is dropped, while another ball is projected horizontally at the same time, It is estimated that (i) two balls will strike the ground simultaneously, (ii) two balls will strike the ground with the same sped.

Read the above passage and answer the foolwing questions :

(i) Do you agree with the two statements ? ltbRgt (ii) How do you justify answer physically ?

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4. While delivering a lecture on $\vec{\rightarrow} rs$ Phusics teacher told the students about zero vector or mnll vector, i.e. a vector which has zero magnitude and arbitray direction. It is represented by $\vec{0}$ (arrow ovet the numnet zero . The students wer baffled.

Read the above passage and answer the following questins :

(i) What was the becessity of the concept zero vector ? ltbRgt Give any one illustravion of zero vector.

(ii) What is the phusical significane of zero vector ?

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5. Honey goes to school with his sister Shreya in their own car,=. The school is about $10km$ from their home, They dirve on alternate days. Shreya is a very careful driver, but Honey is a rasher. He takes 3 minutes lesser than Shreya in reaching the school. Shreya advises Honey to drive safely,

but he hardly listens. ltbRgt Read the above passage and answer the following wuestions : ltbRgt (i) What values are displayed by Shrey ? Do you agree with her ?

(ii) What is the differnce between average speeds of Honey and Sherya if latter takes 15 min . to drive to the school ?

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1 Problems for practice

1. On turning a corner, a motorist rushing at $44ms^{-1}$ finds a child on the road $100m$ away. He applies the brakes so as to stop the motorcar within $1m$ of the child. Calculate the time required to stop.

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2. A body travels from $A \rightarrow B$ at $40ms^{-1}$. And from $B \rightarrow A$ at 60 ms^(-1)`. Calculate the average speed and average velocity.

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3. On a $100km$ track, a train mvoes the first $50km$ with a uniform speed of $50kmh^{-10}$ How fast must the train travel the next $50km$ so as to have average speed ` 60 km h^(-1) for the entire trip ?

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4. A cyclist moving an a circular track of radius $50m$ completes one revolution in $2 \min utes$. What is his (i) distance covered (ii) dislacement (iii) average speed (iv) average velocity, in one full revolution.

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5. A car travelled the first third of a distance (x) at a speed of $10km/h$, the second third at a speed of $20km/h$ and the last third at a speed of $60km/h$. Determine the average speed of the car over the entire distance (x).

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6. A cae is travelling along a straight line. It covers one-half of the total, distance with a velocity $10km/h$. The remaining part of the distance was covered with velocity $12ms^{-1}$. For half the time and with velocity $16ms^{-1}$ for the other half the tiem. Find the average speed over the whole time of motion.

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7. A table clock has its minute hand $5.0cm$ long. Find the average velocity of the tip of the miute hand (a) between $6.000a.m.$ to 6. 15 a.m. and (b) between $6.00a.m. \rightarrow 6.30.p.m.$

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8. The science lecture theatre of a college is $10m$ wide and has a dorr at a cormer. A science techer entres at 12.00 noon through the dorr and makes $8 roundsalongthe$ 10 m $wallback$ and f or $thdur \in gtheperiod$ and $f \in aal \leq avestheclassr\infty mat$ 12 . 40 p.m. through the same door. Compute the averae speed and average velocity.

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9. A ship moves due east at $12kmh^{-1}$ for one hour and then turns exactly towards south to move for and hour at $5kmh^{-1}$. Calculate its average velocity for the given motion.

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10. A body travelling along a straight line traversed one thired of the total distance with a velocity $4ms^{-10}$. The remaining part of the distance was covered with a velocity $2ms^{-1}$ for half the time and with velocity $6ms^{-1}$ for the other hald of time . What is the mean velocity averaged over te whle time of motin ?

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11. A drunkard waking in a borrow lane takes 6 steps forward and 4 steps backward, following againg 6 steps forward and 4 steps backward and so on Each step is 1m long and requires $1s$. Determine how long the drunkard takes to fall in a pit $15m$ away from the start.

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12. Two trains $90m$ and 120

$\in \leq n > hareru \cap \in g \in oppositedirectionsonparal \leq ltrackswithvelocitye$

72 km//h and 36 km//h`. In what tiem they will complerely cross each other ?

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13. Two card are moving in the same direction with the same speed of $30kmh^{-10}$ at a distance of $5km$ from each other . A third car moving in the opposite direction meets these two card at an interval of 4 minutes. Find the speed of third car.

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14. A jet airplane travelling at the speed of $500kmh^{-1}$, ejects the burnt agses at the speed of $1100kmh^{-1}$, relative to the jet airplance. Find the speed of the burnt gases .w.r.t. a stationary onserver on earth.

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15. A car (A) is moving with a speed of $40 kmh^{-1}$ and car (B) is moving with a speed of 60 km h^(-1)

$, alongparal \le lstraightpaths, \star t \in gomthesamep \oint . \hat{W}isthepositionofcar(A)w.r.$

15 minutes` ?

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16. Two trains $120m$ and $100m$ in length are tunning in opposite directions with velocityes $42kmh^{-1}$ and $30kmh^{-1}$ In what tiem they will completely cross each other ?

Watch Video Solution

17. If a man$sspeedwoth$ and $aga \in stthewardrcurrent \in ariverbe$ 15 km h^(-1) and 5 km h^(-1)$thent \in doutthemans$ speed in still warer and the speed of the river.

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18. Two buses started simultanceously towards each other from towns (A) and (B) wich are $480km$ apart, It took the first bus travelling from (A) to (B) eight hours to cover the distance and the second bus travelling frome (B) to (A) ten hous. Determine. when the buses will meet after starting and at what distance from (A).

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19. A police is chasing a culprit going n a motorbike. The motorbike crosses a turning at a speed of 72 km/h.

The jeep follows it at a speed of 90 km/h, crossing the turning tenseconds latert than the bike. Assuming that they tavel at constant speeds, how far from the turning will the jeep catch up with the bike?

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20. Two trains, each of length $100m$, are running on parallel tracks. One overtakes the other in $20second$ and one crosses the other in $10second$.

Calculate the velocities of two trains.

Watch Video Solution

21. Tow card are moving in the same direction with the same speed $30km/h^{-1}$. They are separated by a distance of 4 km. What is the speed of a car moving in the opposite driection if it meets these two card at an interval if ` 5 mimutes.

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22. Three particles A, B and C are situated at the vertices of an equilateral triangle ABC of side d at time $t = 0$. Each of the particles moves with constant speed v. A always has its velocity along AB, B along BC and C along CA. At what time will the particles meet each other?

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23. A car travelling ast 60 km/h overtakes another car travellign at 42 km/h. Assuming each car to be 5.0 m long, find the time taken during the overtake aned the total road distance used for the overtake.

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24. The speed of a motor launch with respect to water in a stream is $8ms^{-1}$ while water current's speed is $3ms^{-1}$. When the launch began travelling upstream, a float was dropped from it. After travelling a distance of $4.8km$ upstream, the launch turned back and caught up with the float. What is the total time which elapsed during the process?

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25. Two persons (P) and (Q) are standing $54m$ apart on a long moving belt. Person (P) rolls a round staone towards person (Q) with a speed of $9ms^{-1}$ with respect to belt . If the belt is moving with a speed of $4ms^{-1}$ in the direction from (P) to (Q) (a) What will be the speed of the stone with respect to an observer on a stationary platform if person (Q) rolls the stone with a velocity of $9ms^{-1}$ with respect to the belt towards person (P) and the time taken by the stoine to travel from (Q) to (P) ?

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2 Problems for practice

1. On turning a corner, a motorist rushing at $44ms^{-1}$ finds a child on the road $100m$ away. He applies the brakes so as to stop the motorcar within $1m$ of the child. Calculate the time required to stop.

Watch Video Solution

2. A train moves with a constant speed of $36kmh^{-1}$ in the first $10 \min utes$, with another constant speed of $45kmh^{-1}$ in the bext $10 \min vtes$ and then with an acceleration of 5 ms^(-2) $\in thel \ast$ 10 minutes. Calculate the average speed of last $10 \min utes$. Calculate the average speed of the train for this journey and the total distance travelled.

Watch Video Solution

3. An object is moving along+ve x-axis with a uniform acceleration of 4 ms^(-2). $Attime$ t=0. $X = 4m$ and $v = 2ms^{-1}$. $(a)W\hat{w}illbethevelocity$ and $positionoftheobjectattime$ t=3 s?

(b) What will be the position of the object when it has a velocity $8ms^{-1}$?

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4. An object is moving with a uniform acceleration. Its velocity after $5s$ 25 ms^(-1) and $after$ 8 s$is34ms^{-1}$ Find the distance travelled by the object in ` 10 th second.

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5. An object is moving with uniform acceleration. Its velocity after $4 s is 20 ms^{-1}$ and after 7 second is 29 ms"^(-1)` . Find the distanc etravelled by the object in 10 th second.

Watch Video Solution

6. A body covers $12m$ in $2nd$ second and $20m$ in $4th second$. Find what distansce the body will cover in $4 second$ agter the $5th second$.

Watch Video Solution

7. An object is moving along a straight line path with a uniform accleration of $4ms(-2)$. Intitially its lociation is at $5ms$ and velcity is $3ms^{-1}$. ltbRgt (i) What will be position and the velocity of object at time $t = 3s ? (ii) W\hat{w}ill be the position of the object when it has a a \in edavel cotiy$ 8 ms^(-1)` ?

Watch Video Solution

8. An automobile starts from rest and accelerates unifomly for $30second \rightarrow aspeedof$ 72 km h^(-1) $. Itthenmoveswithaun$ if or $mveocit$ and $itisf \in allybrought \rightarrow rest \in$ 50 m$withaconstantr\eta rdation. Ifthe \rightarrow taldistancetravel \leq dis$ 950 m`, find the accleration, the retaradation and total time taken.

Watch Video Solution

9. Two diamonds begin a free fall from rest from the same height, 1.0 s apart. How long after the first diamond begins to fall will the two diamonds be 10 m apart? Take $g = 10m/s^2$.

Watch Video Solution

10. A stone is dropped from the top if a cliff and is found to travel $44.1m$ in the last second before it reaches the ground . Fing the height of the cliff.

A. 100

B. 122.5

C. 150

D. 200

Answer: B

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11. A ball thrown up is caught by the thrower after $4second$. How high did it go and with what velocity was it thrown ? How far below its highest point was in $3second$ after starts ? Acceleration due to gravity is $9.8ms^{-2}$.

Watch Video Solution

12. From the top to a tower $100m$ in height a ball is dropped and at the same instant another ball is projeced veticall y upwards from the ground so that it just reaches the top of tower. At what height do the two balls pass one another ?

Watch Video Solution

13. A bodu starting from rest, was onserved to cover $20m$ in $1secnd$ and 1 40 m` during the next second. How far had it travelled before the first observation was taken ?

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14. A body is in motion along a strainght line. As it crosses a fixed point a stop watch is started . The body travels a distance of $1.80m$. In the first 3 second and 2.20 m in next 5 seconds. What will be the velocity at the end of 9 second ?

Watch Video Solution

15. A ball is dropped from the roof of a tower of height (h). The total distanc coverd by it in the last second of its motion is equal to the distance covered by in first three seconds. What will be the velocity at the end of $9\sec \in d$?

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16. A balloon rising vertically up with unitrom velcity $15ms^{-1}$ releases a ball at a deight of $100m$. Calculate the time taken by the ball to hit the ground and total height of balloon when ball hits the ground. Take $g = 10md^{-2}$.

Watch Video Solution

17. A stone is dropped from a balloon at an altitude of $300m$. How ling will the stone take to reach the ground of (a) the balloon is ascending with a velocity of $5, s^{-1}. (b) the ballon is descend \in g with a velocity of$ 5 ms^(-1)` (c) the balloon is shationary ?

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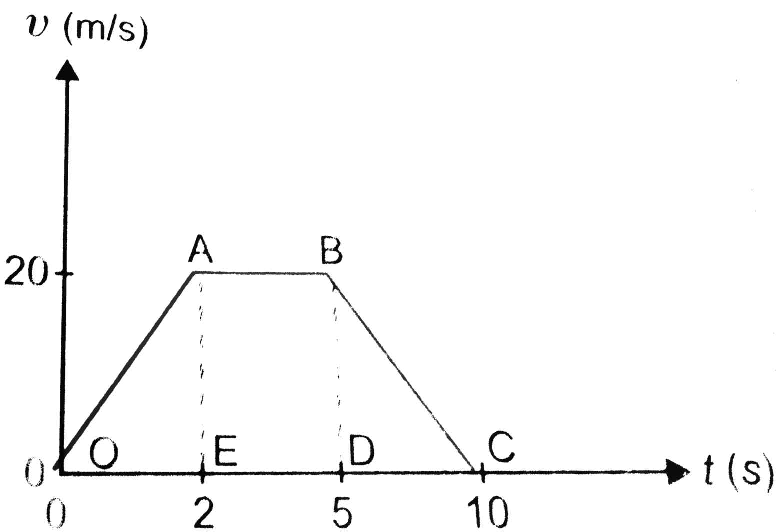
18. A food packet is released from a helicopter which is trising steadily at $3ms^{-1}$. After $3seconds$, (i) what is the velocity of the packet? (ii) how far is it below the helicopter ? Take $g = 9.8m/s^2$.

Watch Video Solution

19. The velocity (u)-time (t) graph of an object moving alon a straight line is as shown is Fig. 2 (b) . 30. Calculate the distance covered by object between $(i)t = 0 \rightarrow t = 5s$ (ii) $t = 0 \rightarrow t = 10s$.



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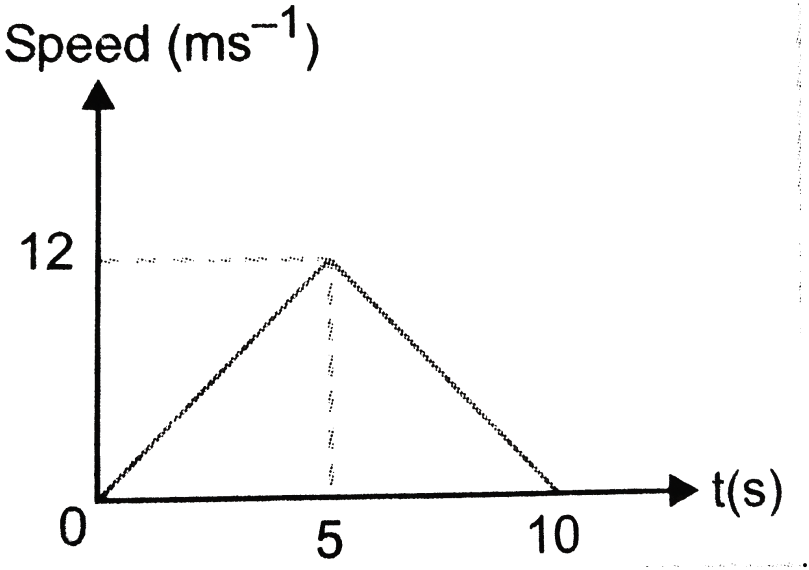
20. The speed -time graph of a particle moving along a fixed direction id shown ifn Fig. 2 (b) . 31. Fid (i) distance travelled by the particle between $0 \sec$ to $10 \sec$ (ii) average speed between thid interval (iii) the time when the speed was minimum (iv) the time when the speed was maximum.



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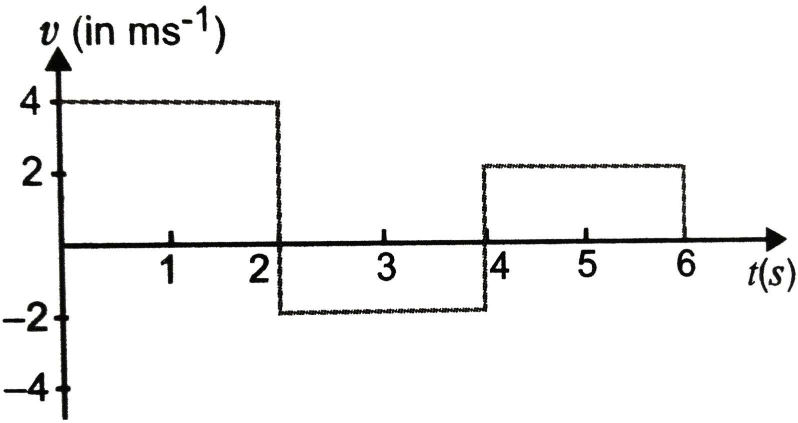
21. The velocit-time graph of a body moving in a straight line is shown in Fig. 2 (d) . 32. Find the displacement and the distance travelled by the body in $6 seconds$.



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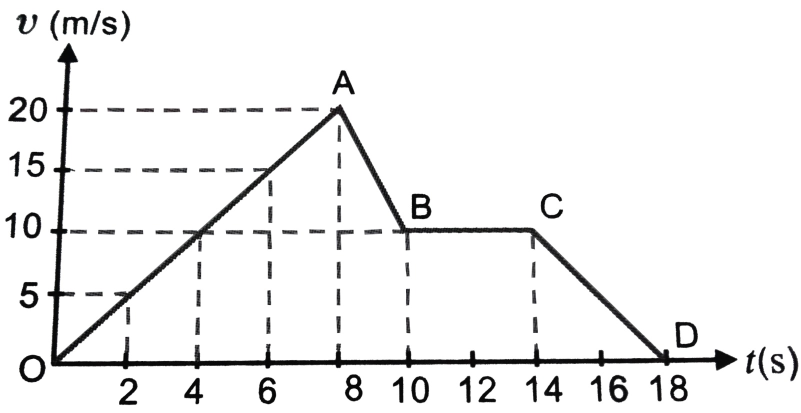
22. The velocity-time graph of a particle moving along a straight line is shown id Fig. 2 (b) . 33. Calculate the distance covered between $t = 0$ to $t = 10 seconds$. Also find displacement tn time $0 \rightarrow 10 seconds$.

.

Watch Video Solution

23. The velocity-tiem graph of a particle movitgn along a straight line is shown in the Fig. 2 (b) . 34$becurve$ OABCD . $Calc\underline{a}tethedistancecoveredbythepartic \leq between(i)$ t =zero to $t = 18seconds(ii)t = 2s \rightarrow t = 12s$. And the maximum value of acceleration during this interval.



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24. A car accelerates from rest at a constant rate α for some time after which it decelerates at a constant rate β to come to rest. If the total time lapse is t seconds , evauate.

(i) maximum velocity reached , and

(ii) the total distance travelled .

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25. A car accelerates from rest at acionstant rate $36kmh^{\circ}$ to comet to rest. If the total time elapsed id ` 1 hour, calculate (i) the maximum velocity attained by the car and (ii) the total distance travelled by car.

Watch Video Solution

26. The acceleration a in ms^{-2} of a particle is given by $a = 3t^2 + 2t + 2$, where t is the time. If the particle starts out with a velocity $v = 2ms^{-1}$ at $t = 0$, then find the velocity at the end of $2s$.

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27. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by $y = \left(8t - 5t^2\right)m$ and $x = 6tm$, where t is in seconds. The velocity with which the projectile is projected at $t = 0$ is.

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28. A particle moves along a staight line such that its displacement at any time t is given by $s = t^3 - 6t^2 + 3t + 4m$. Find the velocity when the acceleration is 0.

Watch Video Solution

29. The dispkacement of particle is zero at $t = 0$ and it is x , at $t - t$. It starts moving in the positive x-direction with a velocity which varices as $v = k\sqrt{x}$, where (k) is a constant. Show that velocity is directly proprtional to time.

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30. The relation between time t and distance x is $t = ax^2 + bx$ where a and b` are constants. The acceleration is

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31. The ball is dropped from a bridge $122.5m$ above a rivet, After the ball has been falling for 2 s, a second ball is thrown straight down after it. What must its initial velocity be so that bothe hit the warer at the same time ?

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32. The acceleration a in ms^{-2} of a particle is given by $a = 3t^2 + 2t + 2$, where t is the time. If the particle starts out with a velocity $v = 2ms^{-1}$ at $t = 0$, then find the velocity at the end of $2s$.

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33. A ball is dropped from the top of a tower of height (h). It covers a distance of $h/2$ in the last second of its motion. How long does the ball remain in air?

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34. An othleter runs a sidtance of $1500m$ as follows , (i) He starts from rest and accelerates himself uniformly with acceleration $2ms^{-2}$ till he covers a distance or $900m$. (ii) He then runs the remaining distance of $600m$ with a uniform speed developed. Calculate the time taken by the athlete to cover the two parts to the distance central point of the total length of track.

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35. A 100 m$spr\int er \in creasesherspeedomrestun$ if or $mlyattherateof$ 1. 5 ms^(-2)` up to three quarters of the total run and covers the last quarter with uniform speed. How much time does she take to cover the first half and the second half of the run ?

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36. A jugglar maintains four balls in motion, vaking each in turn rise to a height of $20.0m$ from his hand .Find the velocity with which the jugglar project these balls and the position of other three balls at the instant when the foruth ball is just leaving the hand of jugglar. Take `g= 10 m//s^2.

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3 Problems for practice

1. Two equal forces have their resultant equal to either. At what angle are they inclined ?

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2. A body is simultanceously given two velocities : one $12ms^{-1}$ due East and other $5ms^{-1}$ due North. Find the resultant velocity.

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3. A mn walds $20m$ north of east and walds $20m$. Calculate the net displaccement of the man. Also dind the direction fonet displacement.

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4. two persons are raising a load pulling at an angle of each other. If they exert forecs of $30N$ and $60N$ respectively and their effective pull is at right angles to the direction of the pull of the first person, what is the angle between their pulling forces ? What is the effective pull

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5. Two forces (2p) and (4p) newton act on a particle. If the first force is doubled and the second force is increased by $30N$, the direction of resultant is unalterd . Fing the value of smaller force.

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6. The greatest and the least resultant of two forces acting at a point ared $14M$ and $4N$ respectively. If each force is incerased by $2N$1 find the resultant of two new new forces acting at an angle of 60° to ach other.

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7. Two eual forces act at a point. The squard of their resultant is 3 times their product, Find the angle between them.

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8. AT what angle two forces (P +Q) and (P-Q) act so that resultant is ` (i) sqrt(2 P^2 + Q^2) (ii) sqrt(2 P^2 + Q^2) (iii) sqrt(2 P^2 + Q^2) .

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9. A particle has the following displacements in succession (i) $12m$ towards East (ii) $5m$ towards North and (ii) $6m$ vertically. Find the magniude of the resultant displacement.

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10. Tow boys raising a buket pull it at an angle θ to each ogher. If each exerts a force of $20N$ and their effective pull is $30N$, what is the angle θ between their arms ?

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11. Two forces, while acting on particle in opposite directions,have the resultant of 10N. If they act at right angles to each other, the resultant is found to be 50N. Find the two forces?

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12. Two forces equal to (F) and (3 F) newton act on a particle . If the first force be tripled and the second froce be increased by 30 neqton, the disrction of the resultant is unaltaerd. Find the value of (F).

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13. A motor cyclist is riding North in still air at $20kmH^{-1}$. If the wind starts blowing westard with a velocity of $45.8kmh^{-1}$ find the apparent velocity with which the motor cyclist moves, tiem it takes to cover $100km$ and its direction of motin.

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14. Given that $\vec{A}+\vec{B}+\vec{C}=\vec{0}$. Out of three vectors, two are equal in magnitude and the magnitude of the third vectors is $\sqrt{2}$ times that of either of the two having equal magnitude. Find the angles between the vectors.

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15. Two buses start from a bus stand with velocitues $10kmh^{-1}$ and $30kmh^{-1}$ along two trachs inclined at an angle 60° . Find the distance between them agter `12 munutes.

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16. A bob weighing $0.06kg$ hangs vertcally at the end of a sting $0.30m$ long. Find the force which when applien horizontally, will pull the bob $0.\,10m$ aside from its initial psition.

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17. A ship is streaming due West at $12ms^{-10}$. A boy runs across the dech at $5ms^{-1}$ in a direction at right angles to the direction of motion of the ship towards South, Calculate the velocity of the boy relative to ship.

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18. A river $800m$ wide flows at the rate of $6kmh-^{1}$ in still water, wishes to cross the tiver straight. ltbRgt (a) Along what direction must he strike ?

(b) What should be his resultant velocity ?

(c) How much time he would take ?

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19. A boat man can rown with a speed of $10kmh^{-1}$ in still water. If the river flows steadily at $5km/h$, in which direction showld the boatman row in order to reach a point on the other bank directly opposite to the point from wher he stared ? The width of the river is $2km$.

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20. A river is flowing steradily with a speed $5kmh^{-1}$. A boat man can row with a speed of $10kmh^{-1}$ in still water. He rows his boat in river at right angles to the bank of river, If width of river is $800m$, (i) how much time the boat man will take to cross the river ? (ii) How far away from a point just opposite to the bank of river he will be reaching there ? (ii) What will be his effective speed gt

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21. A swimmer crosses a flowing stream of width ω to and fro in time t_1. The time taken to cover the same distance up and down the stream is t_2. If t_3 is the time the swimmer would take to swim a distance 2ω in still water, then

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22. A cr travelling at $36kmh^{-1}$ due North turns West in $5\sec \pm ds$ and maintaind the same speed, What is the acceleration of the car ?

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23. A shp is sailing due west at $10ms^{-1}$.A woman runs across the deck at $5ms^{-1}$ in a direction at right angles to the direction of motion of ship , towards north. Find the magnitude and direction of the velocity of woman relative to sea.

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24. A boat is moving with a velocity $3\hat{i} + 4\hat{j}$ with respect to ground. The water in the river is moving with a velocity $-3\hat{i} - 4\hat{j}$ with respect to ground. The relative velocity of the boat with respect to water is.

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25. A train is moving with a velocity $40kmh^{-1}$ due East and a car is moving with a velocity $60kmh^{-10}$ due North, What is the velocity of train as appears to a passenger in the car ?

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26. A train is moving with a velocity of $30kmh^{-1}$ due East and a car is moving with a veloicty of $40kmh^{-1}$ due North . What is the velocity of car as appears to a passenger in the train ?

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27. The velocituy of particle (P) due east is $4ms^{-1}$ due South,. What is the velocity of $Pw.r.t.Q$?

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28. A man is walking due East at a rate of $5kmh^{-1}$ and the rain appears to be falling verticall with a speed of $12kmh^{-1}$. Find the actual speed and direcction of rain with vertcal .

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29. A person standing on a road has to hold his umbrellat at 45° with the vertical to deep the rain away . He throws the umbtella and starts running at $30ms^{-1}$. He find that the rain drops are hitting his head vertically. Fing the speed of the rain drops with respect to (a) road (b) the moving person.

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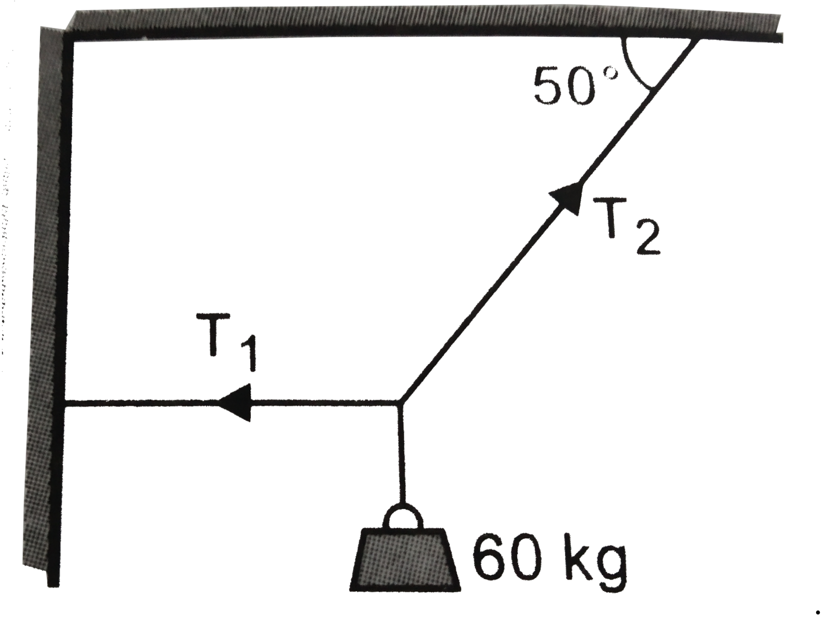
30. find the values of T_1 and T_2 for the sustem shown in Fig. 2 (c) . 76 , $g = 10ms^2$.



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31. A plane is inclened at an angle of 30° with horixontal. Find the componet of a force ltbRgt $\vec{F} = -10\hat{k}N$ perpendicular to the plane. Given that z-direction is vertically upwards.

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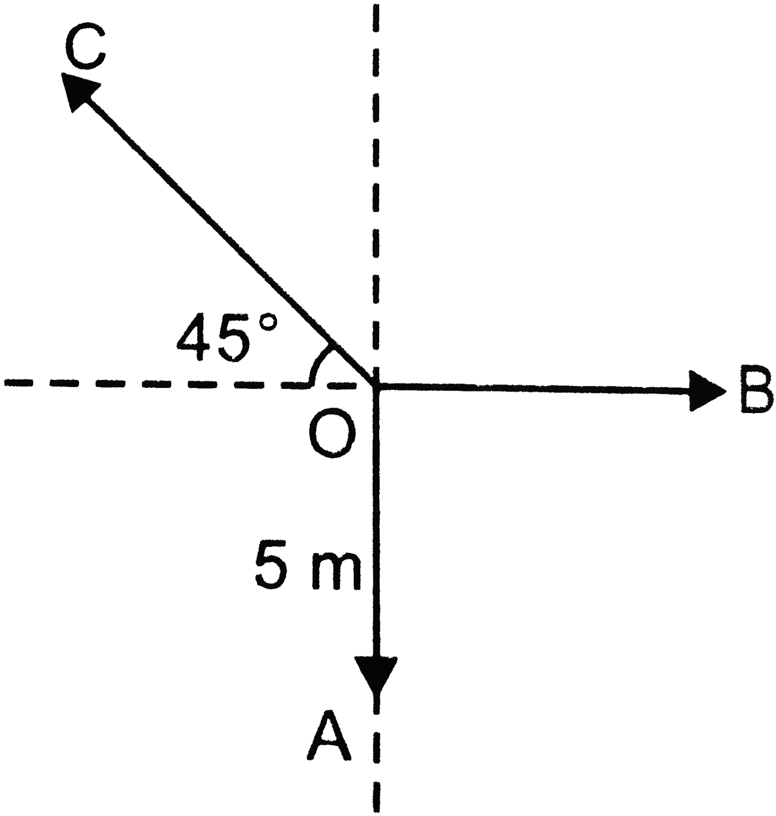
32. The sum of three vectors shown in Fig. 2 (c) . 77. is zero .



(a) What is the magnitude of the vector $\overrightarrow{OB}$? $(b) W\hat{i} sthemagnitudeofthe \vec{\rightarrow} r$

vec (OC)` ?

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33. Find the resultant forece of the following forces which act upon a particle.

(a) $30 N duee *$

(b) $20 N$1 due North

(c) $50 N$ due West

(d) $40 N$ due South.

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34. A point moves in $x - y$ plane according to the law $x = 4 \sin 6 t$ and $y = 4(1 - \cos 6 t)$. Fimd distance traversed by the particle in $5 seconds$, when (x0 and (y) are in metres.

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35. Given three coplanar vectors ` vec A = 2 hat I - hat j , magnitude of the sum of three vectors.

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36. If $veA = 3\hat{I} + 4\hat{j}$ and $\vec{B} = 7\hat{I} + 24\hat{j}$. Find vector haveng the same magnitude as $\vec{B}$ and parallel to $\vec{A}$.

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37. If $\vec{A} = 3\hat{I} + 4\hat{j}$ and $\vec{B} = 7\hat{I} = 24\hat{j}$, find a vector having the same magnitude as $\vec{A}$and parallel to $\vec{B}$.

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38. A bird moves with velocity $10ms^{-1}$ in a direction making an angle if 60° with the eastern derction and 45° with vertical upward direction. Represent the velocity vector of bird in rectanular form.

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39. Find a unit vector parallel to the resultant of vectors $\vec{A} = 3\hat{I} + 3\hat{j} - 2\hat{k}$ and $\vec{B} = \hat{i} - 5\hat{j} + \hat{k}$.

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40. A bird is moving with velocity $10ms?^{-1}$ in a direction making an angle of 60° with vertical upward. Represent the velocity vector in rectangular form.

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41. The x and y-components of vector A are 4 m and 6 m respectively. The x and y-components of vector A + B are 10 m and 9 m respectively. Calculate for the vector B the following:

(a) its x and y-components

(b) its length

(c) the angle it makes with x-axis.

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42. If $\vec{R} = \vec{A} - \vec{B}$, and θ is the smaller angle between $\vec{A}$ and $\vec{B}$, show that ltbRgt $R^2 = A^2 + B^2 - 2AB\cos\theta$.

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43. Find the angle between the vectors

$\vec{A} = \hat{I} + 2\hat{j} - \hat{k}$ and $\vec{B} = -\hat{I} + \hat{j} - 2\hat{k}$.

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44. If the magnitude of two vectors are 3 and 6 and ther scalar product is 9, find the angle between the two vectors.

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45. For what value of (a) are the vectors ltbRgt $\vec{A} = 2a\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{B}a\hat{I} + a\hat{j} - 4\hat{k}$ perpecdicular to each other ?

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46. For what vlue of a, $\vec{A} = 2\hat{i} + a\hat{j} + \hat{k}$, is perpendicular to $\vec{B} = 4\hat{i} - 2\hat{k}$.

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47. Shiw tgat $\left|\vec{A} = \vec{B}\right|^2 - \left|\vec{A} - \vec{B}\right|^2 = 4\vec{A}.\vec{B}.$

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48. Show that $\vec{A} = \hat{I} - 5\hat{j}$ and $\vec{B} = 2\hat{I} - 10\hat{j}$ are parallel to each other.

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49. Find the component of a vectro $\vec{A} = 3\hat{I} + 2\hat{j}$ along the direction of $\left(\hat{I} + \hat{j}\right)$

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50. If $\vec{a}$ and vec b$aretwononcoll \in erarunit \xrightarrow{\ } rs$ and if | vec a+ vec b | = sqrt 3, $thenf \in dthevalueof$ (vec a-vec b). (2 vec a+ vec b)`.

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51. A particle moves from position vector $\vec{r}_1 = \left(23\hat{I} + 2\hat{j} - 6\hat{k}\right)$ to position vector, $\vec{r} - 2 = \left(14\hat{I} + 13\hat{j} + 9\hat{k}\right)$ in metre under the action of a constant force of $\vec{F} = 914\hat{i} + \hat{j} + 3\hat{k}\Big)N$. Calculat word done by the force.

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52. A force of $6\hat{i} + 7\hat{j}$ newton makes a body move on a rough loane with a velocity of (4 hat j = 3 hat k) ms^(-1)` . Calculate the power in watt.

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53. Determine the sine of the angle between the vectors (3 hat i+ 3hat j+ 4 hat k) and $\left(3\hat{i} - 2\hat{j} - 4\hat{k}0.\right.$

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54. Calculate the area of a paralleogeram whose adjcent sides are given by the vectors :

$\vec{A} = \hat{i} - 2\hat{j} = 3\hat{k}$, and $\vec{B} = 2\hat{I} = 3\hat{j} - \hat{k}.$

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55. Find the area of the rriangle formed by the tips of the vectors,

$\vec{a} = \left(2\hat{I} - \hat{j} + 3\hat{k}\right), \vec{b} = 4\hat{I} + 3\hat{j} - \hat{k},$

$\vec{C} = 3\hat{I} - \hat{j} + 2\hat{k}.$

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56. A verctor of magnitude $100N$ is inclined at an angle of 30° to another vector of magnitude $50N$. Calculate the magnitude of dot rpdut and cross parodut fo two vectors.

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57. If $\left|\vec{A}\right| = 2, \left|\vec{B}\right| = 5$ and $\left|\vec{A} \times \vec{B}\right| = 8$, din the value of (vec A. vec B0`.

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58. Dine the unit vector peroendicular to each of the vectors $3\hat{i} + \hat{j}2\hat{k}$ and $2\hat{i} - 2\hat{j} = 4\hat{k}$.

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59. Fven that $\vec{A} \times \vec{B} = \vec{B} \times \vec{C} = \vec{0}$. If $\vec{A}$. $\vec{B}$ and $\vec{C}$ are not null vectors, find the value of $\vec{C} \times \vec{A}$.

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60. For any to vectors $\vec{A}$ and $\vec{B}$, prove that

|vec A xx vec B|^2 = A^2 B^2 - (vec A. vec B)^2`.

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61. Find the area of a traiangle formed by the tips of the vectors $\vec{c} = \left(4\hat{i}_3\hat{j} + \hat{k}\right)$.

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62. Three vector $\vec{A}, \vec{B}$ and vec $Caresucht^{\wedge}$ vec A= vec B+ vec C and $theirmagnitudeare$ 54,3, respectively. Find the angle between $\vec{A}$ and vec C`.

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63. Find the vector sum of N coplanar forces, each of the magnitude F ,when each force makes an angle of $2\pi/N$ with that preceding it.

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64. A vector vec $Awhenadded \rightarrow the \vec{\rightarrow} r$ vec B = 3. 0 hat i+ 4 hat j $yieldsarestan\underline{t} \vec{\rightarrow} rt\hat{i}s \in thepositivey$ - $direction$ and $hasamagn\int udeequal \rightarrow t\hat{o}f$ vec B. $F \in dthemagnitudeof$ vec A` .

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65. A vector $\vec{A}$ of magniude (A) is turned through an angle θ. Calculate the cahng in the magniude of vector.

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66. Two vector $\vec{P}$ and $\vec{Q}$ act at a point and have a resultant $R_1. If$vec Q $isreplacedbythevev \rightarrow r$ (vec (R_1^2-P^2)/Q $showthtthereatan\underline{t}isstillofmagnitude$ vec R_1`.

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67. Two cacar starts together from the asme point and move along two straight lines inclined at an angle θ, one moving with velocity (u) and the other from rest with a uniform acceleration (a). Show that the least relative velocity between then is $u\sin\theta$ and it occurs after a time $t = (u\cos\theta)/a$.

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4 Problems for practice

1. A stone is dropped from the window of a bus moving at $7mh^{-1}$ on the road, IF the window is $2.0m$ high, determine the distance aling the road where the stone will strike the road. Use $g = 10ms^{-2}$`.

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2. A bomb is flying horizontally at a heitht of $2000m$ with a speed of $200ms^{-1}$. When a bomb is relesed from it . Find (i) the time taken by bomb to resch the ground(ii) the velocity with which the bomb hits the target and the distance of the target and the distance of the target from where the bomb is dropped. Take $g = 10m/s^{-2}$.

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3. A fighter jet plane is flying at a height of $500m$ with a velocity $450kmh^{-1}$. If release a bob when $500m$ away from the enemy post, Will the bomb hit post ? Take g=10 ms^(-2)`.

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4. Two tal buldings are situated $200m$ apart, With what speed muat a ballbe thrown horixontally fromt eh winow 550 m above the ground in one building so that it will enter a window $50m$ above the ground in the other building ? Take $g = 10ms^{-2}$.

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5. A ball is thrown horizontally from the top a tower with a speed of $50ms^{-1}$. Find the velocity and position at the end of 3 second. $g = 9.8ms^{-2}$.

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6. A body is thrown horizontally from the top of a tower and strikes the ground after three seconds at an angle of 45° with the horizontal. Find the height of the tower and the speed with which the body was projected. (Take $g = 9.8 m/s^2$)

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7. An air is flying at a heith of $3500 m$ above the ground, If the angle subtended at a ground observation point by the air craft positions $10 s$ apart is 30° while passing over his head, what is the speed of the air caraft ?

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8. A body is projected downwards at an angle of 30° to the horizontal with a velocity of $9.8 m/s$ from the top of a a tower $29.4 m$ high. How long will it take before striking the ground ?

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9. A person can throw a ball to a maximum horizontal distance of $90.\,m$ Calculat the maximum vertcal heitht to which he can through the ball. Fiven $g = 10ms^{-2}$.

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10. A body is projected with a velocity $30ms^{-1}$ at an angle of 30° with the vertical. Find (i) the maximum height (ii) time of flight and (iii) the horizontal range of the projectile. Take $g = 10m/s^{\circ}$.

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11. A ball is kiched at an angle 30° with the verical. If the horizontal componet of its velocity is $20ms^{-1}$, find the maximum hight and hrizontal range. Use $= 10ms^{-2}$.

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12. A particle is projected from the ground with an initial velocity of $20m/s$ at angle fo 30° with the horizontal. What is the magnitude of chang in velocity in $0.5scond$? (g= 10 m//s^2)`.

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13. A bullet fired at an angle of 60° with the vertical hits the grond at a distance of $2.5km.$, Calculate the distance at which the bullet will hit the grund when fired at an angle of 45° with vertical. Assuning the speed to be the same.

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14. A projectil has the same range (R) when the maximum heitht attained by it is either H_1 or H_1 . $F \in dtherelationbetween$ R, H_1 and H_2`.

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15. A ball is thrown at an angle θ and another ball is thrown at an angle $\left(90^{\circ} - tehta\right) withtheh$ or $izontaldirectionomthesamep\oint, eachwithvelocity$ 40 ms^(-1). $Thesecondballreaches$ 40 m $higherthanthefirstball. F \in dtheir \in \div id\underline{h}eiths, Take$ g= 10 m//s`.

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16. A person sees an object on a tree at a heitht of $40m$ and at a distance of $60m$. Whith what velocity he showld throw an arrow at an angle of 45° so that it may hit the object ? Take $g = 10ms^2$.

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17. A football is kicked with speed $20ms^{-1}$ at a projection angle of 45° from the ground. A receiver on the goal line $20m$ away in the disrection of the kich runs the same instant to meet the ball. What must he his speed, of he is to catch the ball cefore it hits the ground ? Take $g = 10ms^{-2}$.

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18. For the angular projesscton θ, the velcity of projectile is (u). Let (H) be the maximum heitht reached by the projectile and ® be its horizontal range , show that $\frac{R^2}{8H} + 2H$ is equal to its maximum range.

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19. A projectile is thrown in the upward direction making an angle of 60° with the horizontal direction with a velocity of $150ms^{-1}$. Then the time after which its inclination with the horizontal is 45° is

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20. A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)m/s$, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical . If $g = 10m/s^2$, the equation of its trajectory is :

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21. A shot is fired at a distance of $39.2m$ from the foot oa a pole $19.6m$ high so that it just passes over it. Find the magnitude and direction of the velcoity of the shot.

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22. A ball is thrown upwards with a velcoity of $80m/s$ at an angle of 30° to the horizontal . Find its velcituy after one second.

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23. Show that the maximum range of a projectile in and direction is dest=cribed in the same time in which it would fall freel undr gravity throuth this distance starting from rest.

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24. a shot is fired at an angle of 30° with horizontal from the top of a tower 182.88 metres high. The velocity of projection is $560.96 m/s$. Find where from the foot of tower it strikes the ground.

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25. A particle with a velcoity (u) so that its horizontal ange is twice the greatest height attained. Find the horizontal range of it.

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26. A projectile takes off with an initial velocity of $10 m/s$ at an angle of elevation of 45°. It is just able to clear two hurdles of height 2 m each, separated from each other by a distance d. Calculate d. At what distance from the point of projection is the first hurdle placed? Take $g = 10 m/s^2$.

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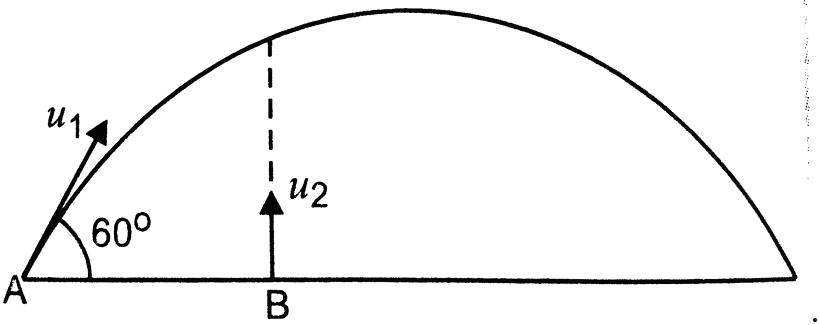
27. A body is projectd with the velcity (U_1) from the point (A) as shown in Fig. 2. (d). 37. At the same tiem another body uis projected vertcally upwards with the velcoity u_2 from the point (B) .What should be the value of $u_1)/u_1$ for both the bodies to collide ?



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28. Calculate the angular velcity of the minute\`s hand of a clock.

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29. The wheel of an automobile is rotating with 4 rotations per second. Find its angular velcoity . If the radius of the fly wheel, is $50cm$, find the linear velcotiy of a point on its cicrumfernce.

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30. The radius of the earths $or bitaroundthesunis$ 1 A . U. Calculate the angular velocity and linear velocity of the earth. Also calculate the angle through which the earth revove around the sun in 44 days. (Given 1 AU= 1.5 xx 10 ^(11)m0`

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31. A body of mass $5kg$ is reoving in a circle of diameter $0.30m$ making 2000 revolutions in (2) minutes, Calculate the linear velocity and centripetal acceleration.

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32. Find the magnitude of the centripetal acceleration of a particle on the tip of a blade, 0.30 metre in diameter, rotating at 1200 revolution per minute.

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33. The angular velocity of a particle moving in a circle of radius $50cm$ is increased in 5 min from 100 revolutions per minute to 400 revolutions per minute. Find the tangential acceleration of the particle.

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34. Calculate the centripetal acceleation of a point on the equator of earth due to the rotatin of earth about its wn axis . Radius of earth $= 6400km.$

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35. Calculate the linear acceleration of a particle moving in a circle of radius $0.5m$ at the iunstant when its angular velcity is $2rads^{-1}$ and its angular acceleaation is 1 6 rad s^(-2)`.

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36. A grass hopper can jump a maximum horizontal distance of $20.4cm$. If it speeds negligible tiem on the ground, what is its speed of travel along the road, $g = 10m/s^{\circ}$.

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37. A cylclist is riding with a speed of $27kmh^{-1}$. As he approaches a circular turn on the road of radius $80m$, he applies brakes and reduces his speed at the constant rate of $0.5ms^{-2}$. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn ?

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38. A target is fixed on the top of a tower $13m$ high. A person standing at a distance of $50m$ from the pole is capable of projecting a stone with a velocity $10\sqrt{g}ms^{-1}$. If he wants to strike the target in shortest possible time, at what angle should he project the stone ?

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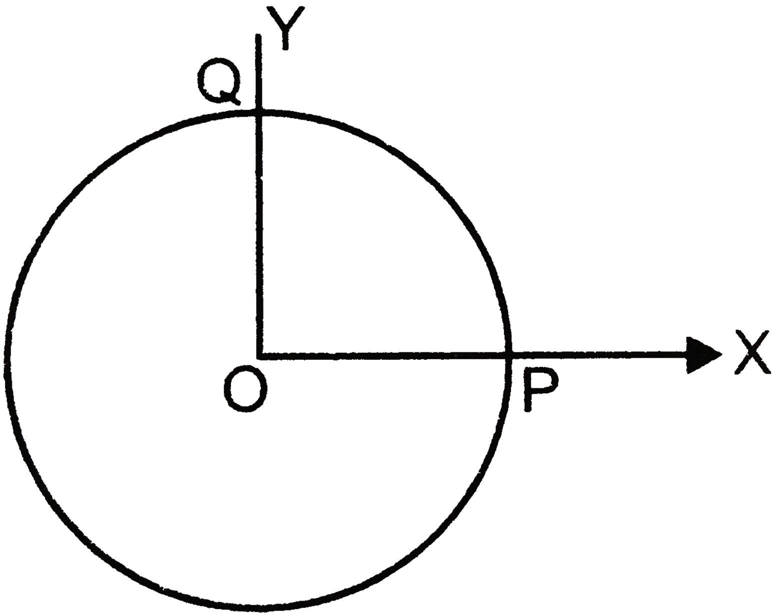
39. A particle moves in a circle of radius $4.0cm$ clockwese at constant speed of $2cmS^{-1}$. If $\hat{x}$ and $\hat{y}$ ar unit accleration vectors along X- asis and Y- axis respectively, find the accleration of the particle at the instant half way between ` PQ. Fig. 2 (d) . 38.



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40. Two bodies were thrown simultaneously from the same point , on straight up and the other, at angle $\theta = 60^\circ$ to the horizontal . The initial velocity of each body is equal to $u = 30 m/s$. Neglecting the air resistance, find the distance between the bodies after 2 seconds.

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41. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by $y = \left(8t - 5t^2\right)m$ and $x = 6tm$, where t is in seconds. The velocity with which the projectile is projected at $t = 0$ is.

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42. A ball is thrown from the ground into air. AT a height of $9.0m$, the velcoity is obsecred ot be $\vec{v} = 7.0\hat{i} + 6.0\hat{j}$. Find the masimum hight to which the ball will rise. $g = 10, s^{-2}$.

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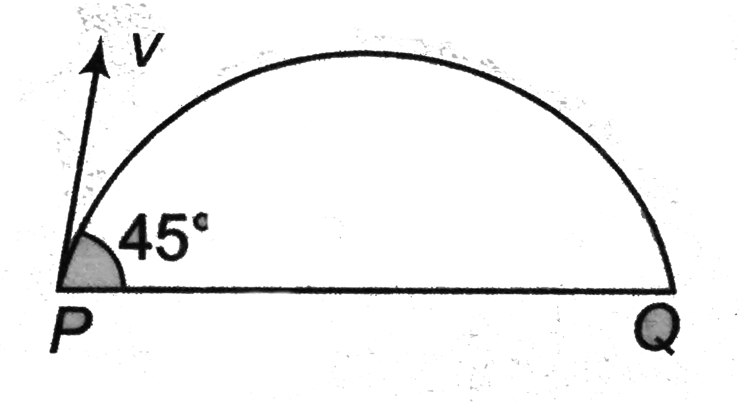
43. The velocity of a projectile when it is at the greatest height is $\left(\sqrt{2/5}\right)$ times its velocity when it is at half of its greatest height. Determine its angle of projection.

Watch Video Solution

44. A projectile of mass m is fired with a velocity v from point P at an angle 45°. Neglecting air resistance, the magnitude of the change in momentum leaving the point P and arriving at Q is



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45. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projection at its highest point as seen from the point of projection is

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1 Multiple choice

1. If distance covered by a particle is zero, what can be its displacement ?

A. it may or may not be zero

B. it can not be zero

C. it must be zero

D. it is negative

Answer: (c)

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2. The ratio of the numerical values of the average velocity and average speed of a body is always.

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3. A body moves aling a circular track of radius (r). It starts from one end of a disameter, moves along the circuar track anf completes one and a half revolutins. The ration of distance travelled by the body to tis displacement is.

A. $1/2\pi$

B. $2/\pi$

C. π

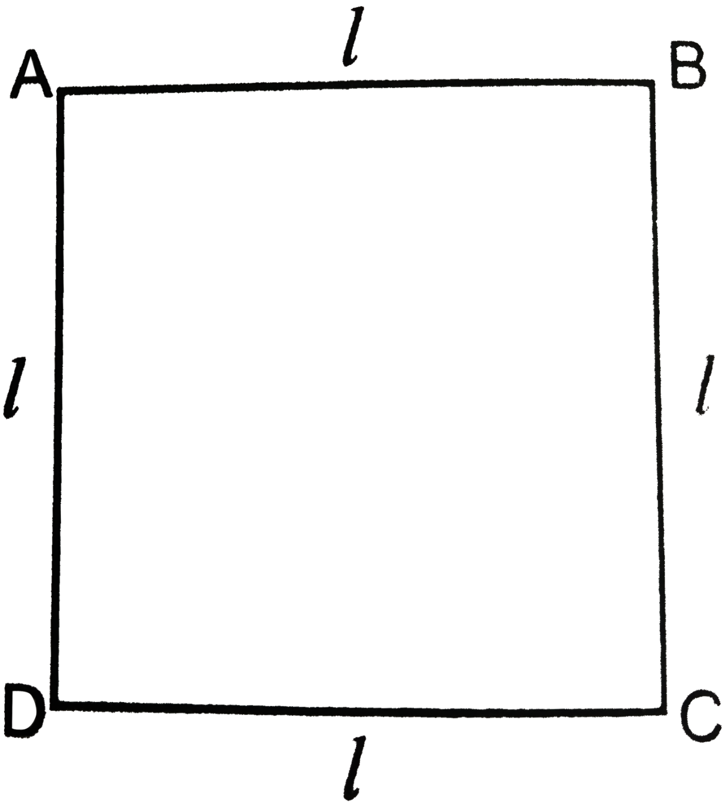
D. $3\pi/2$

Answer: (d)

Watch Video Solution

4. A praticle moves along the side of a squre fo length (l) starting from (A) andreaches the opposite crne (C) by travelling from (A) to (B) and (B) to

(C). If the tiemtaken is (T), the average velocity of the particle is



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5. A car travels along a straight line for first half time with speed $40 km/h$ and the second half time with speed $60 km/h$. Find the average speed of the car.

Watch Video Solution

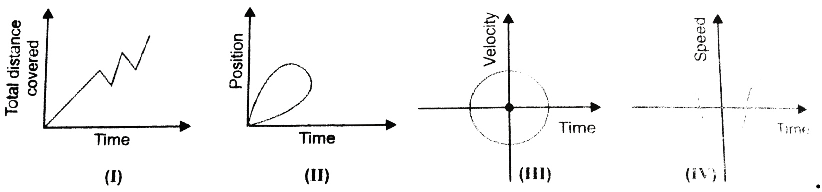
6. A table clock has its minute hand 5.0 cm long $. Theavera \ge velocityofthetipofthe \min uteh$ and $between$ 6.00 am → 6.30 pm` is.

Watch Video Solution

7. A train $100m$ along is moving with a velocity of $60h^{-1}$. The time it takes to cross the bridge ` 1km long is.

Watch Video Solution

8. Which of the following graphs cannot possibly represent one dimensional motion of a particle.



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9. Two cars (A) and (B) are at positions $100m$ and $200m$ from the origin at time $t = 0$. They start simultaneously with velocities ` 10 ms^(-1) respectively. The car (A) will overtake the car (B) at a distance of .

Watch Video Solution

10. Delhi is at a distance of $200km$ from Ambla. (A) sets out from Ambala at a speed of $30kmh^{-1}$ and (B) sets out at the same time from Delhi at a speed fo $20kh^{-1}$. They will meet each other after a tiem of .

Watch Video Solution

2 Multiple choice

1. A body can have

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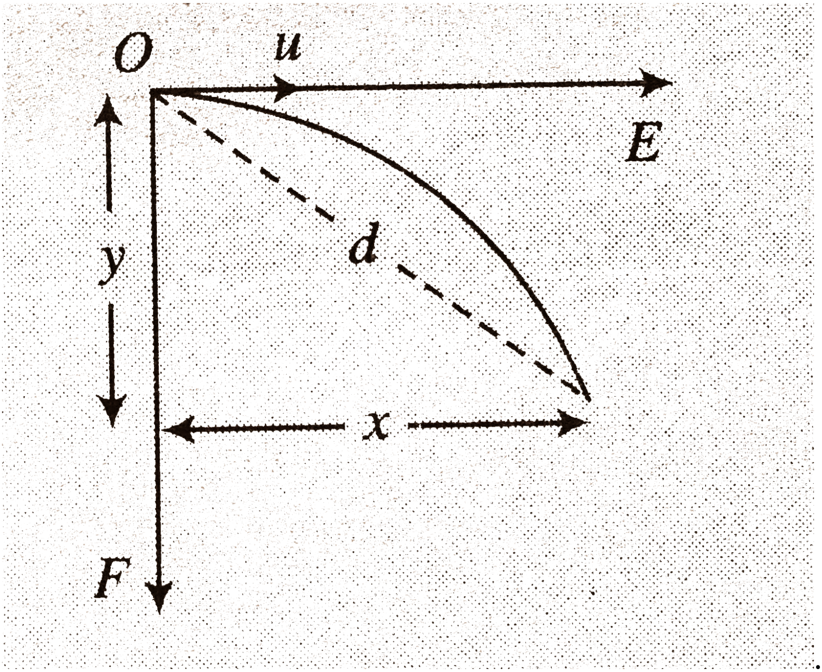
2. A body of mass $2kg$ has an initial velocity of $3ms^{-1}$ along OE and it is subjected to a force of $4N$ in OF direction perpendicular to OE. Find the distance of the body from O after $4s$.



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3. A body released from a great height, falls freely towards the earth, Anoth . Another body is released from the same height ezectly one second later. Then the separation between two bodies, two seconds after the release fo second body is.

Watch Video Solution

4. A stone is throun with an initial speed of $4.9ms^{-1}$~omabrid $\geq\ \in$ verticalupwarddirection. Iffallsdown $\in$ waterafter2` seconds. The height of the bridge is.

Watch Video Solution

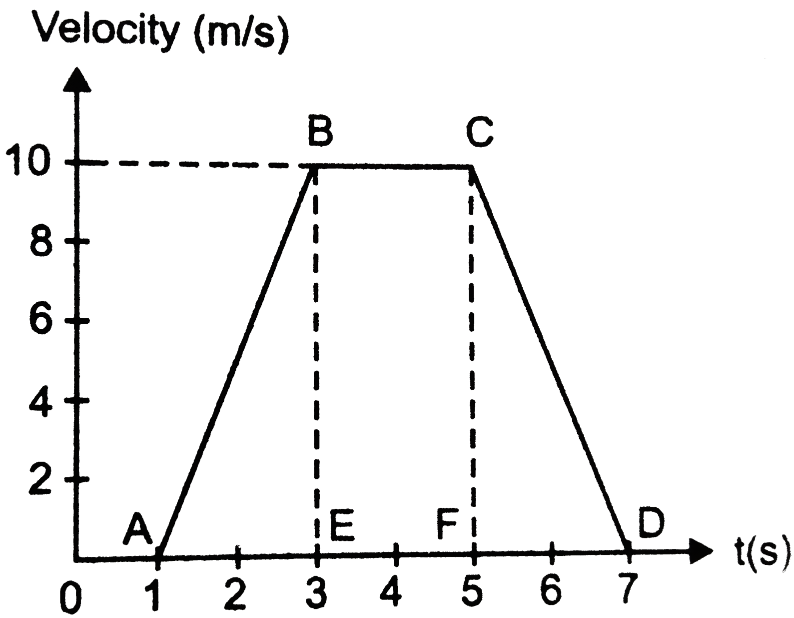
5. A body is released fro certain height, After falling for sometime. If acceleration due to gravity vanishes, then.

Watch Video Solution

6. The nature of graph drawn between displacement in tth secong and tiem (t) of a uniformly accelerated motion is.

Watch Video Solution

7. For the velocity time graph shown in Fig. 2 (CF).14, the distance covered by the body in last two seconds of its what fraction if the total distance covered by it in all the seven seconds?



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8. The acceleration (a) (in ms^(-2)) of a bosy , starting from rest varies with tiem (t) (in s) following the equation, $a = 3t + 4$, The acceleration of the partcle at $t = 1s$ is

Watch Video Solution

9. The displacement of a particle is represented by the equation, $s = 3t^3 = 7t^2 + 4t + 8$ where (s) is in metres and (t) in seconds . The acceleration of the particle at $t = 1s$ is.

Watch Video Solution

10. The velocity fo a body depends on time according to equation, $v = 20 + 0.1t^2$. The body is undergoing.

Watch Video Solution

3 Multiple choice

1. Which of the following physical quantities is an axial vector ?

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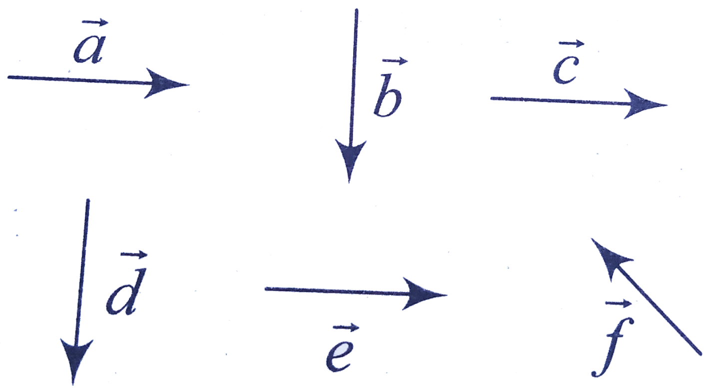
2. Six vector $\vec{a}$ through $\vec{f}$ have the magnitudes and direction indicated in the figure. Which of the following statements is true?



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3. Two vectors $\vec{a}$ and $\vec{b}$ are such that $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$. What is the angle between $\vec{a}$ and $\vec{b}$?

Watch Video Solution

4. The resultant of two forces is $20N$. When one of the force is $10\sqrt{2}$ and angle between two torces is 30°, then what is the value of the second force?

Watch Video Solution

5. Two equal forces act at a point. The square of their resultant is 3 times their product, Find the angle between them.

Watch Video Solution

6. a rain is falling vertically with a speed of $24ms^{-1}$. A woman rides a bicycle with a speed of $12ms^{-10}$ in each to west direction. The direction which woman should hold her umbrellat to proterct from rain is.

Watch Video Solution

7. One of the rectangular components of a force of $50N$ is $25N$. The magnitude of other component is.

Watch Video Solution

8. The magnitude of two vectors are 3 and 4 units and their dot product is $6units$. The angle between the vectors is.

Watch Video Solution

9. If $93\hat{i} - 2\hat{j} + 2\hat{k} + 2\hat{k}\big).\left(2\hat{i} - x\hat{j} + 3\hat{k}\right) = -12$, the value of (x) is .

Watch Video Solution

10. What is the angle between $(\vec{A} + \vec{B})$ and $(\vec{A} \times \vec{B})$?

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11. If $\vec{A}.\vec{B} = \left|\vec{A} \times \vec{B}\right|$, find the value of angle between $\vec{A}$ and $\vec{B}$.

Watch Video Solution

4 Multiple choice

1. A particle has an initial velocity of $3\hat{i} + 4\hat{j}$ and an acceleration of $0.4\hat{i} + 0.3\hat{j}$. Its speed after $10s$ is :

Watch Video Solution

2. On the earth, a stone is thrown from a height in a direction parallel to the earth's surfaces while another stone is simultaneously dropped from the same height. Which stone whould reach the ground first and why ?

Watch Video Solution

3. Path of the bomb released from an aeroplane moving with uniform velocity at certain height as observed by pilot is.

Watch Video Solution

4. A ball is projected horizontally with a velocity of $5ms^{-1}$ from the top fo a building $19.6m$ high. How long will th ball take to hit the ground ?

Watch Video Solution

5. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is .

Watch Video Solution

6. Find the angle of projection at which horizontal range and maximum height are equal.

Watch Video Solution

7. A ball thrown by one player reaches the other in $2s$. The maximum height attained by the ball above the point of projection will be about.

Watch Video Solution

8. Two bodies are projected at angle of 45° and 60° with the horizontal with same velocity simultaneously. Ratio of their horizontal range is.

Watch Video Solution

9. A fly wheel is making 300 rpm. Its angular velocity in radian per second is .

Watch Video Solution

10. A body is moving is a circle of radius $100cm$ with a tiem period of $2second$. The acceleration of the body is.

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1 Fill in the blanks

1. The branch of Phusics which deals with the study of moviton of material objects is called..................... .

Watch Video Solution

2. A branch of mechanics which deals with the study of motion of objects taking into account the factors which cause moving is called ....

Watch Video Solution

3. A moving in which the distance fo the moving particle from a fixed point is always constant during motion is called............................ .

Watch Video Solution

4. A physical quantity which completely expresses the position and direction of motion of the particle at an instant with respect to its mean position is called ....

Watch Video Solution

5. Oscillations of a mass suspended from a vertical spring is ....motion.

Watch Video Solution

6. The revolution of earth aroud the sun is.................................motion.

Watch Video Solution

7. If a paritcle travels distance S_2 and s-2$withspeeds$ v_1 and vec _2` in the same direction, then average speed of the particle is ....

Watch Video Solution

8. If the position-time grath for the motion of a partcle is a straight line parallel to position axis, then its velocity is ....

Watch Video Solution

9. Two persons A and B are walking with speed $4kmh^{-1}$ and $5kmh^{-1}$ respectively in the same direction. After 3 hours, the separation of B from A will be ....

Watch Video Solution

10. Two trains $120m$ and $100m$ in length are tunning in opposite directions with velocityes $42kmh^{-1}$ and $30kmh^{-1}$ In what tiem they will completely cross each other ?

Watch Video Solution

2 Fill in the blanks

1. A man sitting in a train in motion is facing the engine . He tosses a coin up, the coin falls..him.

Watch Video Solution

2. A particle with positive acceleration is slwing down if its ....is negative.

Watch Video Solution

3. 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.

Watch Video Solution

4. The slope of straight line joining two points on velocity-time graph of an object having bobuniform motion gives.. fro the given interval of time.

Watch Video Solution

5. The slope of straight line joining two points on velocity-time graph of an object having non uniform motion gives.. for the given interval of time.

Watch Video Solution

6. The acceleartion of a body, when its velcity-tiem graphis peroendicular to time axis, is ....

Watch Video Solution

7. The acceleartion of a body, when its velcity-time graph is peroendicular to time axis, is ....

Watch Video Solution

8. What does the area under acceleration-time graph for any interal of time represents when the accleration of the moving body is varing with time ?

Watch Video Solution

9. When acceleration of a body is not costant, integration of acceleration gives us................................... and integration of velocity will give us.............................. .

Watch Video Solution

10. If the didplacement is given by , $x = 1 + 2t = 3t^2$, the value of instantaneous acceleration is ....

Watch Video Solution

3 Fill in the blanks

1. Those vectors which have a starting point or a point of application are called ....

Watch Video Solution

2. Those vectors which are having equal or unequal magnitudes and are acting aling the parallel straight lines are called ....

Watch Video Solution

3. When a vector $\vec{A}$ is multiplied by a scalar (S), it becomes a vector ....whose unit is ....from the unit of vector $\vec{A}$.

Watch Video Solution

4. The magnitude of the resultant of two vectors is ....When they act in the same direction and is .... When they act in opposite direction.

Watch Video Solution

5. When a vector is displaced to itself, it ....

Watch Video Solution

Watch Video Solution

6. A unit vector is a..........................and.. .

Watch Video Solution

7. Are the commutative law and associtive law applicable to vectors subtraction.

Watch Video Solution

8. The vector subtraction...................................bya vector.

Watch Video Solution

9. The minimum number of vectors to give zero resultant is ....in one plane.

Watch Video Solution

10. If a man wants to protect himselt from the rain, while moving on a road, he should hold his umbrella in the direction of.. .

Watch Video Solution

11. If $\vec{A} + \vec{B} = \vec{A}$ - $\vec{B}$, then vec B` is a.................................. .

Watch Video Solution

12. (hat i+hat j+ hat k) makes an angle............................with each of X, Y and Z-axis.

Watch Video Solution

4 Fill in the blanks

1. A body thrown with some initial velocity wigh the horizontal direction and then allowed to move in two dimensions under the action of gravity alone is called.................................... .

Watch Video Solution

2. A jet of water issunig from a hole mear the bottom of water tank is an.............................. .

Watch Video Solution

3. When a projectile is projected with velocity (v) making an angle θ with ground.then its velocity at the highest point is ....

Watch Video Solution

4. Whe a projectile is projeected with velcity (v0 making an angle θ with the horizontal direction, then maximum horizontal range is................................ .

Watch Video Solution

5. The angle of rojection for a body to have same horizontal range and maximum height is ....

Watch Video Solution

6. The horizontal range is same whether the angle of projection is αor β , where `alpha+ beta = ...

Watch Video Solution

7. In projectile motion, kinetec eneragy is...............................at the point of frpjection and is...at the highest point.

Watch Video Solution

8. The maximum height attanide by a projectile is equal to...............................of its maximum range.

Watch Video Solution

9. a uniform circular motion is an example of...........................motion.

Watch Video Solution

10. When a body is moving with a constant angular velocity , its angular acceleration is...................................... .

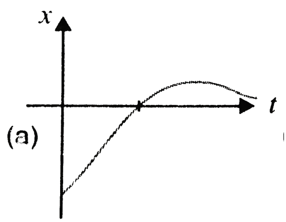
Watch Video Solution

11. The diresction of crntripetal accleration is ....

Watch Video Solution

1 NCERT multiple

1. Among the four graphs shown in the figure there is only one graph for which average velocity over the time interval (0,T) can vanish for a suitably chosen T. Which one is it ?

A. 

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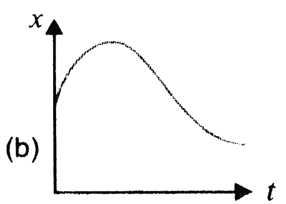
B. 

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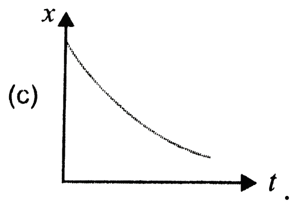
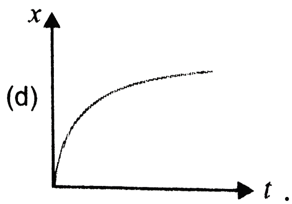
C. 

D. 

Answer: B

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2. A lift is coming from $8th$ floor and is just about to reach $4th$ floor. Taking ground floor as origin and positive direction upwards for all quantities, which one of the following is correct ?

A. $x < 0, v < 0, a > 0$

B. $x > 0, \; < 0, v < 0, a < 0$

C. $x > \;, v < 0, a > 01$

D. $x > 0, v > 0, a < 0$

Answer: A

Watch Video Solution

3. In one dimensional motion, instantaneous speed v satisfies $\left(0 \leq v < v_0\right)$.

A. (a) The displacement in time (T) must always take no-negative values.

B. (b) The displacement (x) isn time (T) satisfies $-v_0T < x < v_0T$.

C. (c) The acceleration is always a non-begative number.

D. (d) ` The motion has no turning points.

Answer: B

Watch Video Solution

4. A vehicle travels half the distance (L) with speed V_1 and the other half with speed V_2, then its average speed is .

A. $\dfrac{V_1 + V_2}{2}$

B. $\dfrac{2V_1 + V_2}{V_1 + V_2}$

C. $\dfrac{2V_1V_2}{V_1 + V_2}$

D. $\dfrac{L\left(V_1 + V_2\right)}{V_1V_2}$

Answer: C

Watch Video Solution

5. The displacement of a particle is moving by $x = (t - 2)^2$ where x is in metres and t in second. The distance covered by the particle in first 4 seconds is.

A. $4m$

B. $8m$

C. $12m$

D. $16m$

Answer: A

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6. At a metro station, a girl walks up a stationary escalator in time t_1 If she remains stationary on the escalator, then the escalator take her up in time t_2. The time taken by her to walk up the moving escalator will be.

A. (a) $\left(t - 1 + t_2\right)/2$

B. (b) $T_1T_2/\left(t_2 - T_1\right)$

C. (c) $t_1t_2/\left(t_2 + t_1\right)$

D. (d) T_1 -t_2`

Answer: C

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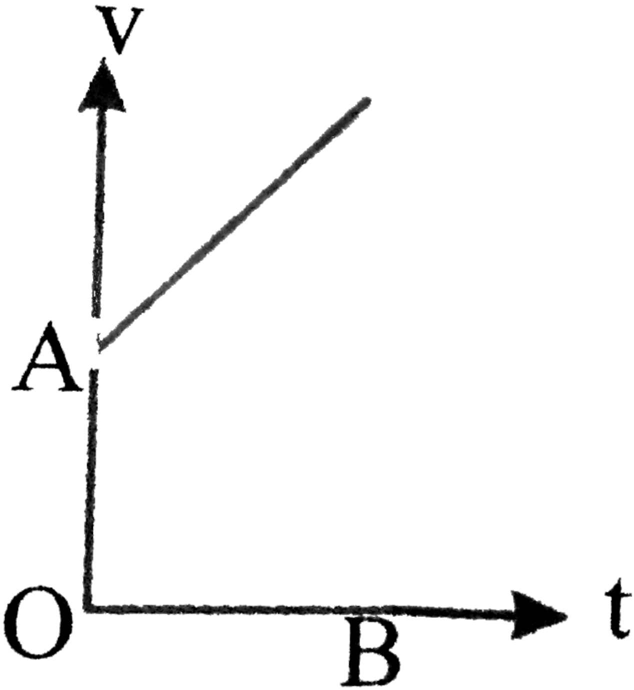

7.

The variation of quantity A with quantity B is plotted in the fig. Describes the motion of a particle in a straight line.

(a) Quantity B may represent time.

(b) Quantity A is velocity if motion is uniform.

(c) Quantity A is displacement if motion is uniform

(d) Quantity A is velocity if motion is uniformly accelerated.

A. (a) Quantity (B) may represent time.

B. (b) Quantity (A) is velocity if motion is uniform.

C. (c) Quantity (A) is displance if motion is uniform.

D. (d) Quantity (A) is velocity if motion is uniformly accelerted.

Answer: A::C::D

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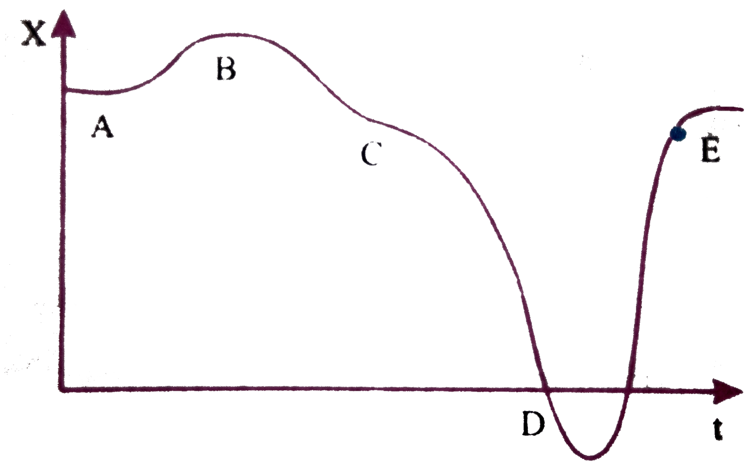

8.

A graph of x versus t is shown in figure. Choose correct alternative from below.

A. The particle was released from rest at $t = 0$

B. At (B) the acceleration $a > 0$

C. At (C), the velocity and the acceleration vanish .

D. Average velocity for the motion between (A) and (D) is positive

Answer: A::C

Watch Video Solution

9. For the one dimensional motion, described by $x = t - \sin t$

A. $x(t) > of \text{ or } allt > 0$

B. $v(t) > 0f \text{ or } allt > 0$

C. $a(t) > 0f \text{ or } allt > 0$

D. $v(t)$ lies between (0) and (2)

Answer: A::D

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10. A spring with one end attached to a mass and the other to a right support is stretched and released

A. Magnitude of acceleration, when just released is maximum.

B. Magnitude of acceleration, when at equilibrium position, is maximum.

C. Speed is maximum when mass is at equilibrium position.

D. Magnitude of displacement is always maximum whenever speed is minimum.

Answer: A::C

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11. A ball is bouncing elastically with a speed $1 m/s$ between walls of a railway compartment of size $10 m$ in a direction perpendicular to walls.

The train is moving at a constant velocity of $10m/s$ parallel to the direction of motion of the ball. As seen from the ground, choose the correct option

A. (a) the direction os motion of the ball changes every ` 10 secends.

B. (b) speed of ball changes every $10seconds$.

C. (c) average speed of ball over any $20second$ interval is fixed.

D. (d) the acceleration of ball is the same as from the train.

Answer: B::C::D

Watch Video Solution

2 NCERT multiple

1. The angle between $\vec{A} = \hat{i} - \ + \hat{j}$ and $\vec{B} = \hat{i} - \hat{j}$ is.

A. 45°

B. 90°

C. -45°

D. 180°

Answer: B

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2. Which one of the following statements is true?

A. A scalar quantity is the one that is conserved in a process

B. A scalar quantity is the one that can never taken negative values

C. A scalar quantity is the one that does not vary from one point to another in space

D. A scalar quantity has same value for observers with different orientations of the axes

Answer: D

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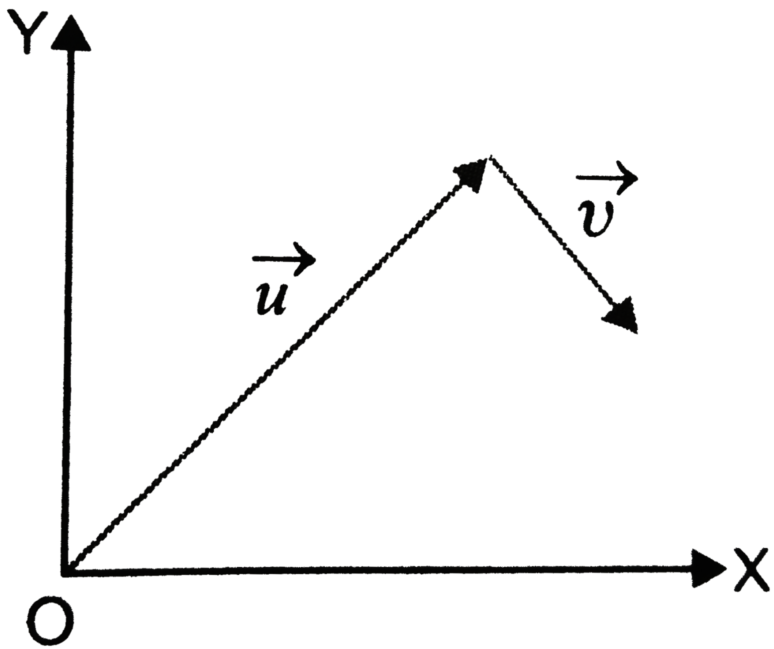
3. Figure 2 (EP). 13 shows the orientatione of two vectors $\vec{u}$ and $\vec{v}$ in the (XY) plane.

If $\vec{u} = a\hat{I} + b\hat{j}$ and $\vec{v} = p \hat{+} q\hat{j}$ which of the following is correct ?



A. (a) a and p are psoitive while b and q are negative

B. (b) a, q and b are positve while q is negative

C. (c) a, b, q and b positve whicl p is negative

D. (d) a, b, p and q are all positive

Answer: B

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4. The component of a vector r along X-axis will have maximum value if

A. (a) $\vec{r}$ is along positve Y-axis

B. (b) $\vec{r}$ is along positve X-axis

C. (c) $\vec{r}$ makes an angle of 45° with the X-axis

D. (d) $\vec{r}$ is along negative Y-axis

Answer: B

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5. The range of a projectile fired at an angle of 15° is 50 m. If it is fired with the same speed at an angle of 45° its range will be

A. $60m$

B. $71m$

C. $100m$

D. $141m$

Answer: C

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6. Consider the quantities, pressure, power, energy impulse, gravitational potential, electoral charge, temperature, area, Out of these, the only vector quantities are.

A. Impulse, pressure and area

B. Impulse and area

C. Impulse and gravitational potential

D. Impulse and pressure

Answer: B

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7. In a two dimensional motion,instantaneous speed v_0 is a positive constant.Then which of the following are necessarily true?

A. The average velocity is not zero at any time

B. Average acceleration must always vanish

C. Displacements in equal time interval are equal

D. Equal path lengths are traversed in equal intervals

Answer: D

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8. In a two dimensional motion, instantaneous speed v_0 is a positive constant. Then which of the following are neccessarily true?

A. (a) The acceration of the particle is zero

B. (b) The acceleration of the particle is bounded

C. (c) The acceleration of the particle is necessarily in the plane of moton

D. (d) The particle must abe undegoing a unifrom circular motion

Answer: C

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9. Three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ add up to zero . Find which is false.

A. (a) $\left(\vec{A} \times \vec{B}\right) \times \vec{C}$ is not zero unless $\vec{B}, \vec{c}$ are prallel

B. (b) $\left(\vec{A} \times \vec{B}\right) \times \vec{C}$ is not zero unless $\vec{B}, \vec{c}$ are prallel

C. (c) If $\vec{A}. \vec{B}, \vec{C}$ define a plane ,$\left(\vec{A} \times \vec{B} \times \vec{C}\right)$ is in that plane

D. (d) $\left(\vec{A} \times B\right). \vec{C} = \left|\vec{A}\right|\left|\vec{B}\right|\left|\vec{C}\right| \rightarrow C^2 = A^2 + B^2$

Answer: B::D

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10. It is found that $|A + B| = |A|$,This necessarily implies.

A. (a) $\vec{B} = 0$

B. (b) vec A, vec B` are antiiparallel

C. (c) $\vec{A}, \vec{B}$ are perpendicular

D. (d) $\vec{A}. \vec{B} \prec 0$

Answer: A::B

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11. Two particles are projected in air with speed v_0 at angles θ_1 and θ_2 (both acute) to the horizontal,respectively.If the height reached by the first particle greater than that of the second,then thick the right choices

A. angle of projection : $\theta - 1 > \theta_2$

B. time of flight : $T_1 > T_2$

C. horizontal range : R_1 gt R_`

D. horizontal range : $R_1 > R_2$

Answer: A::B

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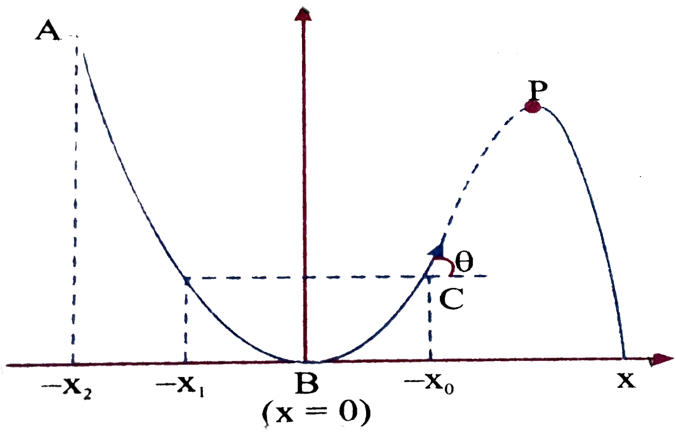
12. A particle slides down a frictionless paraboli $\left(y = x^2\right)$ track $(A - B - C)$ starting from rest at point A.Point B is at the vertex of parabola and point C is at a height less than that of point A.After C,the particle moves freely in air as a projectile. If the particle reaches highest point at P,then



A. (a) KE at $P = KEatB$

B. (b) height at ` P = height at (A)

C. (c) total eneragy at $P = \rightarrow tale \neq ragyat(A)$

D. (d) time of travel from A oto ` B = time of travel from (B) tp (P).

Answer: C

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13. Following are four different relations about displacement, velocity and acceleration for the motion of a particle in general. Choose the incorrect one (s)

A. $\vec{v}_{av} = \frac{1}{2}\left[\vec{v}\left(t_1\right) + \vec{v}\left(t_2\right)\right]$

B. $\vec{v} = \frac{\vec{r}\left(t_2\right) - \vec{r}\left(t_1\right)}{t_2 - t_1}$

C. $\vec{r} = \frac{1}{2}\left(\vec{v}\left(t_2\right) - \vec{v}\left(t_1\right)\right)\left(t_2 - t_1\right)$

D. $a_{av} = \frac{\vec{v}\left(t_2\right) - \vec{v}\left(t_1\right)}{t_2 - t_1}$

Answer: A::C

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14. For a particle performing uniform circular motion, choose the correct statement (s) from the following.

A. (a) Magnitude of paritcle velocity (speed) remains constant

B. (b) Particle velocity remains directed perpendicular to radius vector

C. (c) Direction of acceleation keeps changing as particle moves

D. (d) Angular moventum is constant in magnitude but direction keep changing.

Answer: A::B::C

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15. For tow vectros $\vec{A}$ and vec B | vec A + vec B| = | vec A- vec B|` is always true when.

A. (a) $\left|\vec{A}\right| = \left|\vec{B}\right| \ne 0$

B. (b) (b) $\vec{A} \perp \vec{B}$

C. (c) |vec A| = | vec B| != $\text{ and } \vec{A} \text{ and } \vec{B}$ are parallel or antiparallel

D. (d) When eigher $\left|\vec{A}\right| \text{ or } \left|\vec{B}\right|$ is zero.

Answer: B::D

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3 NCERT multiple

1. A student goes from his to his friend$shousewithspeed$ v_1 $. F \in d \in gthed\infty rofhisiend$s home closed, he returns back to his own house with the speed v_2. Then the averge speed and net displacement of student is [consider distance between two houses be S].

A. (a) $\frac{v_1 + v_2}{2}, 0$

B. (b) $\sqrt{v_1 v_2, 2S}$

C. (c) (2 v_1 v_2)/(v_1+v_2), 0`

D. (d) $v_1 v_2, S$

Answer: C

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2. A particle position as function of time is described as $y(t) = 5\cos(10t + 15)$ in meters. What is the average velocity of the particle from $t = 0$ at $t = 3\sec$?

A. $0.7883 m/s$

B. $-0.4314 m/s$

C. $0.4313 m/s$

D. $-0.7883 m/s$

Answer: B

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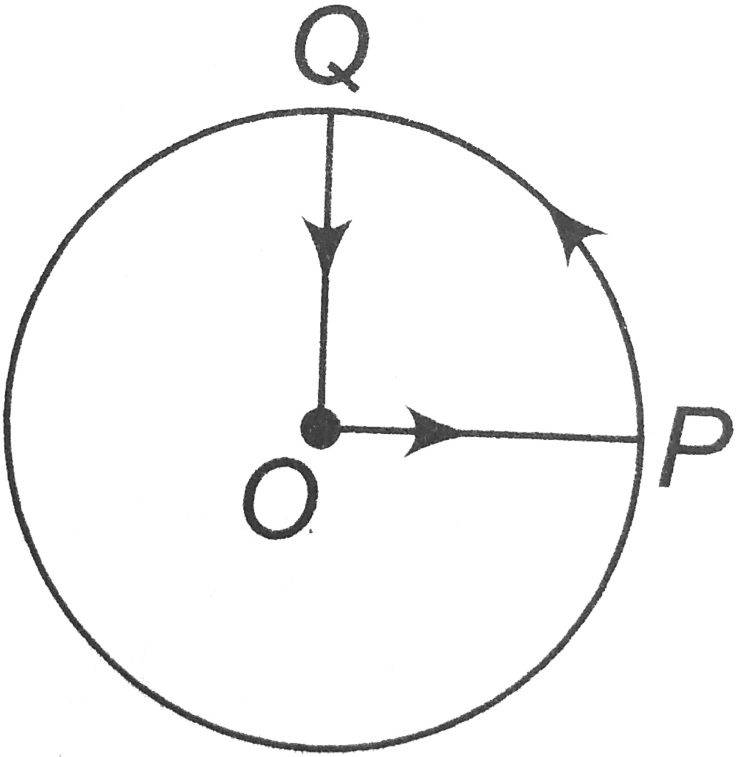
3. A cyclist starts from the centre O of a circular park of radius 1km, reaches the edge P of the park, then cycles along the PQ cicumference and returns to the centre along OQ as shown in fig. If the round trip taken ten minute, the net displacement and average speed of the cylists (in kilometer and kinetic per hour) is



A. (a) $0, 1$

B. (b) $12.4, \frac{\pi + 4}{2}$

C. (c) $\frac{\pi + 4}{0}, 0$

D. (d) $0.\ 21.4$

Answer: D

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4. A body moves along a quadrant of a circle of radius (r). The displacement and distance traveled are.

A. $r\sqrt{2}, \pi r/2$

B. $r_2 \pi r$

C. $2\sqrt{2}r, \pi r$

D. $r_1 \pi r/2$

Answer: A

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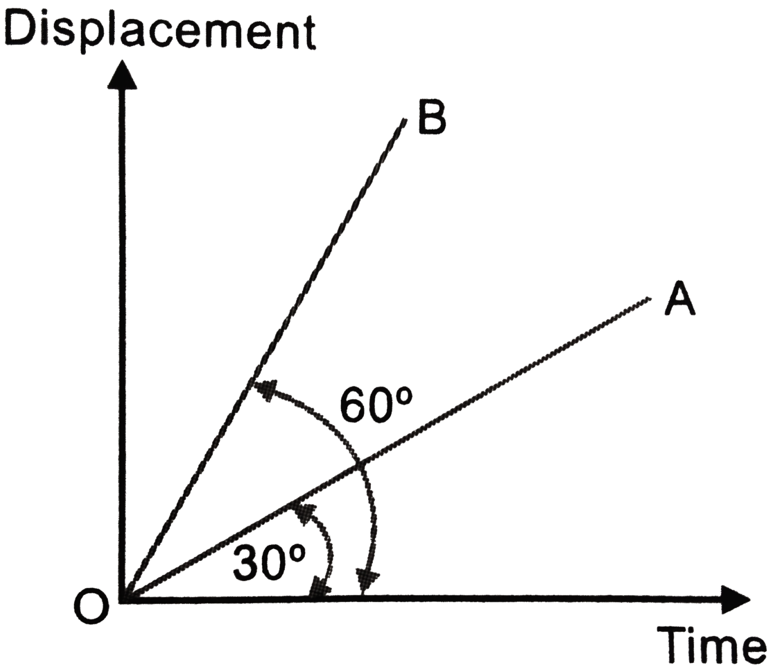
5. Two straight lines drawn on the same displacement-time graph make angles 30° and 60° with time-axis respectively Fig. 2 (a) .36 Which line represents greater velocity? What is the ratio of two velocities?



A. $1:2$

B. $1:3$

C. $2:1$

D. $3:1$

Answer: D

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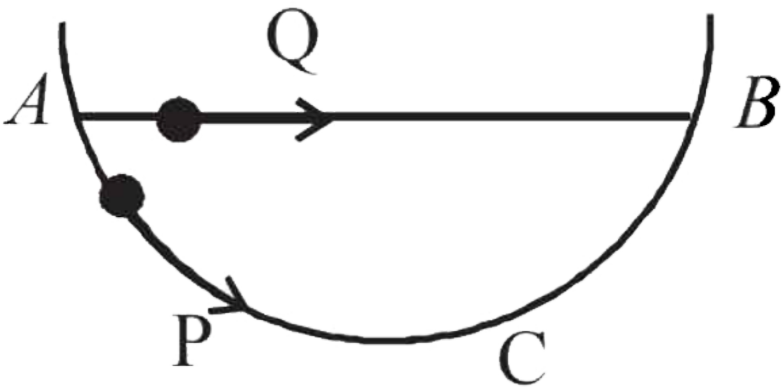
6. A particle P is sliding down a frictionless hemispherical bowl. It passes the point A at $t = 0$. At this instant of time, the horizontal component of its velocity is v. A bead Q of the same mass as P is ejected from A at $t = 0$ along the horizontal string AB, with the speed v. Friction between the bead and the string may be neglected. Let t_P and t_Q be the respective times taken by P and Q to reach the point B. Then:



A. (a) $t_p < tQ$

B. (b) $t_p > t_q$

C. (c) $t_p = t_q$

D. (d) $\frac{t_p}{t_q} = \frac{\le n > hofatarcACB}{} \le n > hofch \text{ or } dAB)$

Answer: A

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7. A body of mass (m) moving along a straight line covers half the distance with a speed of 2 m/s. The remaining half of the distance is covered in two equal tiem intervals with a speed of $3ms^{-1}$ and $5ms^{-2}$ respectively. The average speed of the particle for the entire journey is .

A. (a) $(3/8)ms^{-1}$

B. (8 //3) ms^(-1)`

C. (c) $(4/3)ms^{-1}$

D. (d) $(16/3)ms^{-1}$

Answer: B

Watch Video Solution

8. A car travels half the distanace with constant velocity $30 km/h$ and another half with a constant velocity of ` 40 km //h along a straight line. The average velocity of car in km//h is.

A. (a) 35

B. (b) 34.3

C. (b) 0

D. (d) $\sqrt{30 \times 40s}$.

Answer: B

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9. A cae movies a distance of $200m$. It covers the first half of the distance at speed of $40km/h$ and second half of the distance at a speed (v). The average speed is $48km/h$. Find the value of (v) .

A. (a) $56km/h$

B. (b) $60km/h$

C. (c) $50km/h$

D. (58 km//h`

Answer: B

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10. A car runs at a constant speed on a circulat track of radius $100m$. Taking $62.8s$ for every circular lap. The average velocity and average speed for each circular lap respectively are :

A. (a) $10m/s. 0$

B. (b) ` 0,0,

C. (c) $0, 10m/s$

D. (d) $10m/s. 10m/s$

Answer: C

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11. Taxis leave station X for station Y every $10 \min$. Simultaneously, a taxi also leaves station Y for station$X$ every $10 \min$. The taxis move at the same constant speed and go from X and Y or vice-versa in $2h$, How many taxis coming from the other side will meet each taxi enroute from Y and X?.

A. (a) 11

B. (b) 12

C. (c) 23

D. (d) 24

Answer: C

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12. A particle experiences a constant acceleration for 20 sec after starting from rest. If it travels distance S_1 in the first 10 sec and a distance S_2 in the next 10 sec, Then

A. (a) $S_2 = 2S\big)1$

B. (b) S_2 =3 S_1`

C. (c) $S_1 = 2S_2$

D. (d) $S_1 = 3S_2$

Answer: B

Watch Video Solution

13. A man throws ball into the air one after the other. Throwing one when other is at the highest point. How high the balls rise if he throws twice a second.

A. (a) $2.45m$

B. (b) $1.225m$

C. (c) $19.6m$

D. (d) $4.9m$

Answer: B

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14. A bus begins to move with an acceleration of $1ms^{-1}$. A man who is $148m$ behind the bus starts running at $10ms^{-1}$ to catch the bus, the man will be able to catch the bus after .

A. $6s$

B. $12s$

C. $8s$

D. $4s$

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15. A particle is moving such that its position coordinates (x, y) are $(2m, 3m)$ at time $t = 0, (6m, 7m)$ at time $t = 2s$, and $(13m, 14m)$ at time $t = 5s$.

Average velocity vector $\left(\vec{V}_{av}\right)$ from $t = 0$ to $t = 5s$ is

A. (a) 1/5 (13 hat i+ 14 hat j)`

B. (b) $\frac{7}{3}\left(hati + \hat{j}\right)$

C. (b) 2 (hat I + hat j)`

D. (d) (11) /5 (hat I + hat j)`

Answer: D

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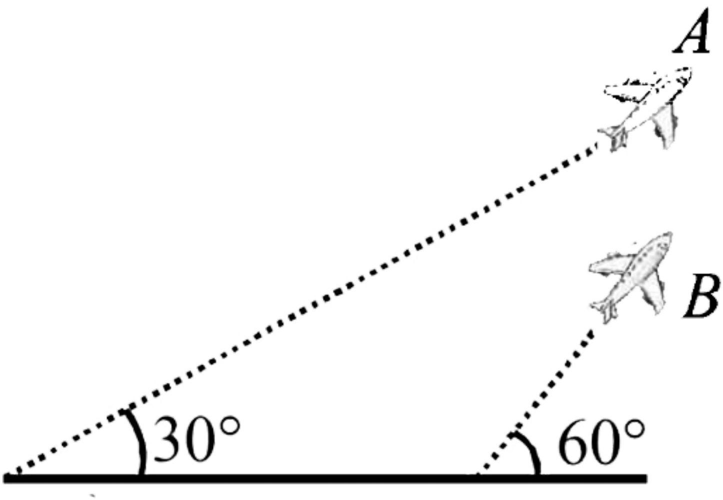
16. Airplanes A and B are flying with constant velocity in the same vertical plane at angles 30° and 60° with respect to the horizontal respectively as shown in figure . The speed of A is $100\sqrt{3}m/s$. At time $t = 0s$, an observer in A finds B at a distance of $500m$. The observer sees B moving with a constant velocity perpendicular to the line of motion of A . If at $t = t_0$, A just escapes being hit by B, t_0 , A just escapes being hit by B, t_0 in seconds is



A. (a) $3, 5S$

B. (B) $5S$

C. (C) $6.5S$

D. (D)$196.\ 0M$

Answer: D

Watch Video Solution

17. Two balls of equal masses are thrown upwards along the same vecticla direction at an interavel of $2seconsds$. With the same intial velcity of $39.2m/s$. The these collede at a height of .

A. (a) $44.1m$

B. (b) $73.5m$

C. (c) $11.6m$

D. (d) 1 9 .0 m`

Answer: B

Watch Video Solution

18. Two balls of equal masses are thrown along the same vertical direction at an interval of $2 seconds$, with the same initial velocity of 1 45 ms^(-1) . $Then these balls collide at a height of \left(use g = 10 ms^{-2}\right.$

A. (a) ` 54 . 2 m

B. (b) ` 96. 25 m

C. (c) $16.7m$

D. (d) $217.0m$

Answer: B

Watch Video Solution

19. A body dropped from top of a tower falls through $40m$ during the last two seconds of its fall. The height of tower in m is (g= 10 m//s^@)`

A. (a) $10m$

B. (b) $45m$

C. (c) 80

D. (d)$50m$

Answer: A

Watch Video Solution

20. A body is rpojected vertically upwards with a velocity of $10m/s$. If reaches the maximum height (h) in time (t). In time $t/2$ the height covered is (g= 10 m//s^@)`

A. (a) $h/2$

B. (b) (2 //5) h`

C. (c) $(3/4)h$

D. (d) $(5/8)h$

Answer: C

Watch Video Solution

21. Two trains travelling on the same track are approaching each other with equal speed of $40m/s$. The drivers of the trains beging to decelerate simultaneously when just ` 2.0 km apart. Assuming deceleration to be uniform and equal the value to the deceleration to barely avoid collision should be .

A. (a) $0.8m/s^2$

B. (b) $2.\ 1m/d^2$

C. (c) $11.0m/d^2$

D. (d) $11.8m/d$

Answer: A

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22. A particle movig with a uniformacceleration travels 24 metre and 64 metre in first two successive intervals of 4 seconds each. Its initial velocity is.

A. (a) $1m/s$

B. (b) 2 m//s`

C. (c) $5m/s$

D. (d)$10m/s.$

Answer: A

Watch Video Solution

23. Water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap, the instant the first drop touches the ground. How far above the ground is the second drop at that instant. $\left(g = 10ms^{-2}\right)$

A. (a) $1.25m$

B. (b) $2.50m$

C. (c) $3.75m$

D. (d) 6sec

Answer: C

Watch Video Solution

24. A body released from the top of a tower falls through half the height of tower in 3 seconds. If will reach the ground after nearly .

A. 3.5sec

B. 4.24sec

C. 4.71sec

D. 6sec

Answer: B

Watch Video Solution

25. A ball is thrown up, it reaches a maximum height anf then comes down. IF t_1 and t_2 (t_2 gt t_1)` ar the time that the ball takes to be at a particular height then the time taken by the ball to reach the highest point is .

A. (a) $\left(t_1 + t_2\right)$

B. (b) $\left(t_2 - t_1\right)$

C. (c) $\left(t_2 - t_1\right)/2$

D. (d) $\left(t_2 + t_1\right)/2$

Answer: D

Watch Video Solution

26. A particle is dropped from rest from a large height Assume g to be constant throughout the motion. The time taken by it to fall through successive distance of $1m$ each will be :

A. all equal being equal to $\sqrt{2/g}$ second

B. in the of square roots of the integers $1, 2, 3, 4$

C. in the ration of the differences in the square roots of integers i.e.

$$\left(\sqrt{1}-\sqrt{0}\right), \left(\sqrt{2}\right)-\sqrt{1}\right), \left(\sqrt{3}-\sqrt{2}\right), \left(\sqrt{4}-\sqrt{3}\right), \ldots$$

D. in the ration $\frac{1}{\sqrt{1}}:\frac{1}{\sqrt{2}}:\frac{1}{\sqrt{3}}:\frac{1}{\sqrt{4}}$

Answer: C

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27. A balloon starts rising from the ground with an acceleration of $1.25ms^{-2}$. After 8 seconds, a stone is released from the balloon. After releasing, the stone will:

A. (a) cover a distance of $40m$

B. (b) have displacement of $50m$

C. (c) reach the ground in 4 seconds `

D. (d) beging to move downward after being released.

Answer: C

Watch Video Solution

28. A man in a balloon rising vertically with an accelration fo $4.9ms^{-2}$ released a ball $2seconds$ after the balloon is let fo from the fround. The greatst height above the ground reached by the ball is .

A. (a) $9.8m$

B. (b) $14.7m$

C. (c) $19.\ 6m$

D. (d) $24.\ 5m$

Answer: B

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29. A bullet loses $1/20$ of its velocity in passing through a plank. What is the least number of plank required to stop the bullet .

A. 8

B. 7

C. 11

D. 14

Answer: C

Watch Video Solution

30. A balloon rises from rest on the ground with constant acceleration $g//8$. A stone is dropped from the balloon when the balloon has risen to a height of (H). Find the time taken by the stone to reach the ground.

A. (a) $4\frac{\sqrt{h}}{g}$

B. (b) $2\frac{\sqrt{h}}{g}$

C. (c) sqrt (2 h) /g`1

D. (d) $\frac{\sqrt{g}}{h}$

Answer: B

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31. A ball rleased from the tope of a tower travels $\frac{11}{36}$ of the height of the tower in the last second of its journey. The height of the tower is (g= 10 ms^(2)).

A. $11m$

B. (b) $36m$

C. (c) $180m$

D. (d) 110 m`

Answer: C

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32. If a particle is thrown vertically upwards , then its velocity so that it covers same distance in ` 5th and 6th seconds would be .

A. (a) $48m/s$

B. (b) $14m/s$

C. (c) $49m/s$

D. (d) $7m/s$

Answer: C

Watch Video Solution

33. A car acceleartion from reat at a constant rate of $3ms^{-2}f$ or $sometime. Thenitr\eta rdsatconstanttateof6ms^{-1}$ and comes to rest. If the total tiem for which it remains in motion is 3 seconds. What is the total distance travelled ?

A. (a) $3m$

B. (b) $4.5m$

C. (6 m`

D. (d) 9.0

Answer: D

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34. A stone is dropped from a certain height which can reach the ground in $5s$. It is stopped after $3s$ of its fall and then it is again released. The total time taken by the stone to reach the ground will be .

A. (a) $2s$

B. (b) 3 s`

C. ($4s$

D. (d)$no \neq of these.$

Answer: C

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35. The ball is dropped from a bridge $122.5m$ above a river, After the ball has been falling for 2 s, a second ball is thrown straight down after it. What must its initial velocity be so that both hit the water at the same time ?

A. (a) $40m/s$

B. (b) $55.5m/s$

C. (c) $26.1m/s$

D. (d) $9.6m/s$

Answer: C

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36. A body is moved along a straight line by a machine delivering constant power . The distance moved by the body is time t is proptional to

A. (a) $t \wedge (1/2)$

B. (b) $t^{3/4}$

C. (c) $t^{3/2}$

D. (d) t^2

Answer: C

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37. A particle is moving in a straight line with initial velocity u and uniform acceleration f. If the sum of the distances travelled in t^{th} and $(t+1)^{th}$ seconds is $100cm$, then its velocity after t seconds, in cm/s, is.

A. (a) 20

B. (b) 30`

C. (c) 50

D. (d) 80

Answer: C

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38. Two particles , one with constant velocity $50m/s$ and the other with uniform acceleration $10m/s^{-2}$. Start moving simultaneously from the same place in the same direction. They will be at a distance of $125m$ other after.

A. $5\sec$

B. $5\left(1+\sqrt{2}\right)\sec$

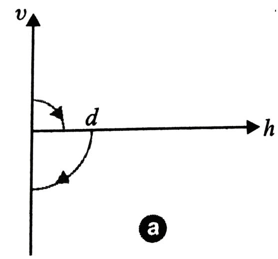
C. $10\sec$

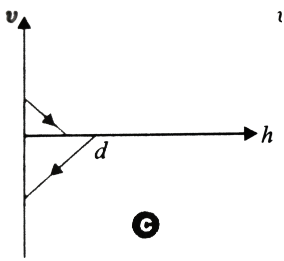
D. $10\left(\sqrt{2}+1\right)\sec$

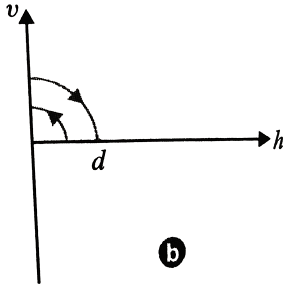
Answer: C

Watch Video Solution

39. A ball is dropped vertically from a height d above the ground . It hits the ground and bounces up vertically to a height $(d)/(2)$. $Neg \leq ct \in g \subset sequentmotion$ and $airresis$tance, $itsvelocity$v $varieswiththeheight$h` above the ground as

A. 

B. 



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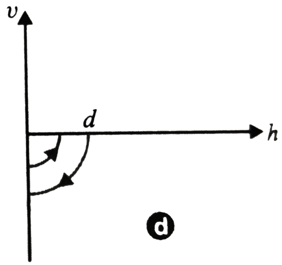

D.

Answer: A

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40. A parachutist after bailing out falls 50m without friction. When parachute opens, it decelerates at $2m/s^2$. He reaches the ground with a speed of $3m/s$. At what height, did the bail out?

A. (a) $11m$

B. (b) $293m$

C. (c) $182m$

D. (d)$243m$

Answer: B

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41. A balloon is ascending vertically with an acceelration of $0.2ms^{-2}$ .Two stones are dropped from it at an interval fo $2s$, the distance between then when the second stone dropped is (tanke g=9.i8 ma^(-2).

A. (a) $0.4m$

B. (b) 4. $9m$

C. © 19 .6 m`

D. (20 .0 m`.

Answer: D

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42. 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 constant and x is the position of the particle. The acceleration of the particle as a function of x is given by.

A. (a) -2 n beta^2 x^(-4n-1)`

B. (b) -2 beta^(2)x^(-2n+1)`

C. (c) $-2n\beta^2 x^{-4}n + 1)$

D. (d) $-2n\beta^2 x^{-2n-1}$

Answer: A

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

A. (a) $24 m / s^{2}$

B. (b) $zero$

C. (c) $6 m / s$

D. (d) $12 m / s^{2}$

Answer: (d)

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44. The retardation fo a moving particle if the relation between time and position is $t = A x^{3} + B x^{2}$ where A and B are appropriate constants will be .

A. (a) $\frac{6 A x + 2 B}{\left(3 A x^{2} + 2 B x\right)^{3}}$

B. (b) $(6 B x + 6 A)$/((3 Ax^2 + 2 B x)^3)`

C. (c) $\frac{6 A + 2 B x}{\left(3 A x + 2 B x^{2}\right)^{3}}$

D. (d) (6 A+2 B x)/((3 A+ 2 B x^3)^2)`

Answer: A

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45. The displacement x of a particle varies with time t as $x = ae^{-\alpha t} + be^{\beta t}$.

Where a, b, α and β positive constant.

The velocity of the particle will.

A. (a) $be \in dependtof$ beta`

B. (b) dorpe to zreo when $\alpha = \beta$

C. (c) ` go ondecreasing with tiem

D. (d) ` go on incrasing with time

Answer: D

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46. The acceleation fo a particle (a) is related to irs velocity (v) by $a = - v$.

What is the bature of velocity-time curve ?

A. (a) Linearly increasing

B. (b) Exponentially decreasing

C. (c) Exponentially increasing

D. (d) Linearly decreasing

Answer: B

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47. An object , moving with a speed of $6.25 m/s$, is decelerated at a rate given by :

$\frac{dv}{dt} = - 2.5\sqrt{v}$ where v is the instantaneous speed . The time taken by the object , to come to rest , would be :

A. (a) $2s$

B. (b) $4s$.

C. (c) 8

D. (d) $1s$

Answer: A

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48. The deceleration exerienced by a moving motor blat, after its engine is cut-off is given by $dv/dt = -kv^3$, where k is constant. If v_0 is the magnitude of the velocity at cut-off, the magnitude of the velocity at a time t after the cut-off is.

A. (a) v_0/(sqrt (1- 2 k v^2 _0t)`

B. (b() v_0/(sqrt(1 + 2 k v_0 t)`

C. (c) $\dfrac{v_0}{\sqrt{1 - 2kv^2 t}}$

D. (d) v_0/(sqrt (1 + 2 k v_0 t)`

Answer: B

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49. The displacement to particle is zero at $t = 0$. It starts moving in the positive x-direction with a velocity which varies, $v = k\sqrt{x}$, where (k) is a constant. Find the relation for variation of velocity with time.

A. (a) (2 k^2)/t`

B. (b) (2 t^2)/k`

C. (c) $\frac{k^2 t}{2}$

D. (d) $\frac{2}{kt^2}$

Answer: C

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50. The displacement of a body is given by $4s = M + 2Nt^4$, where M and N are constants.

The velocity of the body at any instant is .

A. (a) $\frac{m+2nt^4}{4}$

B. (b) $2n$)

C. (c) (m+ 2 n)/4`

D. (d) $2nt^{\#}$

Answer: D

Watch Video Solution

51. The retardation experienced by a movign motr bat after its engine is cut-off , at the instant (t) is given by, =-k v^4, $where(k)isaconstant. If$ v_0` is the magnitude of velocity at the cut-off , the magnitude fo velocity at time (t) after the cut-off is .

A. (a) v_0 /(sqrt(3 kt v_0^3)`1

B. (b) v_0/(sqrt (3 kt v_0^3 + 1 ^(1//3))`

C. (c) `sqrt (3 kt v_0^3)

D. (d) (3 kt v_0^3 + 1)^(1//3)`

Answer: B

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52. The distance traveled by an object along the axes are even by $x = 2t^2, y = t^2 - 4t, z = 3t - 5$. The initial velocity of the particle is .

A. $10unit$

B. $12unit$

C. $5unit$

D. $2unit$

Answer: C

Watch Video Solution

53. 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 constant.

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 $\left(v_x\right)$ is :

A. (a) $\frac{1}{2}f_0T^2$.

B. (b) f_0T^2

C. © 1/2 f_0T`

D. (d) g_0T

Answer: C

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54. The x and y coordinates of the particle at any time are $x = 5t - 2t^2$ and $y = 10t$ respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t=2s is:

A. (a) 0

B. (b) $5m/s^2$

C. (c) $-4m/s^2$

D. (d) - 8 m//s^2`

Answer: C

Watch Video Solution

55. A particle is moving with velocity $\vec{v} = k\left(y\hat{i} + x\hat{j}\right)$, where k is a constant . The genergal equation for its path is

A. (a) `y^1 = x + constant

B. (b) $xy = \text{cos}n\text{tan}t$

C. (c) y^2 = x^2 + constatn

D. (d) ` y =x^2 + constant

Answer: C

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56. A particle starts from the origin of coordinates at time t = 0 and moves in the xy plane with a constant acceleration α in the y-direction. Its equation of motion is $y = \beta x^2$. Its velocity component in the x-direction is

A. (a) sqrt (2 b)/a`

B. (b) sqrta/(2b)`

C. (c) sqrt a/b`

D. (d) sqrt b/a`

Answer: B

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57. A car of mass m starta from rest and accelerates so that the instyantaneous power delivered to the car has a constant magnitude P_0. The instaneous velocity of this car is proportional to

A. (a) $t^2 P_0$

B. (b) $t^{\frac{1}{2}}$

C. (c)- $\frac{1}{2}$) (d) t/(sqertm)`

D.

Answer: B

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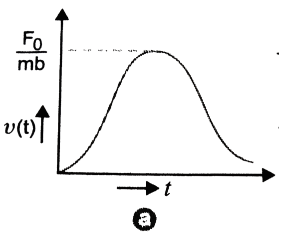
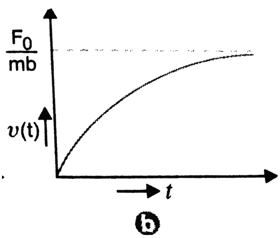
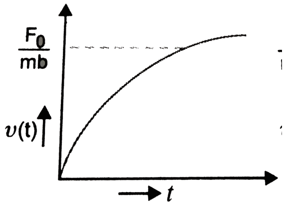
58. A particle of mass m is at rest the origin at time $t = 0$. It is subjected to a force $F(t) = F_0 e^{-bt}$ in the x - direction. Its speed $v(t)$ is depicted by which of the following curves ?



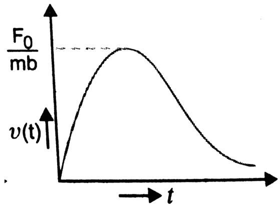
A. (a)



B. (b)



C. (C)



D. (d)

Answer: B

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59. The position vector of a particle $\vec{R}$ as a funtion of time is given by:

$\vec{R} = 4\sin(2\pi t)\hat{i} + 4\cos(2\pi t)\hat{j}$

Where R is in meters, t is in seconds and $\hat{i}$ and $\hat{j}$ denote until vectors along x-and y- directions, respectively Which one of the following statements is wrong for the motion of particle ?

A. (a) Path of particle is a circle of radius 4 metre

B. (b) Acceleration vector is along $-\vec{R}$

C. (c) Magniude fo acceleration vector is v^2/R,

D. (d)$Magniued \rightarrow thevelocityofpartic \le is$8` metre //second

Answer: D

Watch Video Solution

60. If the velocity of a particle is $v = At + Bt^2$, where A and B are constant, then the distance travelled by it between $1s$ and $2s$ is :

A. $\frac{3}{2}A + 4B$

B. $3A + 7B$

C. $\frac{3}{2}A + \frac{7}{3}B$

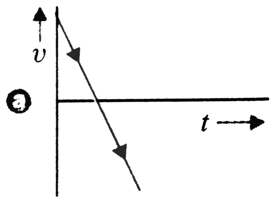
D. $\frac{A}{2} + \frac{B}{3}$

Answer: C

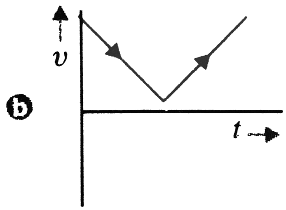
Watch Video Solution

61. A ball is thrown vertically upwards. Which of the following graph/graphs represent velocity time graph of the ball during its flight (air resistance is neglected).

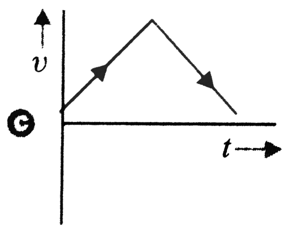
A. (a)



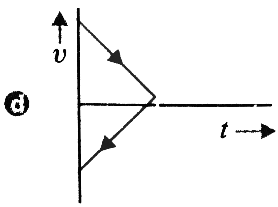
B. (b)



C. (c)



D. (d)



Answer: A

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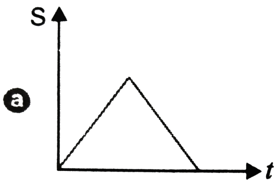
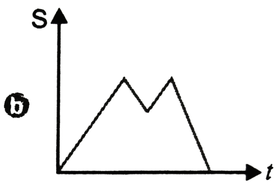
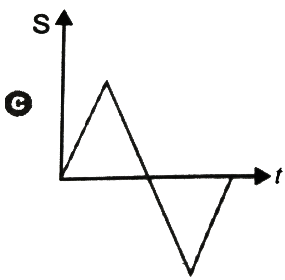
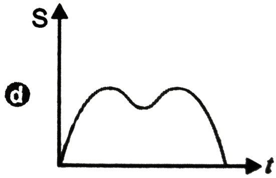
62. Which of the following graphs may not repersent variation of distance (S) with respect ot time (t) ?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: C

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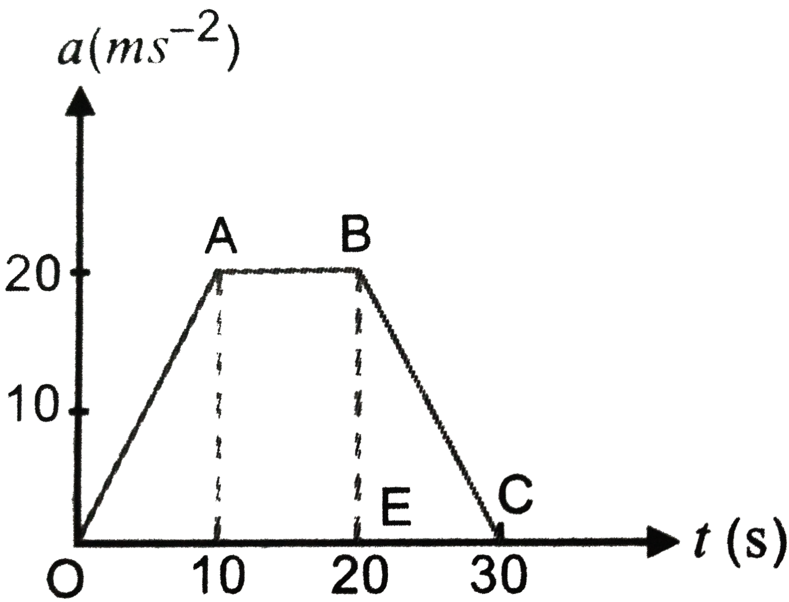
63. Fig. 2 (b) .16 shows the time-acceleration graph for a particle in rectillinear motion. Find the average acceleration in first twenty seconds.



A. $45m/s^2$

B. $40m/s^2$

C. $30m/s^2$

D. $20m/s^2$

Answer: C

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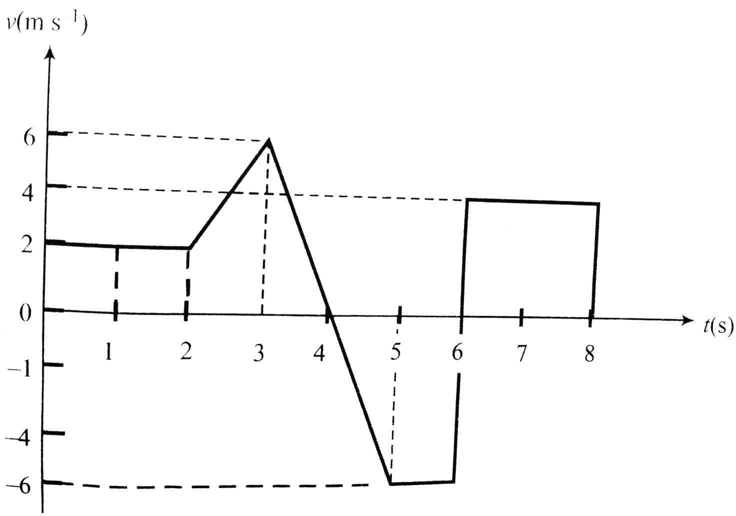
64. The velocity-time graph of a body is shown in .

The displacement of the body in $8s$ is.



A. 9m

B. 12m

C. 18m

D. 27m

Answer: A

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65. In the above questin, the total distance covered by the body in 8 seconds is.

A. 9m

B. 12m

C. 18m

D. 27m

Answer: D

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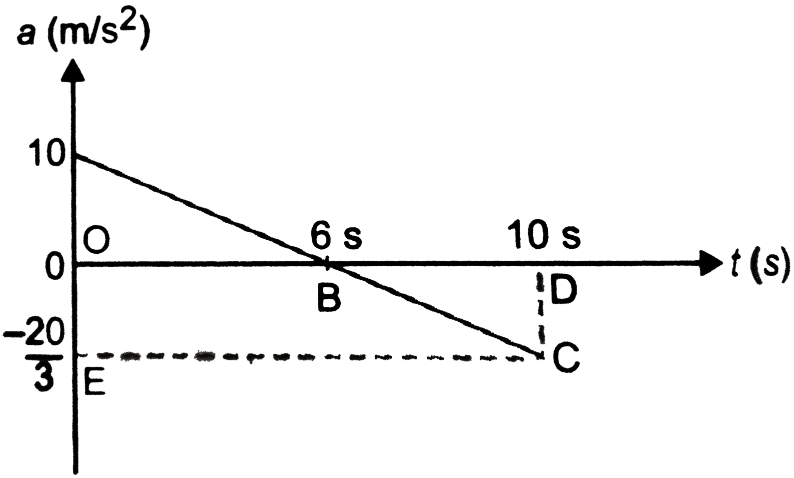
66. The acceleration time graph of a particle is shown in the Fig. 2 (CF). 11.

At time $t = 10s$ is the particle is $8ms^{-1}$. Its velocity $t = 10s$ is.



A. (a) (50)/3 ma^(-1)`

B. (b) (70)/3 ma^(-1)`

C. (c) $\frac{74}{3}ms^{-1}$

D. (d) (144)/3 ms^(-1)`

Answer: C

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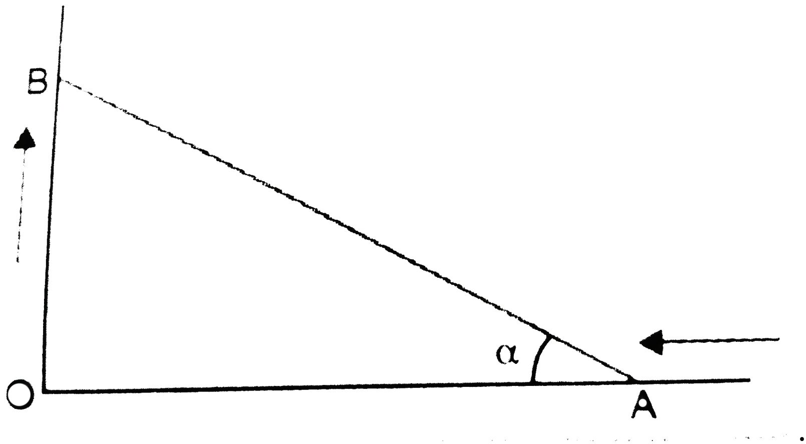
67. Two particles (A) and (B) are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity of (A) to the left is $10m/s$.

What is the velocity of (B) ange $\alpha = 30^{\circ}$.



A. (a) $9.8m/s$

B. (b) $10m/s$

C. (5.8 m//s`

D. ($17.3m/s$

Answer: D

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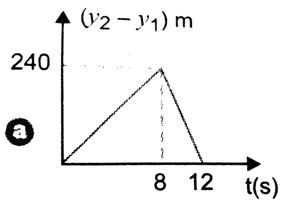
68. Two stones are thrown up simultaneously from the edge of a cliff $240m$ high with initial speed of $10m/s$ and $40m/s$ respectively . Which of the following graph best represents the time variation of relative position of the speed stone with respect to the first ?

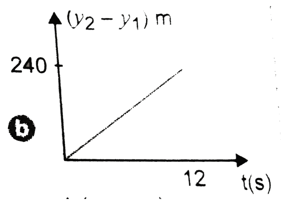
(Assume stones do not rebound after hitting the groumd and neglect air resistance , take $g = 10m/s^2$)

(The figure are schematic and not drawn to scale)

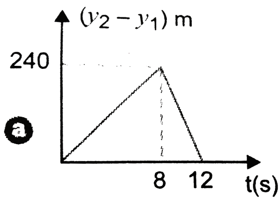
A. (a)



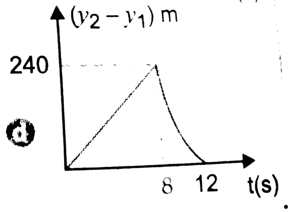
B. (b)



C. (c)



D. (d)



Answer: C

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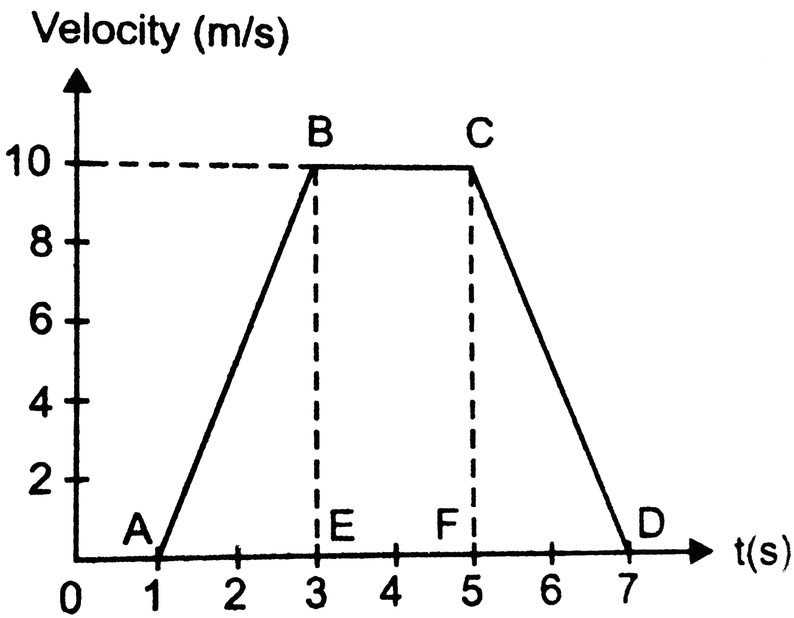
69. For the velocity tiem graph shown in Fig. 2 (CF).14, the distance covered by the body in last two seconds of its what fraction if the total distance covered by it in all the seven seconds?



A. (a) $1\frac{1}{2}$

B. (b) $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{2}{3}$

Answer: B

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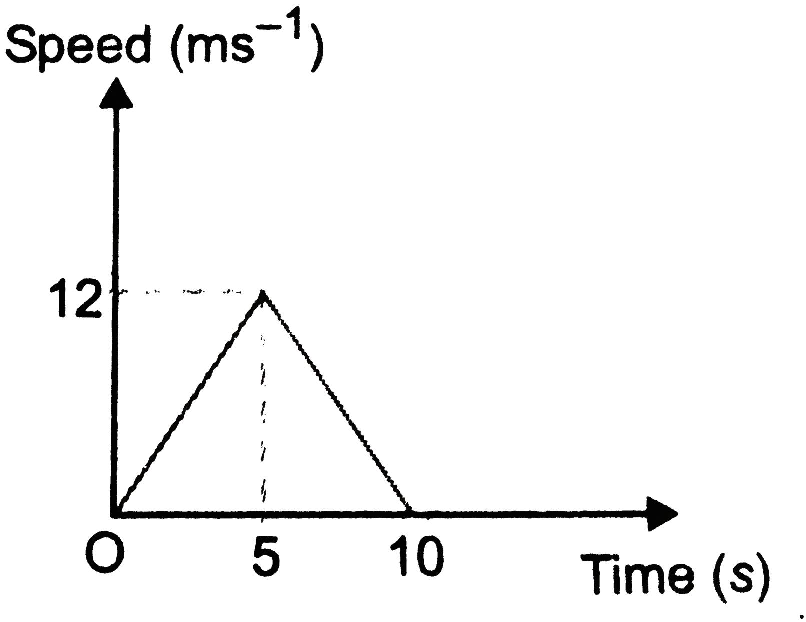
70. The speed-time graph of a particle moving along a fixed direction is shown in the Fig. 2 (CF) . 15. The distance traversed by the particle between $t = 2s\ 6s$ is .



A. $26m$

B. $36m$

C. $46m$

D. $56m$

Answer: B

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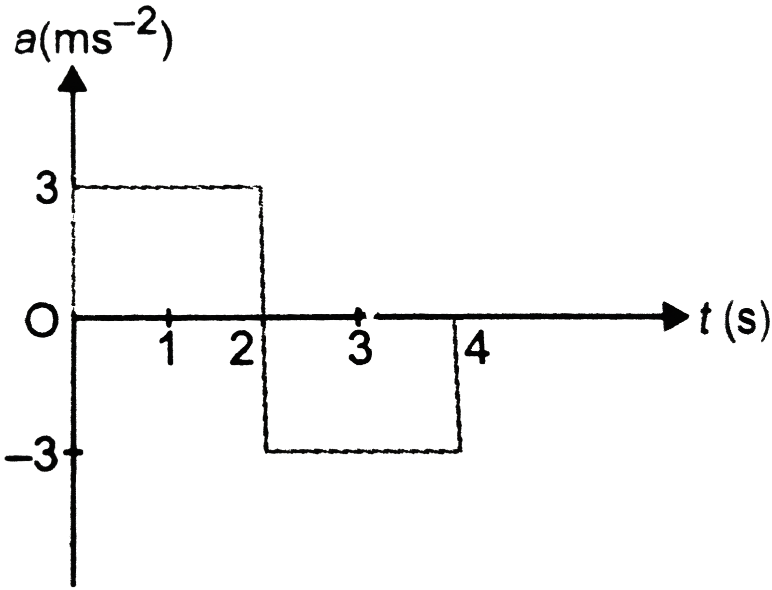
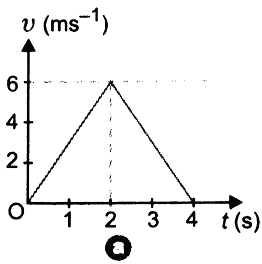
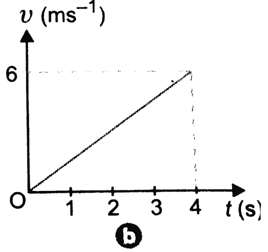
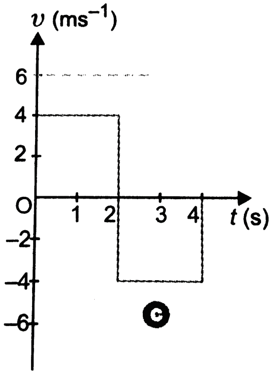
71. A particle starts from rst at $t = 0$ and undergoes and acceleration (a) in ms^(-2)` with tiem (t) in seconds which is shown in Fig. 2 (DF) .16 . Which one of the following plot repesents velocity (v) (in ms_1) versis time (in seconds) ?

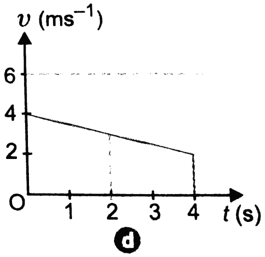


A.



B. 

C. 

D. 

Answer: A

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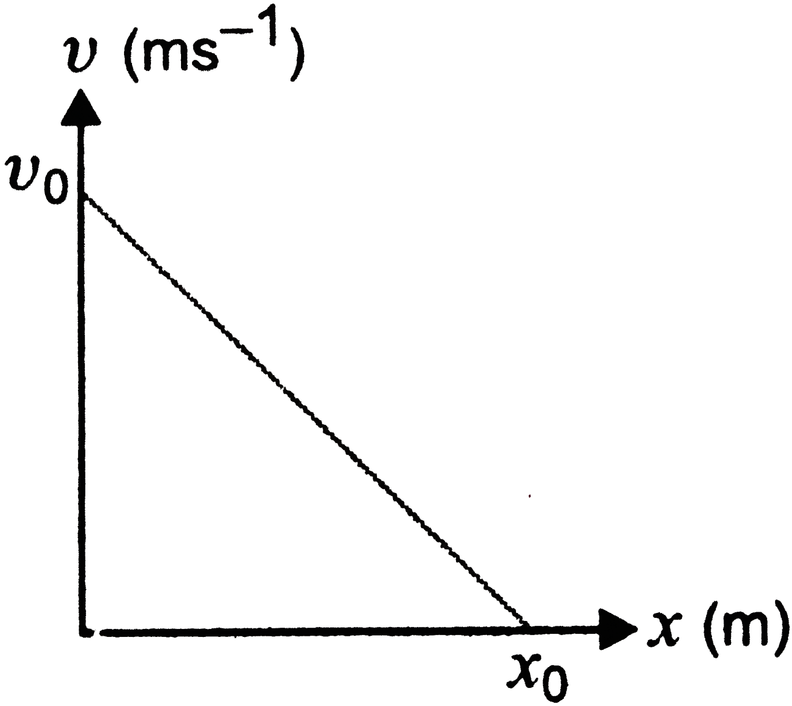
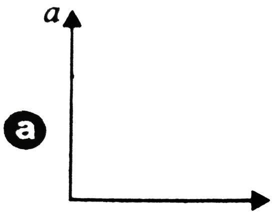
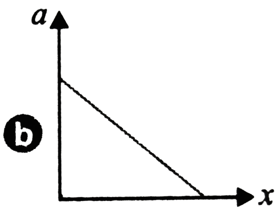
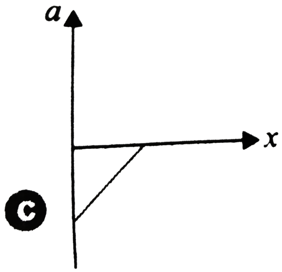
72. In the given v - t graph, the distance travelled by the body in 5 second will be

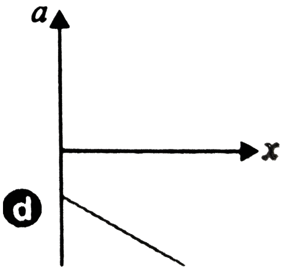


A. 

B. 



C.



D.

Answer: C

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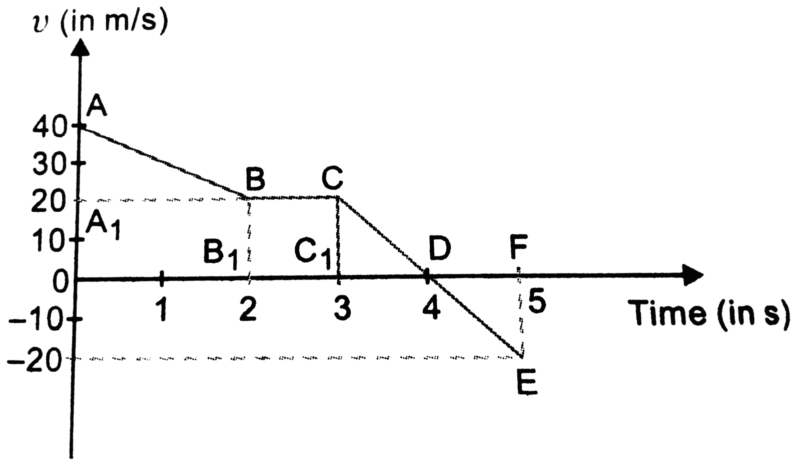
73. What will be the (a) ve (x) graph for the graph shown in Fig. 2 (CF). 18



A. $20m$

B. $40m$

C. 80 m`

D. $100m$

Answer: D

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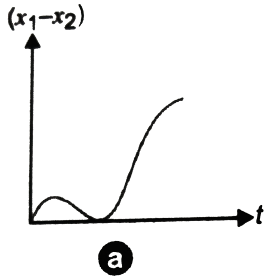
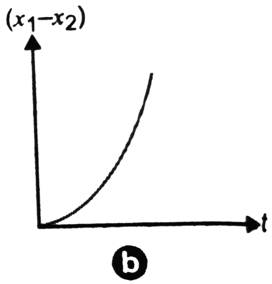
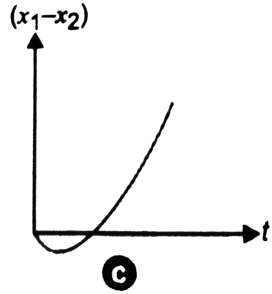
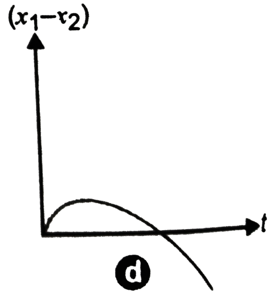
74. A body is at rest at $x = 0$. At $t = 0$, it starts moving in the positive x - *direction* with a constant acceleration . At the same instant another body passes through $x = 0$ moving in the positive x - *direction* with a constant speed . The position of the first body is given by $x_1(t)$ after time 't', and that of the second body by $x_2(t)$ after the same time interval . which of the following graphs correctly describes $\left(x_1 - x_2\right)$ as a function of time 't' ?

A. 

B. 

C. 

D. 

Answer: C

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75. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vector, the angle between these Vector is

A. 0°

B. (b) 90°

C. (45^@`

D. 180°

Answer: B

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76. A particle is moving eastwards with a velocity of $5m/s$. In $10s$ the velocity changes to $5m/s$ nothwards. The average acceleration in this time is

A. $\frac{1}{\sqrt{2}}ms^{-2}$, 45 West of Noth

B. (b) ` 1/2 ms^(-2), 60^@ west of North

C. $2ms^{-2}60^{\circ}$ East of sout

D. $\frac{1}{\sqrt{2}}ms^{-2}$, 30^@` West of south

Answer: A

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77. A person moves $30m$ north, then $30mest, then30\sqrt{2}$ south-west. His diaplacement from the original position is

A. ` 14 m South- West

B. (b) ` 28 m south

C. (c) ` 10 m West

D. $15m$ East

Answer: C

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78. A truck travelling due North at $50kmh^{-1}$ turns Westamd travels at the same speed. What is the change in velocity ?

A. $50kmh^{-1}$ North -West

B. $50\sqrt{2}kmh^{-1}$ South- West

C. $50\sqrt{2}kmh^{-1}$ South -West 50 sqrt 2 km h^(-1)south -West.

D.

Answer: D

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79. A vector $\vec{A}$ of magniude (A) is turned through an angle θ. Calculate the change in the magnitude of vector.

A. $2a\sin(\alpha/2)$

B. $2a\cos(\alpha/2)$

C. $2a\tan(\alpha/2)$

D. $2a\cot(\alpha/2)$

Answer: A

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80. An aeroplane fles a straight path from town (A) to town $B, 500 km$ way . Town (B) is due East ot town (A) and a strong with blows from South to North at 1 300 km//h. $Tfthela \neq$ s air speed is $900 km/h$. Which of following statements is true ?

A. Trip time is $\left.\frac{5}{6}\sqrt{5}\right) hour$

B. Plane's ground speed in $600 km/h$

C. Plane's heading is 30 degree South East.

D. plane' s heading is 60 degree south East.

Answer: A

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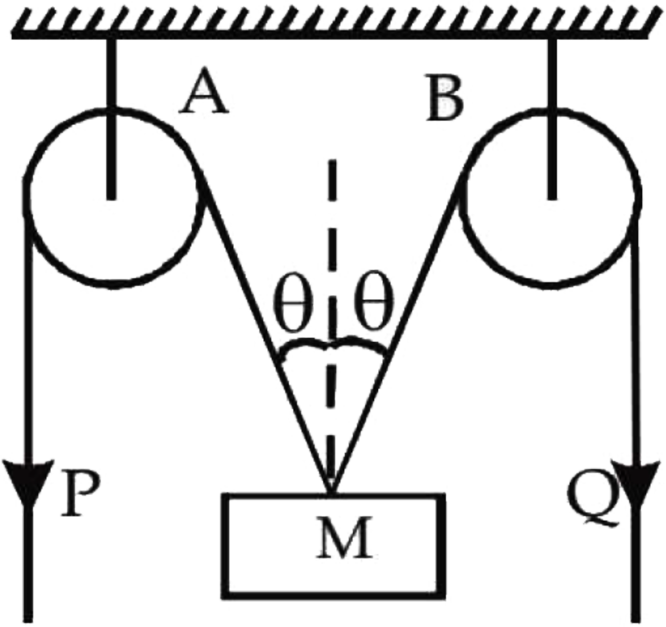
81. In the arrangement shown in the Fig, the ends P and Q of an unstretchable string move downwards with uniform speed U. Pulleys A and B are fixed.

Mass M moves upwards with a speed



A. $2u\cos\theta$

B. $u/\cos\theta$

C. $2u/\cos htea$

D. $u\cos\theta$.

Answer: B

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82. A body is moving with velocity $30m/s$ towards east. After $10s$ its velocity becomes $40m/s$ towards north. The average acceleration of the body is.

A. $1m/s^2$

B. $7m/s^2$

C. $\sqrt{7}m/s^2$

D. $5m/s^{\circ}$

Answer: B

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83. The sum of two forces at a point is 16N. if their resultant is normal to the smaller force and has a magnitude of 8N, then two forces are

A. $6 \neq w \rightarrow n$ and $10 \neq w \rightarrow n$

B. $8 \ne w \rightarrow n$ and $8 \ne w \rightarrow n$

C. $4 \ne w \rightarrow n$ and $12 \ne w \rightarrow n$

D. 2 newton and 14 newton

Answer: A

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84. If vector P, Q and R have magnitude 5,12,and 13 units and $\vec{P} + \vec{Q} = \vec{R}$, the angle between Q and R is

A. $coc^{-1}\frac{5}{12}$

B. cos^(-1) 5/(13)`

C. cos^(-1) (12)/(13)`

D. cos^(-1) 7/(13)`

Answer: C

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85. An object of mass $3kg$ is at rest. Now a force of $\vec{F} = 6t^2\hat{I} + 4t\hat{j}$ is applied on the object, the velocity of object at $t = 3s$ is.

A. $18\hat{I} + 3\hat{j}$

B. $18\hat{I} + 6\hat{j}$

C. 3 hat I + 1 8 hat j`

D. $18\hat{I} + 4harj$

Answer: B

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86. If $\vec{A} = \vec{B} + \vec{C}$, and the magnitudes of $\vec{A}$,$\vec{B}$,$\vec{C}$ are 5,4, and 3 units, then the angle between $\vec{A}$ and $\vec{C}$ is

A. cos^(-1) (3/5)`

B. cos^(-1) (4/5)`

C. $\pi/2$

D. sin ^(-1) (3/5)`

Answer: A

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87. Four persons K,L,M,N are initially at the four corners of a square of side d. Each person now moves with a uniform speed v in such a way that K always moves directly towards L, L directly towards M, M directly towards N, and N directly towards K. The four persons will meet at a time............. .

A. $l/2v$

B. sqrt 2 l //v`

C. $l/\sqrt{2}v$

D. l/v.

Answer: D

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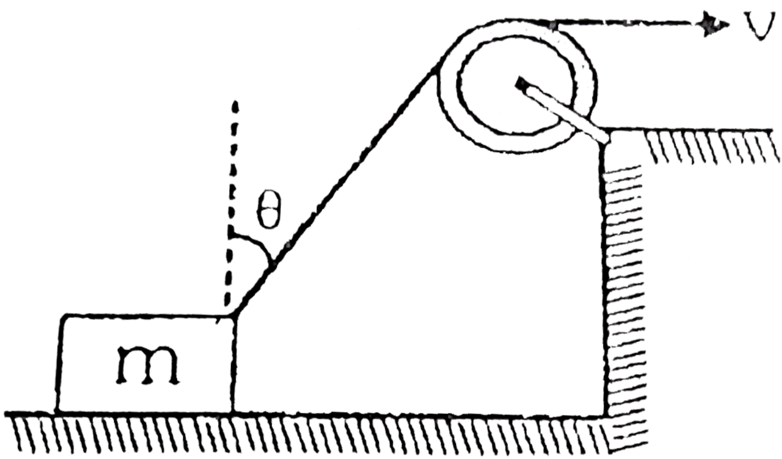
88. A block is dragged on a smooth plane with the help of a rope which moves with a velocity v as shown in figure. The horizontal velocity of the block is :



A. v

B. $v\sin\theta$

C. v//sin theta`

D. $v/\cos\theta$

Answer: C

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89. Forces of $5N, 12N$ and $13N$ are equilibrimum. If $\sin 23^{\circ} = 5/13$, the angle between $5N$ and $13N$ force is.

A. 23^{2}

B. 67°

C. 90°

D. ` 113^@

Answer: D

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90. The resultant ot two forces acting at an angle of 150° is $10N$ and is perpendicular to one of the forces. The other force is .

A. $20/\sqrt{2}N$

B. $10/\sqrt{3}N$

C. $20N$

D. $20\sqrt{3}N$

Answer: C

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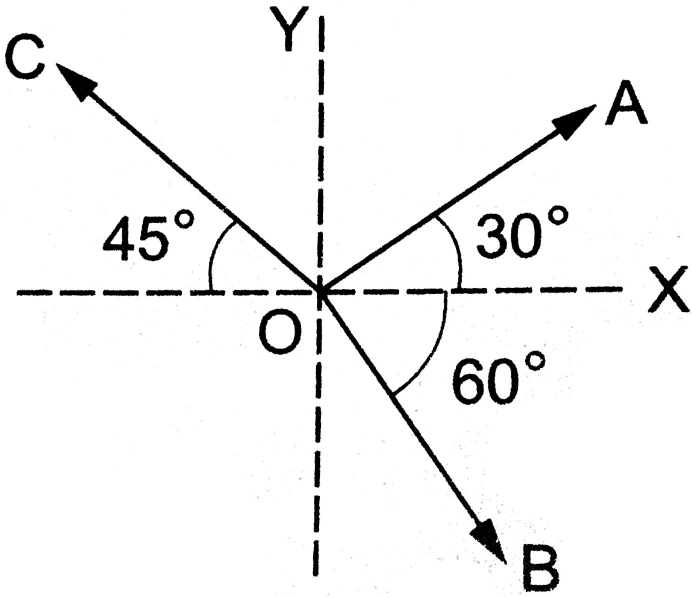
91. The magnitude of vectors $\overrightarrow{OA}, \overrightarrow{OB}$ and $\overrightarrow{OC}$ in figure are equal. Find the direction of $\overrightarrow{OA} + \overrightarrow{OB}$ - $\overrightarrow{OC}$.



A. $\tan^{-1}\left(\dfrac{2-\sqrt{3}-1}{2+\sqrt{3}+1}\right)$

B. $\tan^{-1}\left(\dfrac{1-\sqrt{3}+1}{1+\sqrt{3}+\sqrt{2}}\right)$

C. $\tan^{-1}\left(()1-\sqrt{3}-\sqrt{2}\right)\dfrac{)}{1+\sqrt{3}-\sqrt{2}}\Bigg)$

D. $\tan^{-1}\left(\dfrac{1+\sqrt{3}+\sqrt{2}}{1-\sqrt{3}+\sqrt{2}}\right.$

Answer: B

Watch Video Solution

92. Two unequal vectors are inclined at an angle 30°. When they are added, the resultant can be :

A. zero

B. directed along either

C. derected along eihter

D.

Answer: D

Watch Video Solution

93. The vectors $\vec{P} = a\hat{I} + a\hat{j} + 3\hat{k}\Big)$ and $\vec{Q} = a\hat{I} - 2\hat{j} - \hat{k}l$ are peroendicular to each other. The positve value of (a) is.

A. 3

B. 2

C. 1

D. 0

Answer: A

Watch Video Solution

94. the resultant of two forces is $10\sqrt{13}N$, when one of the force is $10\sqrt{3}N$ and angle between two forces is 1 30^@` then what is the value of second force ?

A. $10N$

B. $20N$

C. $20\sqrt{23}N$

D. $10\sqrt{3}N$

Answer: B

Watch Video Solution

95. The resultant of two vectors $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If the magnitude of $\vec{Q}$ is doubled, the new resultant vector becomes perpendicular to $\vec{P}$. Then, the magnitude of $\vec{R}$ is equal to

A. $P+Q$

B. Q

C. P

D. $\dfrac{P+Q}{2}$

Answer: B

Watch Video Solution

96. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitude of $\vec{A}-\vec{B}$ is equal to (n) times the magnitude of $\vec{A}-\vec{B}$, then angle between $\vec{A}$ and $\vec{B}$ is ?

A. $\cos^{-1}\left(\dfrac{n-1}{n-1}\right)$

B. $\cos^{-1}\left(\frac{n^2 - 1}{n^2 + 1}\right)$

C. $\cos^{-1}\left(\frac{n - 1}{n - 1}\right)$

D. $\cos^{-1}\left(\frac{n^2 - 1}{n^2 + 1}\right)$

Answer: B

Watch Video Solution

97. The magnitude of the component of the vector

`(2 hat i+3 hat j + hat k) along (3 hat I = 4 hat k) is .

A. $\frac{1}{2}$

B. (14) /4`

C. 3

D. $\frac{6}{5}$

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98. A boat which has a speed of $5 km/hr$ in steel water crosses a river of width $1 km$ along the shortest possible path in $15 \min utes$. The velocity of the river water in km/hr is

A. 1

B. 3

C. 4

D. sqrt14`

Answer: B

Watch Video Solution

99. Wind is blowing west to east along two parallel tracks. Two train moving with the same speed in opposite directions on these tracks have the steam tracks. If one is double than the other, what is the speed of each train ?

A. equal to that of wind

B. double that of wind

C. three times that of wind

D. half that of wind

Answer: C

Watch Video Solution

100. A ship travels downstream from point (A) to point (B) in two hours and upstream in three hours. Then the time taken by log wood to cover the distance from (A) to (B) is .

A. $5h$

B. $9h$

C. $12h$

D. $1h$

Answer: C

Watch Video Solution

101. A ship A is moving Westwards with a speed of $10kmh^{-1}$ and a ship B 100km South of A is moving northwards with a speed of $10kmh^{-1}$. The time after which the distance between them shortest is

A. $0h,$ 100 km`

B. $5h, 50\sqrt{2}km$

C. $5\sqrt{2}h, 50km$

D. $10\sqrt{2}h,$ 50 sqrt km`

Answer: B

Watch Video Solution

102. Two cars are moving in the same direction with the same speed $30km/hr$. They are separated by a distance of $5km$, the speed of a car moving in the opposite direction of it meets these two cars at an interval of 4 minutes, will be.

A. $40kmh^{-1}$

B. 45 km h^(-1)`

C. $50kmh^{-1}$

D. $35kmh^{-1}$

Answer: B

Watch Video Solution

103. A man running on the horizontal road at $8kmh^{-1}$ find the rain appears to be falling vertically. He incresases his speed to $12kmh^{-1}$ and find that the drops make angle 30^2 with the vertical. Fin dthe speed and direction of the rain with respedt to the road.

A. $10 km / h$

B. $9.5 km / h$

C. $10.58 km / h$

D. $6 km / h$

Answer: C

Watch Video Solution

104. A train is moving at a constant speed V when its driver observes another train in front of him on the same track and going in the same direction with constant speed v. If the distance between the trains is x then what should be the minimum retardation of the train so as to avoid collision?.

A. $\left(v + v_1^2\right)d$

B. (v -v_1)^2d

C. (v +v_1)^(1//2)d`

D. (v -v_1 ^(2//2)d`

Answer: D

Watch Video Solution

105. A boat can fo across a lake and retyrb ub tune T_0 at a speed v. On a rough day there is a uniform currednt at speed v_1 to help the onward hourney and impede the return jourmey. If the time taken to go across and return on the same day be (T) then T/T_0 is`

A. (1 -v_1^2 //v^21/((1 -v_1^2//v^2)) $\left(1+\frac{v_1^2}{v^2}\right)$

B. $\frac{1}{\left(1-v_1^2/v^2\right)}$

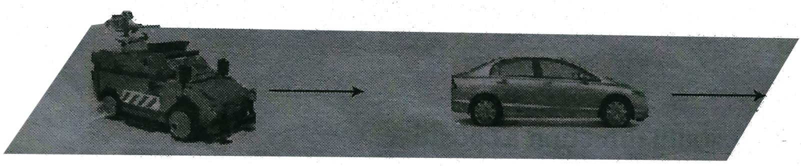
C. $\left(1+\frac{v_1^2}{v^2}\right)$

D. $\frac{1}{\left(1+v_1^2/v^2\right)}$

Answer: B

Watch Video Solution

106. A police van moving on a highway with a speed of $30kmh^{-1}$ Fires a bullet at a thief's car speeding away in a same direction with a speed of $192kmh^{-1}$. If the muzzle speed of the buller is $150ms^{-1}$, with what speed does the bullet hit thief's car? .



.

A. $105ms^{-1}$

B. $210ms^{-1}$

C. $315ms^{-1}$

D. $205ms^{-1}$

Answer: A

Watch Video Solution

Watch Video Solution

107. Two particles having position vectors $\vec{r}_1 = \left(3\hat{i} + 5\hat{j}\right) meters$ and $\vec{r}_2 = \left(-5\hat{i} - 3\hat{j}\right) metres$ are moving with velocities $\vec{v}_1 = \left(4\hat{i} + 3\hat{j}\right) m/s$ and $\vec{v}_2 = \left(\alpha\hat{i} + 7\hat{j}\right) m/s$. If they collide after $2s$, the value of α is

A. 2

B. 4

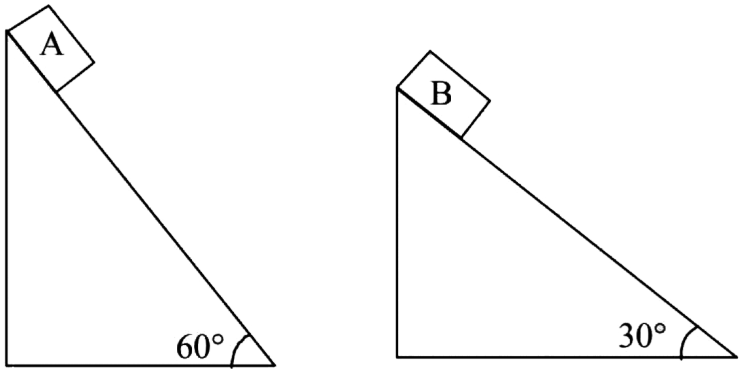
C. 6

D. 8

Answer: D

Watch Video Solution

108. Two fixed frictionless inclined planes making an angle 30° and 60° with the vertical are shown in figure. Two blocks A and B are planes. What is the relative vertical acceleration of A with respect to B?



A. $9.8ms^2$ in vertical direction

B. Zerp

C. $4.9ms^{-2}$ in evrtical direction

D. $4.9ms^{-2}$ in evrtical direction

Answer: C

Watch Video Solution

109. Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if the remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be :

A. $\left(t_1\right) + t_2\frac{)}{2}$

B. (t_1t_2)/(t_2-t_1)`

C. (t_t_2)/(t_2+t_1)`

D. t_1 - t_2

Answer: B

Watch Video Solution

110. A stone is dropped into a well. If the depth of water below the top be h and velocity of sound is v then the splash in water is heard after T sec. Then:

A. $T = 2h/v$

B. T= sqrt (2 h)/g + h /v`

C. $T = \frac{\sqrt{2h}}{v} + \frac{h}{g}$

D. $T = \sqrt{\frac{h}{2g} + \frac{2h}{v}}$

Answer: B

Watch Video Solution

111. A ball is rolled off along the edge of the table (horizontal) with velocity $4ms^{-1}$ .If hits the ground after time ` 0.4 s. Which one of the following statements is wrong ? (g= 10 ms^(-2)).

A. The height of table is 0.8 m`

B. It hits the ground at an angle of 60^2 with the vertical

C. It covers a horizontal distance $1.6m$ from the table

D. It hits the ground wigh vertical velocity $4m/s$

Answer: B

Watch Video Solution

112. An aircraft is flying at a height of $3400m$ above the ground, If the angle subtended at a ground observation point by the aircraft positions $10s$ apart is 30°, what is the speed of the aircraft ?

A. $192ms^{-1}$

B. $182ms^{-1}$

C. $172ms^{-1}$

D. $203ms^{-1}$

Answer: B

Watch Video Solution

113. A person in lift is holing a water jar, which has a small hole at the lower end of its side . When the lift is at rest, the water jet coming out of the hole hits the floor of the lift at a distance (d) of 1.2 m from th person. In the following state of the lift$smotionisgiven \in List$I and $thedistancewherethewaterjethitsthe\lfloor o \rfloor fthel$ if $tisgiven \in ListII. Matchthest$

I$withthose \in List$ II

and $se \leq ctthec$ or $rectanswersuwerusingthcodegivenbelowthelists. ListI, ListII.$

Lift si accelerating vertically $1. d = 1.2m$up

Q. Lift is accelertiong verticallydown with an accelertion less than the gravitational acceelration

R. Lift is moving vertically $3. d < 1.2m$ up with constant speed

S. Lite is falling freely ` 4. No water leaks out of hte jar .

A. $P - 2, Q - 3, R - 2S - 4$

B. $P - 2, Q - 3, R - 1, S - 4$

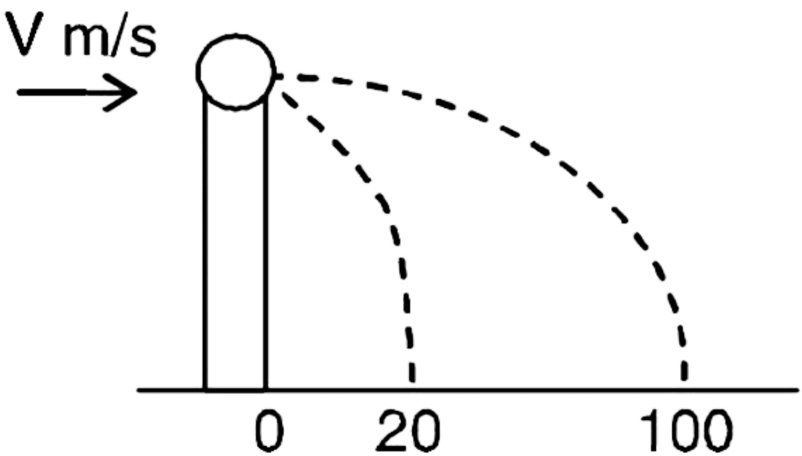
C. P-1, q-1, R-1 S-4`

D. P-2 , Q-3 , R - 1 , s-1`

Answer: C

View Text Solution

114. A ball of mass 0.2 kg rests on a vertical post of height 5 m. A bullet of mass 0.01 kg, travelling with a velocity $V m/s$ in a horizontal direction, hits the centre of the ball. After the collision, the ball and bullet travel independently. The ball hits the ground at a distance of 20 m and the bullet at a distance of 100 m from the foot of the post. The velocity V of the bullet is



A. $250 m/s$

B. $25\sqrt{2} m/s$

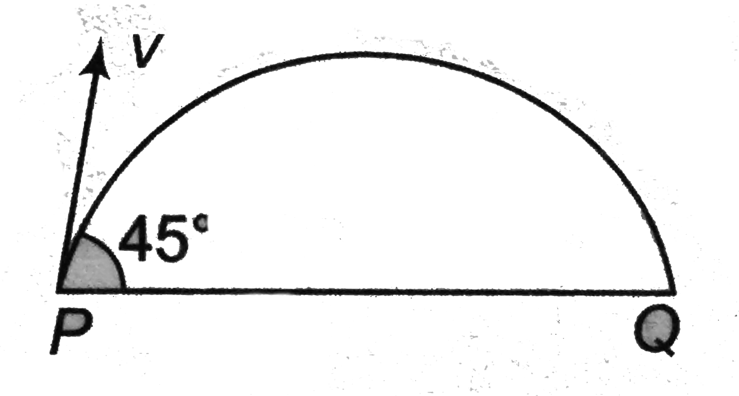
C. $400 m/s$

D. $500 m/s$

Answer: D

Watch Video Solution

115. A projectile of mass m is fired with a velocity v from point P at an angle 45°. Neglecting air resistance, the magnitude of the change in momentum leaving the point P and arriving at Q is



A. mv

B. $2mv$

C. $\sqrt{2}mv$

D. $zero$

Answer: C

Watch Video Solution

116. A football is kicked at a speed of $20m/s$ a projection angle of 45°. A receiver on the goal line 25 meters away in the direction to the kick runs the same instant to meet the ball. Before it hits the ground?

A. $5.483m/s$

B. $6.283m/s$

C. $5.112m/s$

D. $6.112m/s$

Answer: A

Watch Video Solution

117. A projectle is grojected in the upward direction maging an agnle of $60\ ^\circ$ will horizontal derection with a velocity of $147ms^{-1}$. The the time after which its inclination with the horizontal is $45\ ^\circ$ is.

A. $2.74s$

B. $5.49s$.

C. $10.09s$

D. $15s$.

Answer: B

Watch Video Solution

118. A projectile can have the same range$R$ for two angle of projection . If $t-1$ and t_2 be the terms of flight in the two cased then the initial velocity of projectile is?

A. $\frac{1}{4} > t_1t_2$

B. $\frac{1}{2} > t_1 t_2$

C. $\frac{1}{2} > (t_1 + t_2)^2$

D. $\frac{1}{2} > (t_1^2 + t_2^2)^{\frac{1}{2}}$

Answer: D

Watch Video Solution

119. A gun movunted on the top of a voing truck is aimed in the backward direction at an angle of 30° to the vertical. If the muzzle velocity of the bullet firee from the gun is $4ms^{-1}$, then the speed of the truck that will make the bullet come out vertically is.

A. $0.5ms^{-1}$

B. $1.0ms^{-1}$

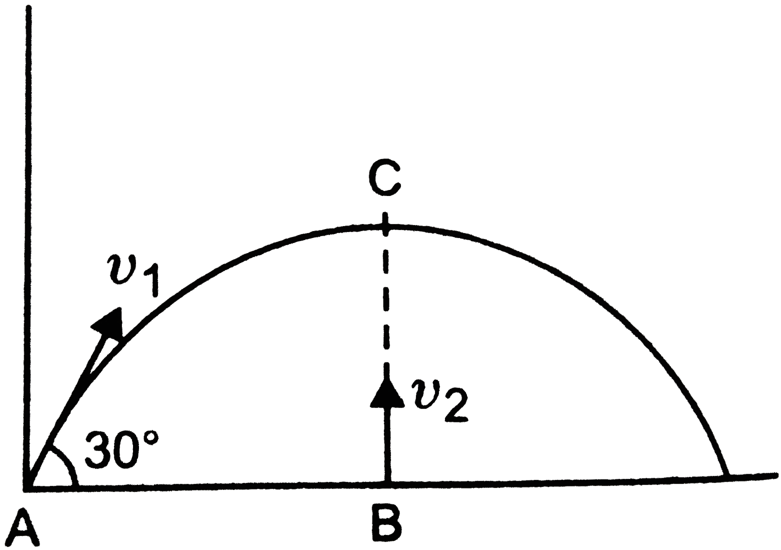
C. $1.5ms^{-1}$

D. $2.0ms^{-1}$

Answer: D

Watch Video Solution

120. A body si projected with velocity v_1 (A), At the same time , another body is projected vetically upwards from (B) with velocity v_2. The point (B) lies vetically below the highestpoint Fig. 2 (CF).29. For bothe the bodies to colled v_2/v_1 should be



A. 0.5

B. 1

C. $\sqrt{3}/2$

D. $2/\sqrt{3}$

Answer: A

Watch Video Solution

121. R is the rangle on a horizontal planne for a shot with the same velocity at two differen angles of projection. If h and h' be the greatest heights attained correspoinding to these angles of projection, what is R^2 equal to ?

A. hh'

B. $9hh'$

C. $16hh'$

D. $25hh'$

Answer: C

Watch Video Solution

122. A body is projected with a velocity of $40ms^{-1}$. After $2s$ it crosses a vertical pole of height $20.4m$ Find the angle of projection and horizontal range of projectile. (g = 9.8 ms^(-2)`.

A. 15°

B. 30°

C. 45°

D. 60°

Answer: B

Watch Video Solution

123. A projectile of mass $100g$ is fired with a velocity of $20ms^{-1}$ making an angle of 30° with the borizontal. As it rises to the highest point of its path its momentum changes by .

A. $1/2kgms^{-1}$

B. $1kgms^{-1}$

C. $2kgms^{-1}$

D. none of these

Answer: B

Watch Video Solution

124. If at a height of $40m$, the direction of moton of a projectile makes an angle $\pi/4$ with the orizontal, then its initial velocity and angle of projection are, respectively,

A. $30, \frac{1}{2}\cos^{-1}\left(-\frac{4}{5}\right)$

B. $30\frac{1}{2}\cos^{-1}\left(-\frac{1}{2}\right)$

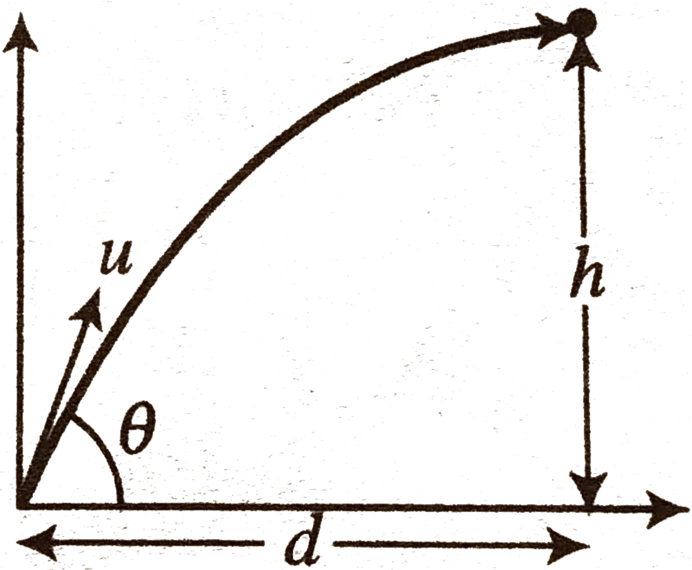
C. $50\frac{1}{2}\cos^{1}\left(-\frac{8}{25}\right.$

D. 60 1/2 cos^(-1) (- 1/4)`

Answer: C

Watch Video Solution

125. If a stone is to hit at a point which is at a distance d away and at a height h (Fig. 5.200) above the point from where the stone starts, then what is the value of initial speed u if the stone is launched at an angle θ ?



A. $\frac{g}{\cos\theta}\sqrt{\frac{g}{2(d\tan\theta - h)}}$

B. $\frac{d}{\cos\theta}\sqrt{\frac{g}{2(d\tan\theta - h)}}$

C. $\frac{\sqrt{gd^2}}{h\cos^2 thea}$

D. $\frac{\sqrt{gd^\circ}}{(d - h)}$

Answer: B

Watch Video Solution

126. A projectile can have same range R for two angles of projection. It t_1 and t_2 are the times of flight in the two cases, then what is the product of two times of flight ?

A. R

B. $1/R$

C. R^2

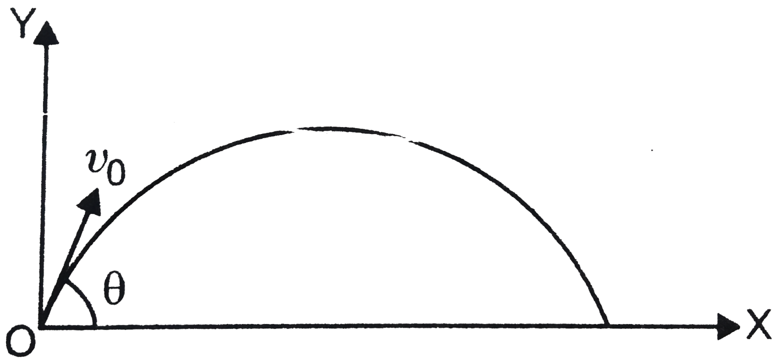
D. $1/R^2$

Answer: A

Watch Video Solution

127. A small particle of mass m is projected at an angle θ with x-axis with initial velocity υ_0 in x-y plane as shown in Fig. Calculate the angular momentum of the particle

at $t < \dfrac{\upsilon_0 \sin\theta}{g}$.



A. $mgv_0 t\cos\theta\hat{k}$

B. $-\dfrac{1}{2}mgv_0 t^2\cos\theta\hat{k}$

C. $\dfrac{1}{2}mgv_0 t^2\cos\theta\hat{i}$

D. $-mgv_0t^2\cos\theta\hat{j}$

Answer: B

Watch Video Solution

128. a projectile is fired from the surface of the earth with a velocity of $5ms^{-1}$ and angle θ with the horizontal. Another projectile fired from another planet with a velocity of $3ms^{-1}$ at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth.The value of the acceleration due to gravity on the planet is in ms^{-2} is given $\left(g = 9.8ms^{-2}\right)$

A. 3.5

B. 5. 9

C. 16, 3

D. 110.8

Answer: A

Watch Video Solution

129. A stone falls freely under gravity. It covered 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 :

A. $h_1 = h_2 = h_{23}$

B. $h_1 = 2h_2 = 3h_3$

C. $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

D. $h_2 = 3h_1$amd $h_3 = 3h_2$

Answer: A

Watch Video Solution

130. A particle projected at a definite angle $\propto$ to the horizontal passes through points (a, b) and (b, a), referred to horizontal and vertical axes through the points of projection. Show that :

(a) The horizontal range $R = \dfrac{a^2 + ab + b^2}{a + b}$.

(b) The angle of projection $\propto$ is given by

$\tan^{-1}\left[\dfrac{a^2 + ab + b^2}{ab}\right]$.

A. $\tan^{-1}\left[\dfrac{P^2 + PQ + Q}{PQ}\right]$

B. tan^(1) [(P^2+Q^2)/(PQ)]`

C. $\tan^{-1}\left[\dfrac{P^2 + Q^{\circ}}{2PQ}\right]$

D. $\sin^{-1}\left[\dfrac{P^2 + Q^2 + PQ}{2PQ}\right]$

Answer: A

Watch Video Solution

131. A particle of mass m is projected from the ground with an initial speed u_0 at an angle α with the horizontal. At the highest point of its trajectory, it makes a completely inelastic collision with another identical particle, which was thrown vertically upward from the ground with the same initial speed u_0. The angle that the composite system makes with the horizontal immediately after the collision is

A. $\pi/4$

B. $(\pi/4) + ajpga$

C. $(\pi/2)$ - α

D. (pi//2)`

Answer: A

Watch Video Solution

132. A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)m/s$, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical . If $g = 10m/s^2$, the equation of its trajectory is :

A. $y = x$ - $5x^2$

B. $y = 2x$ - $5x^2$

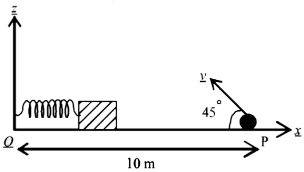
C. $4y = 2x - 5x^2$

D. $4y = 2x - 25x^2$

Answer: B

Watch Video Solution

133. A small block is connected to one end of a massless spring of un - stretched length $4.9m$. The other end of the spring (see the figure) is fixed. The system lies on a horizontal frictionless surface. The block is stretched by $0.2m$ and released from rest at $t = 0$. It then executes simple harmonic motion with angular frequency $(\omega) = (\pi/3)rad/s$. Simultaneously at $t = 0$, a small pebble is projected with speed (v) from point (P) at an angle of 45° as shown in the figure. Point (P) is at a horizontal distance of $10momO$. If the pebble hits the block at $t = 1s$, the value of (v) is $\left(takeg = 10m/s^2\right)$.



A. $\sqrt{50}m/s$

B. sqrt 51 m//s`

C. $\sqrt{52}m/s$

D. $\sqrt{53}m/s$

Answer: A

Watch Video Solution

134. A projectile is projected in the upward direction making an angle of 45° with horizontal direction with a velocity of $150ms^{-1}$. Then the time after which its inclination with the horizontal is 30° is (g=10 ms^(-2)).

A. $2.24s$

B. $4.48s$

C. $9.98s$

D. $12.23s$

Answer: B

Watch Video Solution

135. A particle moves so that its position vector is given by $\vec{r} = \cos\omega t\hat{x} + \sin\omega t\hat{y}$, where ω is a constant which of the following is true ?

A. velocity and acceleration both are prependicular to $\vec{r}$

B. velocity and acceleration both are parallel to $\vec{r}$

C. velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin

D. velocity is perpendicular to $\vec{r}$ and acceelration is directed away from the origin

Answer: C

Watch Video Solution

136. The length of a seconds hand in watch is $1cm$. The change in velocity of its tip in $15s$ is

A. zero

B. $\pi/\left(30\sqrt{2}\right)$

C. $\pi/30$

D. $2\pi/\left(30\sqrt{2}\right)$

Answer: D

Watch Video Solution

137. A particle is moving in a circle of radius r centred at O with constant speed v. What is the change in velocity in moving from $AtoB\left(\angle AOB = 40^{\circ}\right)$?

A. $2v\cos 40^{\circ}$

B. $2v\sin 20^{\circ}$

C. $2v\text{cosec}40^{\circ}$

D. $2v\sec 20^{\circ}$

Answer: B

Watch Video Solution

138. A particle is moving in a circular path with a constant speed. If θ Is the angular displacement, then starting from $\theta = 0$, the maximum and minimum change in the linear momentum will occur when value of θ is respectively

A. 45° and 90°

B. 90^{2} and 180°

C. 180° and 360^@`

D. 90^@ and 270^@`

Answer: C

Watch Video Solution

139. A particle moves along a circle if radius $(20/\pi)$ m with constant tangential acceleration. If the velocity of the particle is $80m/s$ at the end of the second revolution after motion has begun the tangential acceleration is .

A. $40m/s^2$

B. $640m/s^2$

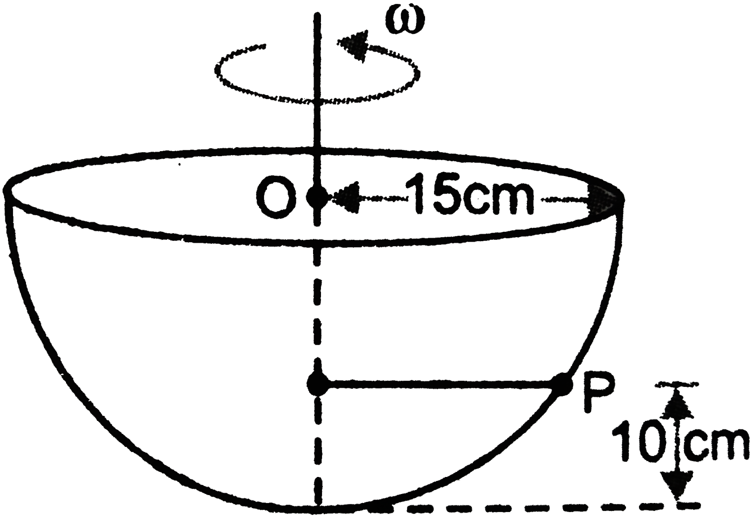
C. $160m/s^2$

D. $40m/s^2$

Answer: A

Watch Video Solution

140. A smooth hemispherical bowl $30cm$ diameter potates with a constatn angular velocity ω, about its vertical axis of symmetry. A particle at (P) of weighing $5kg$, is onserved to remantn at rest telative to the bowal at a height $10cm$ above teh base, Fig. 1 (CF) . 34. The magnitude fo speed of rotation of the bowl is



A. $15 rad/s$

B. $23 rad/s$

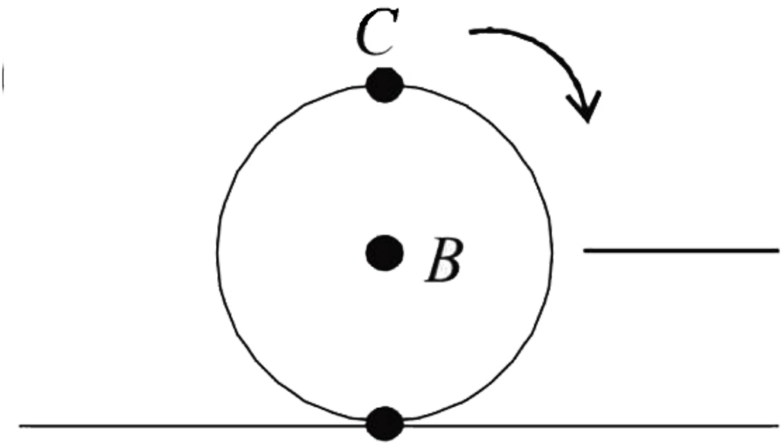
C. $14 rad/s$

D. $16 rad/s$

Answer: C

Watch Video Solution

141. A sphere is rolling without slipping on a fixed horizontal plane surface. In the figure, A is the point of contact, B is the centre of the sphere and C is its topmost point. Then



A. $\vec{v}_C - \vec{\_}A = 2\left(\vec{v}_B - \vec{v}_C\right)$

B. $\vec{v}_c - \vec{\_}B = \vec{v}_B - \vec{\_}A$

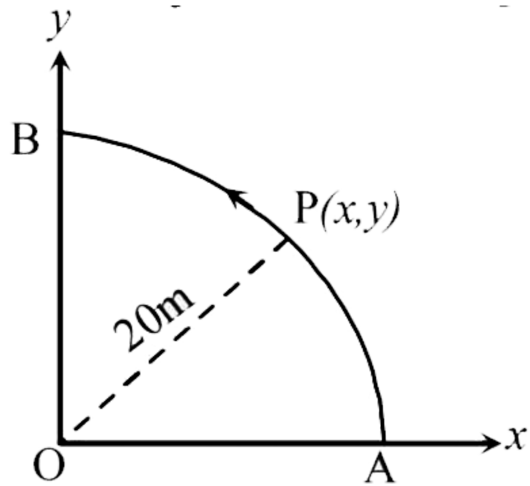
C. $\left|\vec{\_}C - \vec{\_}A\right| = 2\left|\vec{\_}B - \vec{\_}B - \vec{\_}C\right|$

D. $\left|\vec{\_}c - \vec{v}_A\right| = 4\left|\vec{\_}B\right|$

Answer: C

Watch Video Solution

142. A point p moves in counter - clockwise direction on a circular path as shown in the figure . The movement of 'p' is such that it sweeps out in the figure . The movement of 'p' is such that it sweeps out a length $s = t^3 + 5$, where s is in metres and t is in seconds . The radius of the path is $20m$. The acceleration of 'P' when $t = 2s$ is nearly .



A. $12m/s$

B. $7.2m/s^2$

C. `7. 2 m//s^2

D. $13m/s^2$

Answer: C

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143. For a particle in uniform circular motion , the acceleration $\vec{a}$ at a point $p(R, \theta)$ on the circle of radiu R is (Here θ is measured from the x - $a\xi s$)

A. $\frac{v^2}{R}\sin\theta\hat{I} + \frac{v^2}{R}\cos\theta\hat{j}$

B. - $\frac{v^2}{R}\cos\theta\hat{I}$ - $\frac{v^2}{R}\sin\theta\hat{j}$

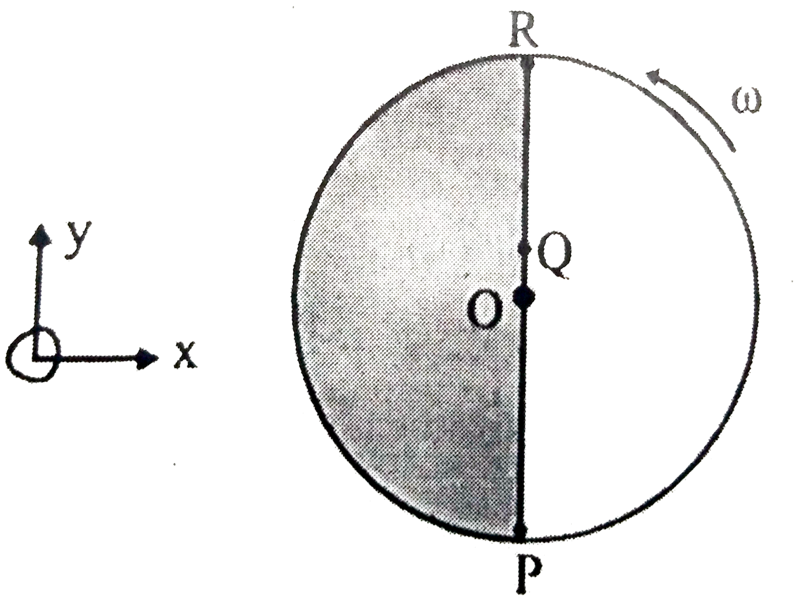
C. - $\frac{v^2}{R}\cos\theta\hat{I} + \frac{v^2}{R}\sin\theta\hat{j}$

D.

Answer: B

Watch Video Solution

144. Consider a disc rotating in the horizontal plane with a constant angular speed ω about its centre O . The disc has a shaded region on one side of the diameter and an unshaded region on the other side as shown in the figure. When the disc is in the orientation as shown, two pebbles P and Q are simultaneously projected at an angle towards R. The velocity of projection is in the y-z plane and is same for both pebbles with respect to the disc. Assume that (i) they land back on the disc before the disc has completed $\frac{1}{8}$ rotation, (ii) their range is less than half the disc radius, and (iii) w remains constant throughout. Then



A. (P) lands in the shaded ragion and (Q) in the unshaded region

B. (P) lands in the unshaded region and (Q) in the saded region

C. Both (P) and (Q) land in the unshaded region

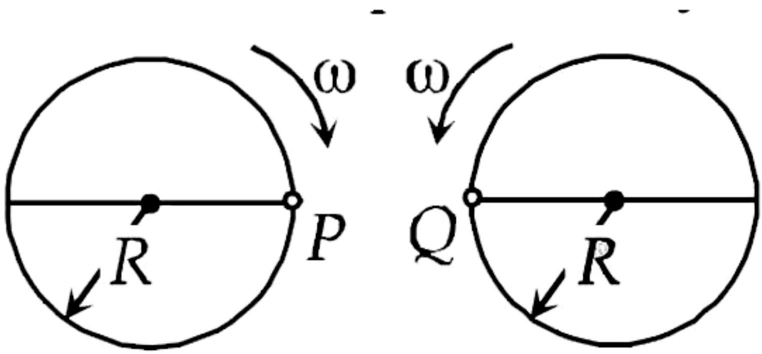
D. Both (P) and (Q) land in the shaded region

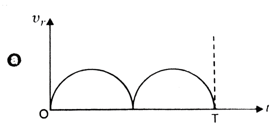
Answer: B

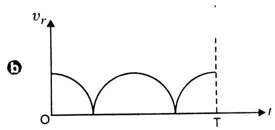
Watch Video Solution

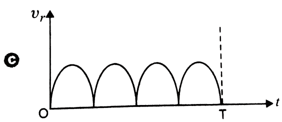
145. Two identical discs of same radius R are rotating about their axes in opposite directions with the same constant angular speed ω . The discs are in the same horizontal plane. At time $t = 0$, the points P and Q are facing each other as shown in the figure. The relative speed between the two points P and Q is v_r. In one time period (T) of rotation of the discs ,

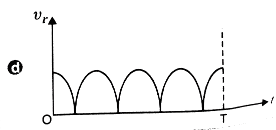
v_r as a function of time is best represented by



A. 

B. 

C. 

D. 

Answer: A

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146. Which of the following statemeents are true for motion with uniform velocity .

A. the motion is always a straight line path

B. the motion is alwaus in the same direction

C. magnitude of displacement is less than the distance is equal to instantaneous velocity.

D. average velocity is equal to instantaneous velocity

Answer: A::B::D

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147. An object while moving may not have .

A. variable speed but constant velocity

B. variable velocity but constant speed

C. non-zero acceleration but constant speed

D. non - zero acceleration but constant velocity

Answer: A::D

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148. A particle moves along the X-axis as $x = u(t - 2s) = at(t - 2)^2$.

A. the acceleration of particle is a

B. the initial velocity of particle is u

C. at $t = 2s$, the particle is at origin

D. the acceleration of particles is $2\ a$

Answer: B::C::D

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149. Choose the correct statement for a particle going on a straight line.

A. If the position and velocity are in opposite direction, the particle is moving towards the origin

B. If the acceleration and velocity are in opposite direction. The particle is slowing down

C. If the velocity is zero for a time interval the acceleration is zero at any moment within that time interval

D. If the velocity is zero at any instant, then the acceleration must be zero at that instant .

Answer: A::B::C

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150. Which of the following is not an example of projectile motion.

A. A car moving in a straight line

B. A bullet fired from a rifle

C. A piece of stone thrown in any direction

D. Second`s hand of a clock

Answer: A::D

Watch Video Solution

151. Which of the following doesn`t represent the relation of angular projection.

A. $R = \frac{u^2 \sin^2 \theta}{g} 0$

B. $h = \frac{u^2 \sin 2\theta}{2g}$

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

D. $v = \sqrt{v_x^2 + v_y^2}$

Answer: A::B

Watch Video Solution

152. A particle is moving on a straight line path with constant accleration directed along the direction of instantaneous velocity. Which of the following statements are false about the motion of particle ?

A. the average velocity is less than the average speed

B. the average velocity is equal to the instaneous velocity

C. the distance covered is equal to the magnitude of displacement

D. the particle may reverse the direction of motion.

Answer: A::B::D

Watch Video Solution

153. A particle is forced to meove on a straight line path. It returns to the starting point after $10 seconds. The \rightarrow taldistancecoveredbythepartic \le dur \in gthistimeis$ 20 m`.

Which of the foolowing statements are true regarting the motion of the particles .

A. the average velocity of the particle is zero

B. the displacement of the particle is zero

C. the average speed of the particle is $2.0ms^{-1}$

D. the displacement of the particle is $20m$.

Answer: A::B::C

Watch Video Solution

154. A ball is thrown vertically upwards from the ground. If T_1 and T_2 are the respective time taken in going up and coming down, and the air resistance is not ignored, then

A. $t_1 = t_2$

B. $t_1 < ty_2$

C. $t_1 > t_2$

D. $t_2 \prec t_1$

Answer: B

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155. Acceleration of a particle which is at rest at $x = 0$ is $\vec{a} = (4 - 2x)\hat{i}$.

Select the correct alternative (s).

A. Maximum speed of the particle is 4 units

B. Particle further comes to rest at $x = 4$

C. Particle oscillates about $x = 2$

D. Particle will continuously acceleration along the x-axis.

Answer: B::C

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156. The motion of a body is given by the equation $dv/dt = 6 - 3v$, where v is in m//s. If the body was at rest at $t = 0$

(i) the terminal speed is $2m/s$

(ii) the magnitude of the initial acceleration is $6m/s^2$

(iii) The speed varies with time as $v = 2\left(1 - e^{-3t}\right)m/s$

(iv) The speed is $1m/s$, when the acceleration is half initial value

A. the terminal speed is $2.0ms^{-1}$

B. the magnitude of initial acceleration is $6.0ms^{-2}$

C. the speed varies with time as $v(t) = 2\left(1 - e^{-3}\right)m/s$

D. the speed is $1.0ms^{-1}$ when the acceleration is half the initial value.

Answer: B::C::D

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157. A particl leaves the orgin with an lintial veloity $\vec{u} = \left(3\hat{I}\right)ms\&(-1)$ and a constant acceleration $\vec{a} = \left(-1.0\hat{i} - 05\hat{j}\right)ms^{-1}. Itsvelocity$ vec v and *positvion* $\vec{r}$ vec r` when it reaches its maximum x-coosrdinate aer .

A. $\vec{v} = (-3\hat{})ms^{-1}$

B. $\vec{v} = \left(-\frac{2}{2}\hat{j}\right)ms^{-1}$

C. $\vec{r} = \left(3\hat{} - 2\hat{j}\right)m$

D. $\vec{r} = \left(\frac{9}{2}\hat{I} - \frac{9}{4}\hat{j}\right)m$

Answer: B::D

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158. A projectile is hurled into air from a point on the horizontal ground at an angle with the vertical. If the air exerts a constat resistve force,

A. the path of projectile will be parabolec path

B. the time of ascent will be ewual to time of decent

C. the total energy of the projectile is not conserved

D. at the highest point, the velocity of projectile is horizontal

Answer: A::C::D

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159. The figure shows a system consisting of (i) a ring the outer radius 3R rolling clockwise without slipping on a horizontal surface with angular speed ω and (ii) an inner disc of radius 2R rotating anti clockwise with angular speed $\omega/2$. The ring and disc are separted. The point P on the inner disc is at a distance R from the origin, where OP makes an angle of 30° with the horizontal. Then with respect to the horizontal surface,

A. The point (O) has a linear velocity $3R\omega\hat{i}$

B. The point (P) has a linear velocity $\frac{11}{4}R \pm ega\hat{I} + \frac{\sqrt{3}}{4}R\omega\hat{k}$

C. The point (P) has a linear velocity $\frac{13}{4}R\omega\hat{I} - \frac{\sqrt{3}}{4}R\omega\hat{k}$

D. The point (P) has a linear velocity $\left(3 - \frac{\sqrt{3}}{4}\right)R\omega\hat{I} + \frac{1}{4}R\omega\hat{k}$

Answer: A::B

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160. Two shells are fired from a canon with seped (u) each, at angles if α and β respectively with the horizontal . The time intrval between the shots is (t). They collide in mid air after time (T) from the first shot . Which of the following consitions must be satisfied ?

A. $\alpha > \beta$

B. $T\cos\alpha = (T - t)\cos\beta$

C. $T - t)\cos\alpha = T\cos\beta$

D. $u\sin\alpha T - \frac{1}{2}gT^2 = u\sin bwta(T - t) - \frac{1}{2}g(T - t)^2$

Answer: A::B::D

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161. A projectile can have same range R for two angles of projection. It t_1 and t_2 are the times of flight in the two cases, then what is the product of two times of flight ?

A. $T_1 T_2 \propto R$

B. $T_1 T_2 \propto R^2$

C. $T_1 / T_2 = \tan\theta$

D. $T_1 / T_2 = 1$

Answer: A::C

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4 NCERT multiple Choice

1. The position vector $\vec{r}$ of a particle of mass m is given by the following equation

$\vec{r}(t) = \alpha t^3 \hat{i} + \beta^2 \hat{j},$

where $\alpha = 10/3 ms^{-3}, \beta = 5 ms^{-2}$ and m = 0.1kg. At t=1s, which of the following statement (s) is (are) true about the particle?

A. The velocity $\vec{v}$ is given by $\vec{v} = \left(10\hat{i} + 10\hat{j}\right)ms^{-1}$

B. The angular momentum $\vec{L}$ with respect to the origin is given by

$\vec{L} = -(5/3)\hat{k}Nms$

C. The force $\vec{F}$ is given by $\vec{F} = \left(\hat{i} + 2\hat{j}\right)N$

D. The torque with respect to the origin is given by $\vec{\tau} = -\frac{20}{3}\hat{k}Nm$

Answer: A::B::D

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2. An aeroplane is fluisg with velocity $\vec{v}_p$ (= 100 ms^(-1) towards East) with respect to ground through motionless air and $\vec{v}_w$ is the wind velocity with respect ot ground. The total velocity of aeroplane is $\vec{v} = \vec{v}_P + \vec{v}_w$

The magnitude of the velocity is often called speed . the heading of the plane is the direction in which the nose of the plane is the direction is which th nose fo the plane points. In fact, it is the direction in which the engine propels the plane . Abswer the following questions :

If the wind blow with velocity $25ms^{-1}$ Norhtwards, the plane velocity is deflected from East by an angle.

A. $\frac{\sin^{-1}(25)}{100}$

B. $\frac{\cos^{-1}(25)}{100}$

C. $\frac{\tan^{-1}(25)}{100}$

D. $\frac{\cot^{-1}(25)}{100}$

Answer: C

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3. An aeroplane is flying with velocity $\vec{v}_p = 100ms^{-1}$ towards East with respect to ground through motionless air and $\vec{v}_w$ is the wind velocity with respect of ground. The total velocity of aeroplane is $\vec{v} = \vec{v}_P + \vec{v}_w$

The magnitude of the velocity is often called speed . the heading of the plane is the direction in which the nose of the plane points. In fact, it is the direction in which the engine propels the plane . Answer the following questions :

If θ is the answer to question 156, the total speed of the plane in ms^{-1} is.

A. $100\sin\theta$

B. $100\cos\theta$

C. $100\cos ec\theta$

D. $100\sec\theta$

Answer: D

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4. An aeroplane is flying with velocity $\vec{v}_p\left(= 100ms^{-1}\right.$ towards East) with respect to ground through motionless air and $\vec{v}_w$ is the wind velocity with respect ot ground. The total velocity of aeroplane is $\vec{v} = \vec{v}_P + \vec{v}_w$

The magnitude of the velocity is often called speed . the heading of the plane is the direction in which the nose of the plane is the direction is which th nose fo the plane points. In fact, it is the direction in which the engine propels the plane . Abswer the following questions :

If the wind blow with velocity $25 ms^{-1}$ Norhtwards, the plane velocity is deflected from East by an angle.

A. $\sin^{-1}(25/100)$

B. cos ^(-1) (25 //100)`

C. $\tan^{-1}(25/100)$

D. cot^(-1) (25 //100)`

Answer: A

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5. N//s

A. 2.5

B. 3.0

C. 3.5

D. 4.02 m`

Answer: B

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6. N//s

A. $.12m$

B. $3.54m$

C. $2.56m$

D. $4.02m$

Answer: C

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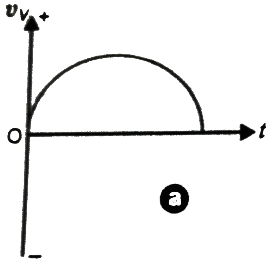
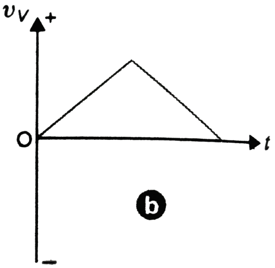
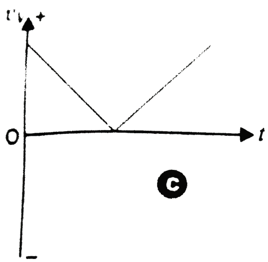
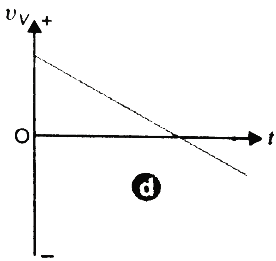
7. Which of these describe the motion of a projectile vertically upwards?

A. 

B. 

C. 

D. 

Answer: D

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8. Two cars (A) and (B) travel in straight line . The distance of (A) from the starting point is given as a function of time be $a_A(t) = pt + qt^2$, with $p = 2.60ms^{-1}$ and $q = 1.20ms^{-2}$. The distance of (B) from the starting pint is $x_B(t) = rt^2 - st^3$ are $r = 2.80ms^{-2}$ and $s = 0.20ms^{-3}$. Answer the following questions ,

Which car is ahead just after they have the starting point ?

A. Car (A) moves ahead

B. Car (B) moves ahead

C. Cars (A) and (B) move simultaneously

D. Data is insufficient to decide.

Answer: A

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9. Two cars (A) and (B) travel in straight line. The distance of (A) from the starting point is given as a function of them be $a_A(t) = pt + qt^2$, with

$p = 2.60ms^{-1}$ and $q = 1.20ms^{-2}$. The distance of (B) from the starting point is $x_B(t) = rt^2 - st^3$ are $r = 2.80ms^{-2}$ and $s = 0.20ms^{-3}$. Answer the following questions,

At what time (s) are the cars at the same point ?

A. $2.60s$

B. $2.27s$

C. $5.73s$

D. both $2.27s$and $5.73s$

Answer: D

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10. Two cars (A) and (B) travel in straight line . The distance of (A) from the starting point is given as a function of time be $a_A(t) = pt + qt^2$, with $p = 2.60ms^{-1}$ and $q = 1.20ms^{-2}$. The distance of (B) from the starting pint is $x_B(t) = rt^2 - st^3$ are $r = 2.80ms^{-2}$ and $s = 0.20ms^{-3}$. Answer the following questions ,

At what time (s) do the cars (A) and (B) have the same acceleration ?

A. $2.67s$

B. $6.27s$

C. $4.33s$

D. both 6.27 and $4.33s$

Answer: A

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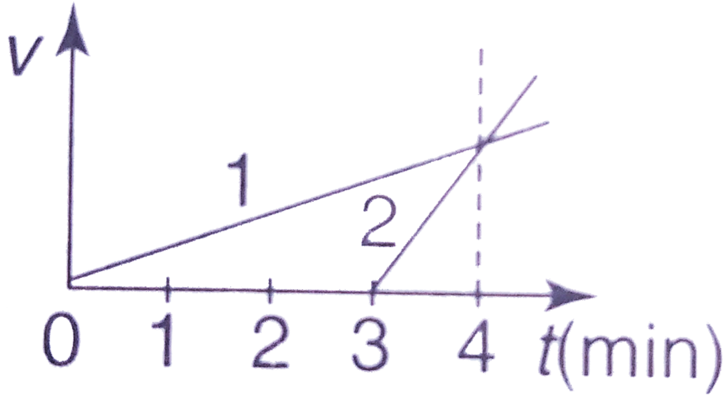
4 NCERT Integer type

1. The drawing shows velocity (v) versus time (t) graphs for two cyclists moving along the same straight segment of a highway from the same point. The second cyclist starts moving at $t = 3 \text{ min}$. At what time do the two cysclist meet ?



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2. A body falling from rest was observed to fall through 78.4m in 2 seconds. Find how long had it been falling before observed

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3. Ball are dropped from the roop fo towar at fived interval if tiem . At the moment when $9th$ ball reaches the groun the nth ball is $(3/4)$ the heith of the tower Wgat the vale of $n?G = 10m/s^2$.

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4. A bird flies for $4s$ with a velocity $v = (t - 2)ms^{-1}$ in a straight line. Calculate the displacement of the bird ans distance traveled by the bird.

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1 NCERT Assertion-Reaseon Type

1. A point moving in a straight line travels in its second, $16m, 28m \in 2nd \text{ and } 5th\sec$ respectively , prove that point is moving with constant acceleration. Aso find the total distance moving by particle in ` 10 seconds.

A. (a) both Assertion and Reason are true and the Reason is correct explanation of the Assertion .

B. (b)both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

C. (C) Assertion is true but the Reason is false.

D. (d) both Assertion and Reason are false.

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2. The sum of the magnitudes of two forces acting at a point is 18 and the magnitude of their resultant is 12. If the resultant is at 90° with the force of smaller magnitude, What are the magnitudes of forces?

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3. A ball rolls of the top fi a strair way with horizonntal velocity of magnitude $1.8ms^{-1}$. The steps are $0.20m$ high and $0.02m$ wide , Which step will the ball it first ? (g = 10 m//s^@)`.

A. (a) both Assertion and Reason are true and the Reason is correct explanation of the Assertion .

B. (b)both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

C. (C) Assertion is true but the Reason is false.

D. (d) both Assertion and Reason are false.

Answer: C

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4. A train is moving along a straight line with a constant acceleration 'a' . A boy standing in the train throws a ball forward with a speed of $10m/s$, at an angle of $60(\circ)$ to the horizontal. The boy has to move forward by $1.15m$ inside the train to catch the ball back at the initial height . the acceleration of the train , in m/s^2 , is

A. (a) both Assertion and Reason are true and the Reason is correct explanation of the Assertion .

B. (b)both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

C. (C) Assertion is true but the Reason is false.

D. (d) both Assertion and Reason are false.

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5. Statement I: A body can have acceleration even if its velocity is zero at a given instant .

Statement II: A body is momentarily at rest when it reverses its direction of velocity.

A. (a) both Assertion and Reason are true and the Reason is correct explanation of the Assertion .

B. (b)both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

C. (C) Assertion is true but the Reason is false.

D. (d) both Assertion and Reason are false.

Answer: D

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6. An object can have constatn speed but vartable velocity.

Soeed is a scalar but velocity is a vector quantity.

A. (a) both Assertion and Reason are true and the Reason is correct explanation of the Assertion .

B. (b)both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

C. (C) Assertion is true but the Reason is false.

D. (d) both Assertion and Reason are false.

Answer: B

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7. Assertion- The speed of a body can be be negative.

Reason- If the body is moving in the opposite direction of positive motion, then its speed is negative.

A. both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

C. Assertion is true but the Reason is false.

D. both Assertion and Reason are false.

Answer: D

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8. 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.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: D

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9. when a body is projected at an angle 45°, its range is maimum.

For maximum range, the value of $\sin 2\theta$ should be equal to one.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

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10. The value of tremperature caon be positive or negative. ltBrgt Temperature is a vector quantity

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: A

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11. Rocket in flight is not an illustration of projectle .

Rocket takes flight due to combustion of fuet and does not move undr the graveity effect alone.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: B

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12. Assertion: Two balls of different masses are thrown vertically upward with 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.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: D

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13. Statement-1 : The position-time graph of a uniform motion in one dimension of a body can have negative slope.

Statement-2 : When the speed of body decreases with time, the position-time graph of the moving body has negative slope.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: C

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14. A positive accelration of a body can be associated with a $shoe \in gdown$ of the body.

Acceleration is a vector equantity.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: A

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1 NCERT Comprehension

1. When a body is subjected to a uniform acceleratuib, it alwaus moves in a straight line.

Straight line motion is the natural tendency of the body.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: D

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2. The outside horses on a merry-go=round get more accelertion than inside ones.

This is because oflinear acceleration is directly propositionl the distance.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: A

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3. The three vectors not lying in a plane can never add up to give a bull vector .

The three vectors not lying in a plane can not be represented by the three sedes of a traingel taken in the same order.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: A

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4. Asserion: Magnitude of the resultant of two vectors may be less than the magnitude of either vector.

Reason: The resultant of two vectors is obtained by means of law of parallelogram of Vectors.

A. (a) Statement-1 is true , Statement-2 is true , Statvement -2 is correct explanation of Statement-1 .

B. (b) Statement-1 is true , statement -2 is true , statement -2 is not coerrecrt explanation of Statement-1.

C. (C) Statement-1 is true , Statement-2 is false.

D. (d) Statement-1 is false , Statement-2 is true.

Answer: C

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