PHYSICS

AAKASH INSTITUTE ENGLISH

MOTION IN A PLANE

Example

1. If $\vec{a} + \vec{b} = \vec{c}$ and $a^2 + b^2 = c^2$, then prove that $\vec{a}$ and $\vec{b}$ are prependicular to each other .

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2. The resultant of two forces 3P and 2P is R. if the first is doubled the resultant is also doubled. Then angle between two forces.

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3. A man swims across a river with speed of V_m perpendicular to the flow direction of river. If the water flows with a speed V_w with what resullant velocity does the man cross the river ?

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4. A vector lying in x-y plane has a magnitude 3, and makes an angle 30° with the x-axis. Find its components along the two axes.

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5. Aboy Walks 4m east and then 3m south .Find the displacement of the boy.

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6. The x and y components of a position vector P have numerical values 5 and 6 respectively. Direction and magnitude of vector P are

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7. Find the resultant of two vectors $\vec{P} = 3\hat{i} + 2\hat{j}$ and $\vec{Q} = 2\hat{i} + 3\hat{j}$

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8. If x and y components of a vector $\vec{P}$ have numerical values 5 and 6 respectively and that of $\vec{P} + \vec{Q}$ have magnitudes 10 and 9, find the magnitude of $\vec{Q}$

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9. Two forces of magnitudes 3N and 4 N act together on an object making an angle 60° with each other. Find the resultant force acting on the

object.

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10. The position of a particle is expressed as $\vec{r} = \left(4t^2\hat{i} + 2t\hat{j}\right)$ m, where t is time in second. Find the velocity o the particle at t = 3 s

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11. The position of a particle is expressed as $\vec{r} = \left(4t^2\hat{i} + 2t\hat{j}\right)$ m. where t is time in second. Find the acceleration of the particle.

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12. An object has a velocity, $v = \left(2\hat{i} + 4\hat{j}\right)ms^{-1}$ at time $t = 0s$. It undergoes a constant acceleration $a = \left(\hat{i} - 3\hat{j}\right)ms^{-2}$ for 4s. Then

(i) Find the coordinates of the object if it is at origin at $t = 0$

(ii) Find the magnitude of its velocity at the end of 4s.

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13. A stone is thrown upwards with velocity 25m/s. Another stone is simultaneously thrown downward from the same point with speed 10 m/s. When the first stone is at a height 10 m. what is the relative velocity of first stone w.r.t second ?

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14. When two particles A and B are at point O, A is moving with a constant velocity 50 m/s , while B is not moving. But B possesses a constant acceleration of 10 m/s^2 . After how much time they will be at a distance of 125 m ?

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15. A plane moves in windy weather due east while the pilot the plane somewhat south of east. The wind is blowing at 50 km/h directed 30°

east of north, while the palne moves at 200 km/h relative to the wind . What is the velocity of the plane relative to the ground and what is the direction in which the pilot points the palne ?

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16. A river is following from west to east at a speed of 5m/minute. A boy on the south bank of the river, capable of swimming at 10 meters/minute in still water, wants to swin across the river in the shortest time, (i) Find the direction in which he should swin, (ii) find the direction when drift along the river is zero.

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17. A man wishes to cross a river of width 120 m by a motorboat. His rowing speed in still water is $3m/s$ and his maximum walking speed is $1m/s$. The river flows with velocity of $4m/s$.

(a) Find the path which he should take to get to the point directly

opposite to his starting point in the shortest time.

(b) Also, find the time which he takes to reach his destination.

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18. Rain is falling vertically with a speed of 30 m/s. wind starts blowing after some time with a speed of 15 m/s in east to west direction. In which direction should a boy waiting at a bus hold his umbrella ?

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19. 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 with respect to (a) the road (b) the moving person.

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20. 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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21. A bird is flying with velocity $5\hat{i} + 6\hat{j}$ w.r.t wind and wind to blowing along x-axis with velocity u. if bird starts moving from A and after some after some time reaches point B (see figure), find the value of u ?

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22. A train moves northwards with speed $80kmh^{-1}$. While a car moves towards east with a speed of $60kmh^{-1}$, what is the velocity of the train w.r.t the driver of the car ?

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23. A man swims across a river with speed of $5kmh^{-1}$ (in still water). While a boat goes upstream with speed $12kmh^{-1}$ (in still water). How fast and in which direction does, the man appear to go to the boatman ? Given that the speed of flowing water is $2kmh^{-1}$

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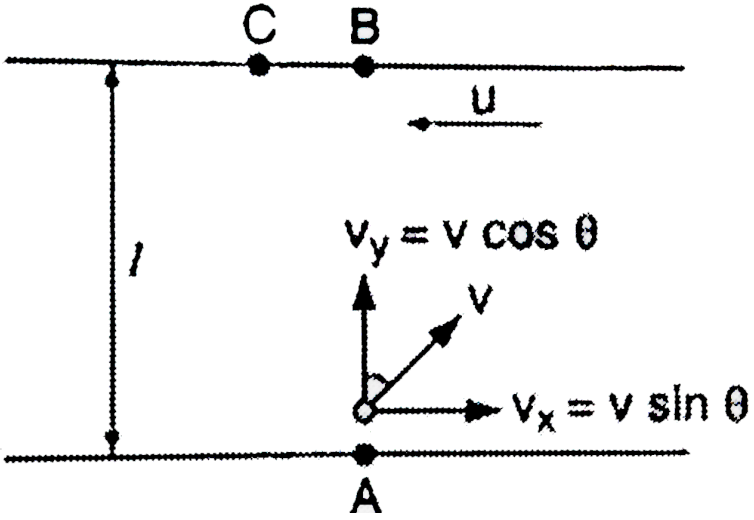
24. Two swimmers start at the same time from point A one bank of a river to reach point B on the other bank, lying directly oppostie to point A. one of them crosses the river along the straight line AB, while the other swims at right angles to the stream and then walks the distance, which he has been carried awayby the stream to get to point B. Both swimmers reach point B at the same time. what was the velocity (assumed uniform) of his walking if velocity of both the swimmers in still water is 2.5 km h^{-1}

and the stream velocity is 2 km h^{-1}?



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25. To a man running upwards on a hill, the rain appears to fall vertically downwards with $4ms^{-1}$. The velocity vector of the man with respect to earth is $2\hat{i} + 3\hat{j}$. If the man starts running down the hill with the same speed, then what will be the relative speed of the rain with respect to man?

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26. A person walking ,on a horizontal road at 2 km/h finds that the rain is falling vertically . Now the person increasses his speed to 4 km/h and find that rain makes an angle 45° with the vertical . Find the velocity of rain with respect to the road.

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27. Three points are located at the vertices of an equilateral triangle each of whose sides measure a. They all start simultaneously with speed v, each aiming at the next in order. How soon will the points converge ?

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28. From a light-house an observer two ships A and B. Ship A proceeding towards north at a speed $20\sqrt{2}$ km//h and ship B proceeding towards north-east at a speed of 20 km//h. Find in which direction and at what speed the ship B would appear to move to an observer standing on the deck of the ship A.

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29. The initial speed of an arrow shot from a bow, at an elevation of 30°, is $15ms^{-1}$. Find its velocity when it hits the ground back

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30. A ball is thrown with a speed of 20 m s^{-1} at an elevation angle 45°. Find its time of flight and the horizontal range (take g = $10ms^{-2}$)

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31. A projectile has a range of $40m$ and reaches a maximum height of $10m$. Find the angle at which the projectile is fired.

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32. A stone is thrown with a speed of $10ms^{-1}$ at an angle of projection 60°. Find its height above the point of projection when it is at a horizontal distance of 3m from the thrower ? (Take $g = 10ms^{-2}$)

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33. Discuss the motion of a body when projected horizontally from a height .

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34. 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 . Then find ,

(i) The height of the tower

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35. A projectile is fired with an initial velocity of 240 m/s at a target B located 600 m above the gun A and at a horizontal distance of 3600 m. Neglecting air resistance, determine the value of the firing angle θ .

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36. A particle is projected from the ground at an angle 30° with the horizontal with an initial speed $20ms^{-1}$. After how much time will the velocity vector of projectile be perpendicular to the initial velocity ? [in second].

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37. A helicopter while flying at a height of 100 m with velocity 30 m.s at an angle 30° with the horizontal, drops a packet. Where will the packet strike the ground ? (g = 10 m/s^2)

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38. Two particles are projected simultaneously from two points O and O' such that d is the horizontal distance and h is the vertical distance between them as show in figure. These are projected at same inclination α with the horizontal with the same speed v. Find an expression for time at which their separation becomes minimum.

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39. A particles is projected horizontally with a speed v from the top of a plane inclined at an angle $tehta$ to the horizontal as shown in the figure.

(a) Hwo far from the point of projection will the particle strike the plane ?

(b) Find the time taken by the particel to hit the plane.

(c) What is the velocity of particle just before it hits the plane ?

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40. A ball is projected from point A with velocity 20 m/s prependicular to the inclined plane as shown in figure. What is the range of the ball on the inclined plane ?

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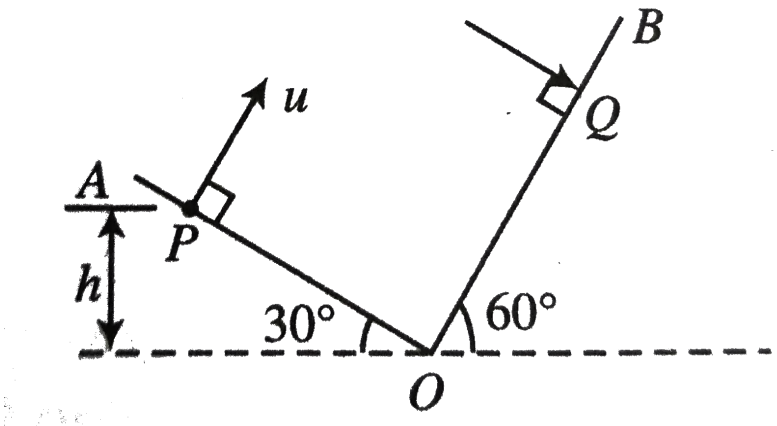
41. Two inclined planes OA and OB having inclination (with horizontal) 30° and 60°, respectively, intersect each other at O as shown in figure. A particle is projected from point P with velocity $u = 10\left(\sqrt{3}\right)ms^{-1}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicularly at Q, calculate



The velocity with which particle strikes the plane OB,

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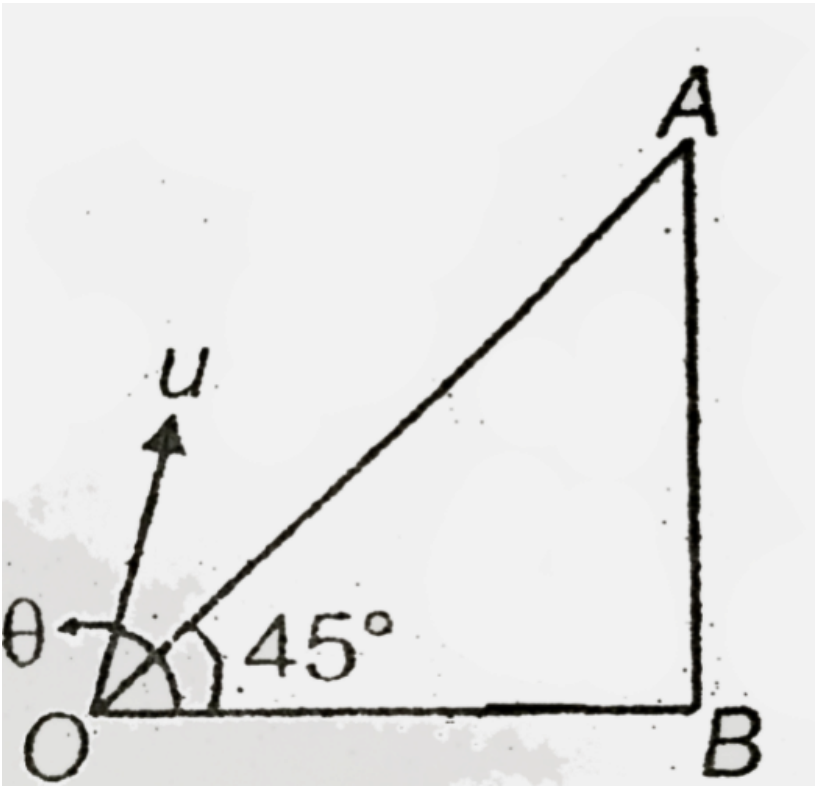
42. A particles is projected from the foot of an inclined plane having inclination 45° , with the velocity u at angle $\theta(>45^\circ)$ with the horizontal in a vertical plane containing the line of greatest slope through the point of projection. Find the value of $\tan\theta$ if the particle stikes the plane.

(i) Horizontally

(ii) Normally



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43. Two particles P and Q are projected from two points in the same plane as shown. Find the condition for collision of two paricles.

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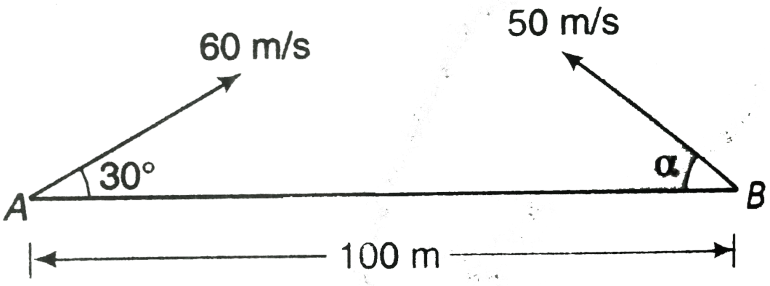
44. A particle A is projected with an initial velocity of $60m/s$ at an angle 30° to the horizontal. At the same time a second particle B is projected in opposite direction with initial speed of $50m/s$ from a point at a distance of 100 m from A. If the particles collide in air, find (a)the angle of projection α of particle B, (b) time when the collision takes place and (c) the distance of P from A, where collision occurs. $\left(g = 10m/s^2\right)$



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45. An object revolves uniformly in a circle of diameter 0.80 m and completes 100 rev $\min^{-1}$. Find its time period and angular velocity.

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46. Calculate the angular speed of flywheel making 420 revolutions per minute.

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47. A boy whirls a stone tied to a thread ,such that the stone moves uniformly in a circle. What must be the length of the thread if the stone completes 42 rounds in a minute with a uniform speed of $2.2ms^{-1}$?

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48. Calculate the average angular velocity of the hour hand of the of a clock.

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49. A particle is moving on a circular path with speed given by v= αt, where α is a constant. Find the acceleration of the particle at the instant when it has covered the n^{th} fraction of the circle.

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50. A particle is moving in the x-y plane. At certain instant of time, the components of its velocity and acceleration are as follows: $v_x = 3ms^{-1}$, $v_y = 4ms^{-1}$, $a_x = 2ms^{-2}$ and $a_y = 1ms^{-2}$. The rate of change of speed at this moment is

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(i) Find the coordinates of the object if it is at origin at $t = 0$

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(ii) The speed of projection of the body

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Ilustration 1 :

1. Two cars A and B move in mutually perpendicular, directions as shown in the figure . Find v_{BA}

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Try yourself

1. The resultant of $\vec{p}$ and $\vec{q}$ makes angle $\alpha$with $\vec{p}$ and β with $\vec{q}$. Then

A. $\alpha < \beta$

B. $\alpha < \beta, p < q$

C. $\alpha < \beta, \quad \text{if} \quad p > q$

D. $\alpha < \beta, \quad \text{if} \quad p = q$

Answer: C

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2. Two forces 12 N and 16 N are acting upon a body, what can be the maximum and minimum resultant force on the body ?

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3. A motorboat is racing towards north at 25 km/h and the water current in that region is $10km/h$ in the directioni of 60° east of south. Find the resultant velocity of the boat.

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4. A hydrogen balloon is flying eastward with speed $12m.s^{-1}$. When wind starts blowing from north to south with speed $5m.s^{-1}$ what is the resultant velocity of balloon ?

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6. A vector of magnitude 10 has its rectangular components as 8 and 6 along x and y axes. Find the angles it make with these axes.

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7. One of the rectangular components of a force of 40 N is 20 N. Find the angle it makes with the component.

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8. Two perpendicular forces of magnitudes 10 N and 5 N act at a point. Find their resultant.

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9. The x and y components of a vector are $4\sqrt{3}m$ and 4 m respectively. What angle does the vector make with positive x-axis ?

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10. A vector of magnitude 13 makes an angle 65.37° with the x-axis . What is its component along positive y-axis ?

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11. What is the resultant of unit vector s $\hat{j}$ and $\hat{k}$?

[Hint : $\left|\hat{j}\right| = \left|\hat{k}\right| = 1$]

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12. A particle lies in space at point (2,3,4) find the magnitude of its position vector.

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13. Find the sum of the vectors $10\hat{i} + 6\hat{j}$ and $4\hat{i} - 2\hat{j}$

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14. The vectors are given below

$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}\ \vec{b} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ and $\vec{c} = 3\hat{i} + 6\hat{j} + 9\hat{k}$

find the components of the vector $\vec{a} + \vec{b} - \vec{c}$

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15. Rain is falling at the speed of $25\sqrt{3}$ m/s vertically . The wind blows west to east at a speed of 25 m/s . Find the velocity of rain as experienced by a person standing on the ground .

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16. Two vectors having magnitude 12 and 13 are inclined at and angle45° to each other.find their resultant vector.

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17. A resultant of two vectors makes 30° with one vector and 45° with the other. Find the two vectors if the resultant has the magnitude 15

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18. The velocity of an object is given by $\vec{v} = \left(6t^3\hat{i} + t^2\hat{j}\right)m/s$. Find the acceleration at t = 2s.

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19. The velocity (in m/s) of an object changes from $\vec{v}_1 = 10\hat{i} + 4\hat{j} + 2\hat{k}$ to $\vec{v}_2 = 4\hat{i} + 2\hat{j} + 3\hat{k}$ in 5 second. Find the magnitude of average

acceleration.

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20. The position of an object is given by $\vec{r} = \left(9t\hat{i} + 4t^3\hat{j}\right)$ m. find its velocity at time t= 1s.

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21. The position of an object changes from $\vec{r} = \left(2\hat{i} + \hat{j}\right)$ m to $\vec{r}_1 = \left(4\hat{i} + 3\hat{i}\right)$ m in 2s. Find its average velocity.

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22. The velocity of an object at t =0 is $\vec{v}_0 = -4\hat{j}$ m/s . It moves in plane with constant acceleration $\vec{a} = \left(3\hat{i} + 8\hat{j}\right) m/s^2$. What is its velocity after 1 s?

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23. An object starts from rest, and moves under the acceleration $\vec{a} = 4\hat{i}$. Its position after 3 s is given by $\vec{r} = 7\hat{i} + 4\hat{j}$. What is its initial position ?

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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 boat is moving towards east velocity 4 m/s w.r.t still water and river is flowing towards north with velocity 2 m/s and the wind blowing towards north with velocity 6 m/s. the direction of the flag blown over by the wind hpisted on the boat is

A. a. North - west

B. b. south- west

C. c. $\tan^{-1}\left(\frac{1}{2}\right)$ with east

D. d. North

Answer: 1

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26. Rain is falling vertically with a speed of $35ms^{-1}$. A woman rides a bicycle with a speed of $12ms^{-1}$ in east to west direction. In which direction should she hold her umbrella ?

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27. A ship is steaming towards east with a speed of 8 m/s. A women runs across the deck at a speed of $6ms^{-1}$ towards north. What is the velocity of the women relative to the sea ?

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28. 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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29. A bus appears to move northwards at a speed of $20\sqrt{3}\ \mathrm{km\ h^{-1}}$ to a man driving his car eastwards with speed $20\ \mathrm{km\ h^{-1}}$. Find the velocity of the bus w.r.t ground.

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30. Find the velocity of a projectile at the highest point, if it is projected with a speed $15ms^{-1}$ in the direction 45° above horizontla. (take g = $10ms^{-2}$)

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31. 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 to the same level, and (c)the distance from the thrower to the point where the ball returns to the same level.

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32. A bullet fired at an angle of 60° with the vertical hits the levelled ground at a distance of 200 m . Find the distance at which the bullet will hit the ground when fired at angle of 30°. (with same speed).

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33. An object is projected with velocity $\vec{v}_0 = 15\hat{i} + 20\hat{j}$. Considering x along horizontal axis and y along vertical axis. Find its velocity after 2s.

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34. A player kicks a ball at an angle of 37° to the horizontal with an initial speed of $15ms^{-1}$. Find its time of fight.

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35. Find the ratio of maximum horizontal range and the maximum height attained by the projectile. i.e. for $\theta_0 = 45^\circ$

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36. A hiker stands on the edge of a cliff 490 m above the ground and throws a stone horizontally with a speed of 15 m s^{-1}. The time taken by the stone to reach the ground is

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37. A a certain instant of time a ballon is moving downwards with speed of 5m/s. It has a constant retardation of 5m/s2. A man in the ballon drops a stone at that instant. It hits the ground after 2s. Then the speed with which the stone hits the ground is.

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38. An insect trapped in a circular groove of radius, 12 cm moves along the groove steadily and completes 7 revolutions in 100s. What is the angular speed and the linear speed of the motion ?

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What is the magnitude of the centripetal acceleration in above problem ?

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40. A mark on the rim of a rotating cicular wheel of 0.50 m radius is moving with a speed of $10ms^{-1}$. Find its angular speed.

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41. Find the angular speed of the minute hand of a clock.

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42. A dust particle lying at the rim of a wheel has an angular speed of 22 rad/s. Find the time period.

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43. If and object completes 49 revolutions in a minute around a circular path with a speed $7ms^{-1}$ find the radius of the path.

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44. A particle goes uniformly in circular motion with an angualr speed $\frac{\pi}{8} rads^{-1}$. What is its time period ?

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45. The angualr displacement of an object having uniform cirular motion is $\frac{\pi}{4}$ rad in every 3s. Find its frequency of revolution.

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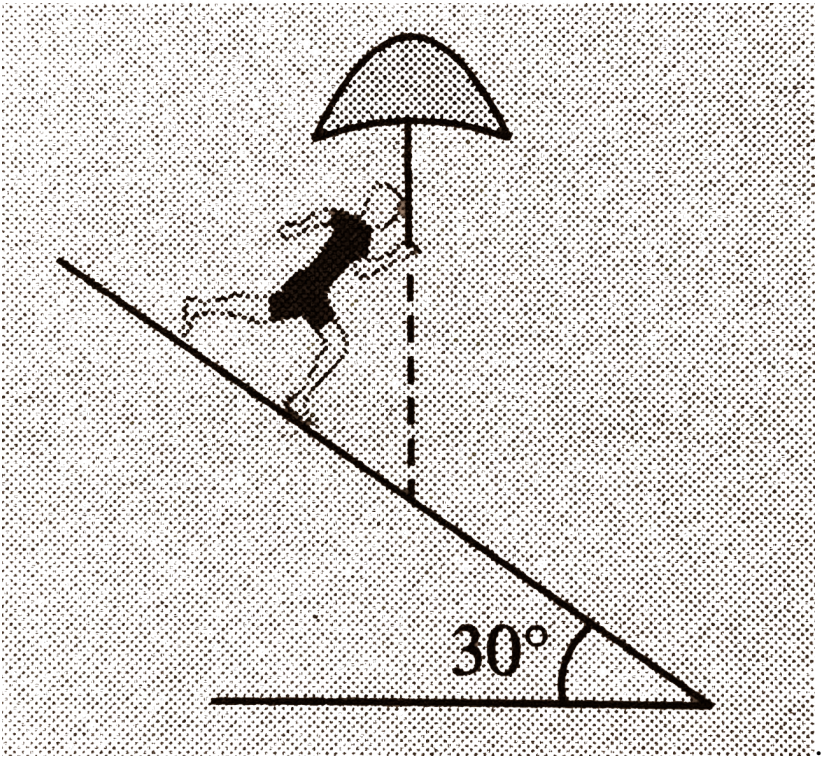
46. A man is coming down an incline of angle 30°. When he walks with speed $2(\sqrt{3}) ms^{-1}$ he has to keep his umbrella vertical to protect himself from rain. The actual speed of rain is $5ms^{-1}$. At angle with vertical should he keep his umbrella when he is at rest so that he does

not getb drenched ?



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47. If the helicopter is flying at constant velocity then where will it be when the packet strikes the ground.

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

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57. A particle lies in space at point (2,3,4) find the magnitude of its position vector.

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58. Find the sum of the vectors $10\hat{i} + 6\hat{j}$ and $4\hat{i} - 2\hat{j}$

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59. Three vectors are given below

$\vec{a} = \hat{i} + 2\hat{i} + 3\hat{k}$, $\vec{b} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ and $\vec{c} = 3\hat{i} + 6\hat{j} + 9\hat{k}$.

Find the components of the vector $\bar{a} + \bar{b} - \bar{c}$.

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60. Rain is falling at the speed of $25\sqrt{3}m/s$ vertically. The wind blows west to east at a speed of 25 m/s. find the velocity of rain as experienced by a person standing on the ground.

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61. Two vectors having magnitude 12 and 13 are inclined at and angle45° to each other.find their resultant vector.

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62. A resultant of two vectors makes 30° with one vector and 45° with the other. Find the two vectors if the resultant has the magnitude 15

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63. The velocity of an object is given by $\vec{v} = \left(6t^3\hat{i} + t^2\hat{j}\right)m/s\Big)$. Find the acceleration at t = 2s.

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64. The velocity (in m/s) of an object changes from $\vec{v}_1 = 10\hat{i} + 4\hat{j} + 2\hat{k}$ to $\vec{v}_2 = 4\hat{i} + 2\hat{j} + 3\hat{k}$ in 5 second. Find the magnitude of average acceleration.

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65. The position of an object is given by $\vec{r} = \left(9t\hat{i} + 4t^3\hat{j}\right)$ m. find its velocity at time t= 1s.

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66. The position of an object changes from $\vec{r} = \left(2\hat{i} + \hat{j}\right)$ m to $\vec{r}_1 = \left(4\hat{i} + 3\hat{j}\right)$ m in 2s. Find its average velocity.

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67. The velocity of an object at t =0 is $\vec{v}_0 = -4\hat{j}$ m/s . It moves in plane with constant acceleration $\vec{a} = \left(3\hat{i} + 8\hat{j}\right)m/s^2$. What is its velocity after 1 s?

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68. An object starts from rest, and moves under the acceleration $\vec{a} = 4\hat{i}$. Its position after 3 s is given by $\vec{r} = 7\hat{i} + 4\hat{j}$. What is its initial position ?

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69. Rain is falling vertically with a speed of $35ms^{-1}$. A woman rides a bicycle with a speed of $12ms^{-1}$ in east to west direction. In which direction should she hold her umbrella ?

Watch Video Solution

70. A ship is steaming towards east with a speed of 8 m/s. A women runs across the deck at a speed of $6ms^{-1}$ towards north. What is the velocity of the women relative to the sea ?

Watch Video Solution

71. A boat stems in a river with velocity $2\hat{i}+\hat{j}$ with respecitve to the ground. The river water flows with a velocity $-3\hat{i}-4\hat{j}$ with respect to the ground. What is the relative velocity of boat w.r.t river water ?

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72. A bus appears to move northwards at a speed of $20\sqrt{3}\ \mathrm{km\ h^{-1}}$ to a man driving his car eastwards with speed $20\ \mathrm{km\ h^{-1}}$. Find the velocity of the bus w.r.t ground.

Watch Video Solution

73. Find the velocity of a projectile at the highest point, if it is projected with a speed $15ms^{-1}$ in the direction 45° above horizontla. (take g = $10ms^{-2}$)

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74. 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 to the same level, and (c)the distance from the thrower to the point where the ball returns to the same level.

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75. A bullet fired at an angle of 60° with the vertical hits the levelled ground at a distance of 200 m . Find the distance at which the bullet will hit the ground when fired at angle of 30°. (with same speed).

Watch Video Solution

76. An object is projected with velocity $\vec{v}_0 = 15\hat{i} + 20\hat{j}$. Considering x along horizontal axis and y along vertical axis. Find its velocity after 2s.

Watch Video Solution

77. A player kicks a ball at an angle of 37° to the horizontal with an initial speed of $15ms^{-1}$. Find its time of fight.

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78. Find the ratio of maximum horizontal range and the maximum height attained by the projectile. i.e. for $\theta_0 = 45^\circ$

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79. A hiker stands on the edge of a cliff 490 m above the ground and throws a stone horizontally with a speed of 15 m s^{-1}. The time taken by the stone to reach the ground is

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80. A hiker stands on the edge of a cliff 490 m above the ground and throws a stone horizontally with an initial speed of $15ms^{-1}$. Neglecting

air resistance, find the time taken by the stone to reach the ground, and the speed with which it hits the ground. (Take g $= 9.8ms^{-2}$)

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81. An insect trapped in a circular groove of radius 12 cm 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 the its magnitude?

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82. An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100s.What is the magnitude of the centripetal acceleration.

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83. A mark on the rim of a rotating circular wheel of 0.50 m radius is moving with a speed of $10ms^{-1}$. Find its angular speed.

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84. A dust particle lying at the rim of a wheel has an angular speed of 22 rad/s. Find the time period.

Watch Video Solution

85. A dust particle lying at the rim of a wheel has an angular speed of 22 rad/s. Find the time period.

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86. If and object completes 49 revolutions in a minute around a circular path with a speed $7ms^{-1}$ find the radius of the path.

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87. A particle goes uniformly in circular motion with an angualr speed $\frac{\pi}{8} rads^{-1}$. What is its time period ?

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88. The angualr displacement of an object having uniform cirular motion is $\frac{\pi}{4}$ rad in every 3s. Find its frequency of revolution.

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Assignement section -A Objective (one option is correct)

1. The vector quantity among the following is

A. mass

B. Time

C. Distance

D. Displacement

Answer: D

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2. A+B can also be written as

A. $\vec{A} - \vec{B}$

B. $\vec{B} - \vec{A}$

C. $\vec{B} + \vec{A}$

D. $\vec{B} . \vec{A}$

Answer: C

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3. Which of the following represents a unit vector ?

A. $\frac{\left|\vec{A}\right|}{A}$

B. $\frac{\vec{A}}{\left|\vec{A}\right|}$

C. $\frac{\vec{A}}{\vec{A}}$

D. $\frac{\left|\vec{A}\right|}{\left|\vec{A}\right|}$

Answer: B

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4. A vetor is added to an equal and oppsite vector of similar nature,forms a

A. Unit vector

B. Position vector

C. Null vector

D. Displacement vector

Answer: C

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5. Unit vector does not have any specified

A. Direction

B. Magnitude

C. Unit

D. All to these

Answer: C

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6. The displacement of a particle from a point having position vector $2\hat{i} + 4\hat{j}$ to another point having position vector $5\hat{j} + 1\hat{j}$ is

A. 3 units

B. $3\sqrt{2}$ units

C. 5 units

D. $5\sqrt{3}$units

Answer: B

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7. Velocity vector and acceleration vector in a uniform circular motion are related as

A. 0°

B. 180°

C. 90°

D. 45°

Answer: C

Watch Video Solution

8. The magnitude of $\hat{i} + \hat{j}$ is

A. 2

B. 0

C. $\sqrt{2}$

D. 4

Answer: C

Watch Video Solution

9. Three forces given by vectors $2\hat{i}+2\hat{j}.\ 2\hat{i}-2\hat{j}$ and $-4\hat{j}$ are acting together on a point object at rest. The object moves along the direction.

A. x -axis

B. y-axis

C. z-axis

D. object does not move

Answer: D

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10. the angle made by the vector $\sqrt{2}i+\hat{i}$ with x-axis body from its initial

A. 35.26°

B. 45°

C. 60°

D. 90°

Answer: A

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11. A body move 6 m north, 8 m east and 10 m vertically upwards, the resultant displacement from its initial position is

A. $10\sqrt{2}$ m

B. 10 m

C. $\frac{10}{\sqrt{2}}$ m

D. 20 m

Answer: A

Watch Video Solution

12. A particle has an initial velocity of $4\hat{i} + 3\hat{j}$ and an acceleration of $0.4\hat{i} + 0.3\hat{j}$. Its speed after 10s is

A. $7\sqrt{2}$ units

B. 7 units

C. 8.5 units

D. 10 units .

Answer: A

Watch Video Solution

13. A vector multiplied by the number 0, results into

A. 0

B. $\overrightarrow{A}$

C. $\overrightarrow{0}$

D. $\overrightarrow{A}$

Answer: C

Watch Video Solution

14. The resultant of two vectors makes an angle of 60° with one vector and 30° with one other. If the magnitude of resultant is 25, the two vectors are of magnitude

A. 24,7

B. 12,5

C. 12.5,12.5$\sqrt{3}$

D. 15.7, $15.7\sqrt{2}$

Answer: C

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15. The position vector of an object at any time t is given by $3t^2\hat{i} + 6t\hat{j} + \hat{k}$. Its velocity along y-axis has the magnitude

A. 6t

B. 6

C. 0

D. 9

Answer: B

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16. A body lying initially at point (3,7) starts moving with a constant acceleration of $4\hat{i}$. Its position after 3s is given by the coordinates

A. (7,3)

B. (7,18)

C. (21,7)

D. (3,7)

Answer: C

Watch Video Solution

17. The initial position of an object at rest is given by $3\hat{i} - 8\hat{j}$. It moves with constant acceleration and reaches to the position $2\hat{i} + 4\hat{j}$ after 4s. What is its acceleration ?

A. $-\frac{1}{8}\hat{i} + \frac{3}{2}\hat{j}$

B. $2\hat{i} - \frac{1}{8}\hat{j}$

C. $-\frac{1}{2}\hat{i}8\hat{j}$

D. $8\hat{i} - \frac{3}{2}\hat{j}$

Answer: A

Watch Video Solution

18. If $\left|\vec{P} + \vec{Q}\right| = \left|\vec{P}\right| - \left|\vec{Q}\right|$, the angle between the vectors $\vec{P}$ and $\vec{Q}$ is

A. 0°

B. 90°

C. 180°

D. 45°

Answer: C

Watch Video Solution

19. if $\left|\vec{P}+\vec{Q}\right|=\left|\vec{P}\right|+\left|\vec{Q}\right|$, the angle between the vectors $\vec{P}$ and $\vec{Q}$ is

A. 0°

B. 180°

C. 60°

D. 90°

Answer: C

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20. if $\vec{P}\, a + \vec{Q} = \vec{0}$, then which of the following is necessarily true ?

A. $\vec{P} = \vec{0}$

B. $\vec{P} = -\vec{Q}$

C. $\vec{Q} = 0$

D. $\vec{P} = \vec{Q}$

Answer: A

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21. A displacement vector of magnitude 4 makes an angle 30° with the x-axis. Its rectangular components in x-y plane are

A. $2\sqrt{3}, 2$

B. $4\sqrt{3}, 4$

C. $\frac{2}{\sqrt{3}}, 2$

D. $\frac{4}{\sqrt{3}}, 4$

Answer: C

Watch Video Solution

22. If $\left|\vec{P}+\vec{Q}\right| = \left|\vec{P}-\vec{Q}\right|$ the angle between $\vec{P}$ and $\vec{Q}$ is

A. 0°

B. 90°

C. 180°

D. 45°

Answer: C

Watch Video Solution

23. if $\vec{P}+\vec{Q} = \vec{P}-\vec{Q}$, then

A. $\vec{P} = \vec{0}$

B. $\vec{Q} = \vec{0}$

C. $\left|\vec{P}\right| = 1$

D. $\left|\vec{Q}\right| = 1$

Answer: B

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24. At the topmost point of a projectile trajectory, its velocity and acceleration are an angle of

A. 0°

B. 45°

C. 90°

D. 180°

Answer: C

Watch Video Solution

25. For angle of prijection of projectile at angle$(45^\circ - \theta)$ and $(45^\circ + \theta)$, the horizontal range described by the projectile are in the ratio of

A. $2:1$

B. $1:1$

C. $2:3$

D. $1:3$

Answer: A

Watch Video Solution

26. A cricket ball of mass m is hitted at the angle 45° to the horizontal with velcoity v its kinetic energy at the topmost point is

A. 0

B. $\frac{1}{2}mv^2$

C. $\frac{mv^2}{4}$

D. $\frac{mv^2}{2\sqrt{2}}$

Answer: c

Watch Video Solution

27. The path of a projectile is

A. Circular

B. parabolic

C. Linear

D. Hyperbolic

Answer: B

Watch Video Solution

28. Two cars of masses m_1 and m_2 are moving in circles od radii r_1 and r_2. Their speeds are such that they complete one revolution in the same time. The ratio of their angular speed is :

A. $R_1 : R_2$

B. $R_2 : R_1$

C. $1 : 1$

D. $R_1 R_2 : 1$

Answer: B

Watch Video Solution

29. Which of the following is not a projectile ?

A. An aircraft taking off

B. A bullet fired from a rifle

C. A ball thrown horizontally from a roof

D. A football kicked by a player

Answer: A

Watch Video Solution

30. The maximum number of rectangular components into which a vector in space can be resolved into is

A. Infinite

B. Four

C. Two

D. One

Answer: C

Watch Video Solution

31. If a stone projected from ground, takes 4 s to reach the topmost point, of its trajectory, then time of fight is

A. 4 s

B. 8 s

C. 2 s

D. 10 s

Answer: B

Watch Video Solution

32. A projectille covers a horizontal distance of 6 m, when it reaches 10 m above the level of projection, how farther should if travel horizontally to reach back the same height , if its horizontal range is 20 m ?

A. 6 m

B. 12 m

C. 8 m

D. 20 m

Answer: C

Watch Video Solution

33. An arrow shots from a bow with velocity v at an angle θ with the horizontal range R . Its range when it is projected at angle 2θ with the same velocity is

A. 2R

B. $\frac{R}{2}$

C. $2R\cos 2\theta$

D. $\frac{R}{2\cos^2\theta}$

Answer: C

Watch Video Solution

34. The maximum height attained by a ball projected with speed $20ms^{-1}$ at an angle 45° with the horizontal is [take g = $10ms^{-2}$]

A. 40 m

B. 20 m

C. 10 m

D. 30 m

Answer: C

Watch Video Solution

35. The time of fight of an object projected with speed $20ms^{-1}$ at an angle 30° with the horizontal , is

A. 1 s

B. 4 s

C. 2 s

D. 6s

Answer: A

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36. The range of particle when launched at an angle of 15° with the horizontal is 1.5 km. What is the range of the projectile when launched at an angle of 45° to the horizontal

A. 1.5 km

B. 3.0 km

C. 6.0 km

D. 0.75 km

Answer: C

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37. A food packed is dropped, from a height of 500 m, from a plane flying horizontally with speed 100km/h. The packet reaches to the ground after travelling a horizontal distance. [Take g $= 10ms^{-2}$]

A. 100m

B. 204.5 m

C. 500 m

D. 277. 7 m

Answer: D

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38. The objects x and y are projected from a point with same velocities , at angle $30^\circ \text{ and } 60^\circ$, the ratio of their maximum height attained:

A. $1:1$

B. $1:3$

C. $1:2$

D. $4:1$

Answer: B

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39. At the topmost point of its path, a projectile has acceleration of magnitude

A. 0

B. g

C. $\frac{g}{2}$

D. $\frac{g}{\sqrt{2}}$

Answer: C

Watch Video Solution

40. At what angle of elevation , should a projectile be projected with velocity with velocity $20ms^{-1}$, so as to reach a maximum height of 10 m ?

A. 0°

B. 90°

C. 45°

D. 60°

Answer: C

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41. Angular speed of a uniformly circulating body with time period T is

A. $2\pi T$

B. $\frac{2\pi}{T}$

C. πT

D. $\frac{\pi}{T}$

Answer: B

Watch Video Solution

42. An object moving in a circular path at constant speed has constant

A. Energy

B. Velocity

C. Acceleration

D. Displacement

Answer: A

Watch Video Solution

43. Speed of an object moving in cirular path of radius 10 m with angular speed 2 rad/s is

A. 10 m/s

B. 5 m/s

C. 20 m/s

D. 30 m/s

Answer: C

Watch Video Solution

44. A body performing uniform cicular motion completed 140 revolution in a second. Its angular speed is

A. 880 rad/s

B. 440 rad/s

C. 220 rad/s

D. 240 rad/s

Answer: A

Watch Video Solution

45. Centripetal acceleration of a cyclist completing 7 rounds in a minute along a circular track of radius 5 m with a constant speed ,is

A. $2.7m/s^2$

B. $4m/s^2$

C. $3.78m/s^2$

D. $6m/s^2$

Answer: A

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46. The velociies of A and B are $\vec{v}_A = 2\hat{i} + 4\hat{j}$ and $\vec{v}_B = 3\hat{i} - 7\hat{j}$, velocity of B as observed by A is

A. $5\hat{i} - 3\hat{j}$

B. $\hat{i} - 11\hat{j}$

C. $-\hat{i} + 11\hat{j}$

D. $2\hat{i} - 3\hat{j}$

Answer: B

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47. A man can swin with speed 6 km/h in still water. If he tries of swim across a river flowing with speed 5km/h, how fast does a leaf floating on water appears to go , to the man ?

A. 6 km/h across the river

B. 5 km/h across the river

C. 6km/h upstream

D. 5 km/h upstream

Answer: A

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48. A bus appears to go with a speed of 25 km/hr to a car driver, driving at the rate 7 km/hr northwards. If the bus actually travels in east direction, its speed is

A. 24 km/h

B. 23 km/h

C. 26 km/h

D. 30 km/h

Answer: A

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49. If the angle between two vectors $\vec{A}$ and $\vec{B}$ is 90° then

A. $\vec{A} = 2\vec{B}$

B. $\vec{A} - \vec{B} = \vec{0}$

C. $\left|\vec{A} + \vec{B}\right| = \left|\vec{A} - \vec{B}\right|$

D. $\vec{A} + \vec{B} = \vec{0}$

Answer: C

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50. If the frequency of an object in unifrom circular motion is doubled, its acceleration becomes

A. Two times

B. Four times

C. Half

D. one fourth

Answer: B

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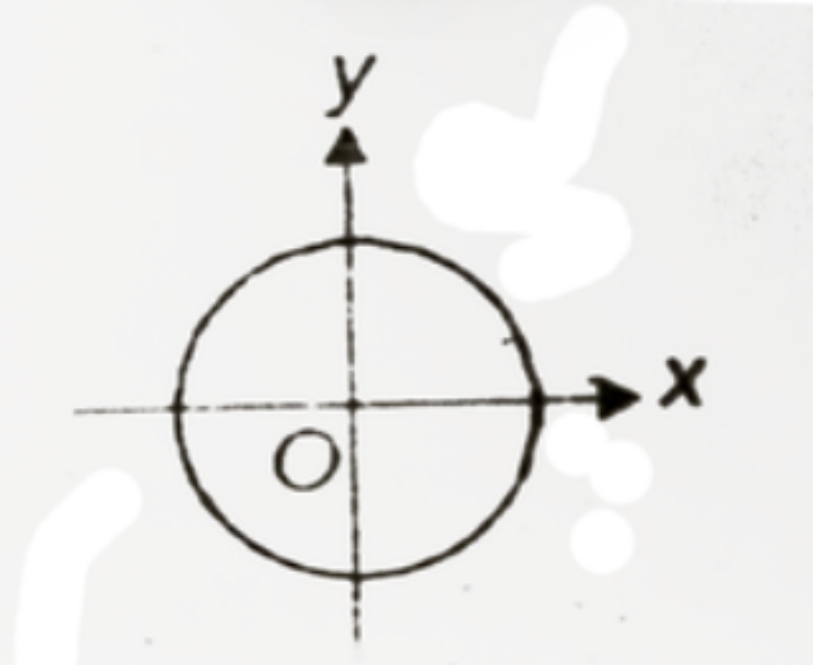
Assignement section -B Objective (one option is correct)

1. An object moves at constant speed along a cicular path in a horizontal xy plane. With the centre as origin.when the object is at x= -2m , it s

velocity is $-4\hat{j}$m/s , its acceleration when it is at y= 2 m/s



A. $-8\hat{i}m/s^2$

B. $-2\hat{j}m/s$

C. $-8\hat{j}m/s^2$

D. $2\hat{j}m/s^2$

Answer: C

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2. A particle moves along the positive branch of the curve $y = \frac{x^2}{2}$ where $x = \frac{t^2}{2}$, x and y are measured in metres and t in second. At $t = 2s$, the velocity of the particle is

A. $\frac{1}{\sqrt{2}} m/s$

B. $\sqrt{3} m/s$

C. $\sqrt{2} m/s$

D. $2\sqrt{2} m/s$

Answer: A

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3. A body is prodected with initial velocity $\left(5\hat{i} + 12\hat{i}\right)$ m//s from origin . Gravity acts in negative y direction. The horizontal rang is (Take g = 10 m/s^2)

A. 12m

B. 18 m

C. 17 m

D. 7 m

Answer: A

Watch Video Solution

4. A particle moves along the positive branch of the curve $y = \frac{x^2}{2}$ where $x = \frac{t^2}{2}$, x and y are measured in metres and t in second. At $t = 2s$, the velocity of the particle is

A. $2\hat{i} - 4\hat{j}$

B. $2\hat{i} + 4\hat{j}$

C. $4\hat{j} + 2\hat{j}$

D. $4\hat{i} - 2\hat{j}$

Answer: B

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5. One second after the projection, a stone moves at an angle of 45° with the horizontal. Two seconds from the start,

it is travelling horizontally. Find the angle of projection with the horizontal. $\left(g = 10ms^{-2}\right)$.

A. 60°

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

C. $\tan^{-1}(3)$

D. $\tan^{-1}(2)$

Answer: D

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6. The horizontal range of a projectile is R and the maximum height attained by it is H. A strong wind now beings to blow in the direction of

horizontal motion of projectile, giving to constant horizontal acceleration equal to g. Under the same conditions of projections , the new range will be (g = acceleration due to gravity)

A. R + H

B. R + 2H

C. $R + \frac{3H}{2}$

D. R + 4H

Answer: D

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7. Amplitude of a harmonic oscillator is A ,when velocity of particles is half of maximum velocity ,then determine the position of particle.

A. $\frac{\sqrt{v_1 v_2}}{g}$

B. $\frac{v_1\sqrt{v_1 + v_2}}{g}$

C. $\frac{(v_1 + v_2)\sqrt{v_1 v_2}}{g}$

D. $\frac{v_2\sqrt{v_1 v_2}}{g}$

Answer: C

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8. A rectangular box is sliding on a smooth inclined plane of inclination α as shown in the figure. At t = 0, the box starts to move on the inclined plane. A bolt starts to fall from point A. Find the time after which bolt strikes the bottom surface of the box.

Watch Video Solution

9. The speed of a projectile when it is at its greatest height is $\sqrt{2/5}$ times its speed at half the maximum height. What is its angle of projection?

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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10. If the horizontal range of a projectile be a and the maximum height attained by it is b, then prove that the velocity of projection is $\left[2g\left(b+\frac{a^2}{16b}\right)\right]^{\frac{1}{2}}$

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

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

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

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

Answer: B

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11. A grasshopper can jump a maximum horizontal distance of 40cm. If it spends negligible time on the ground then in this case its speed along the horizontal raod will be

A. 1 m/s

B. 2 m/s

C. $\sqrt{2}m/s$

D. $2\sqrt{2}m/s$

Answer: C

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12. A body is projected horizontally with a speed v_0 find the velocity of the body when it covers equal distance in horizontal and vertical directions.

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13. A particle is thrown with a speed is at an angle θ with the horizontal. When the particle makes an angle ϕ with the horizontal, its speed changes to v, then

A. $u \cos \alpha$

B. $u \cos \alpha . \sec \beta$

C. $u \cos \alpha . \cos \alpha$

D. $u \sec \alpha . \cos \beta$

Answer: B

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14. A projectile is thrown with an initial velocity of $\left(a\hat{i} + b\hat{j}\right) ms^{-1}$. If the range of the projectile is twice the maximum height reached by it, then

A. 1

B. 2

C. 3

D. 4

Answer: B

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15. A particle is projected with a velocity of 30 m/s at an angle θ with the horizontal . Where $\theta = \tan^{-1}\left(\frac{3}{4}\right)$. After 1 second, direction of motion of the particle makes an angle α with the horizontal then α is given by

A. $\tan\alpha = \frac{1}{3}$

B. $\tan\alpha = \frac{1}{2}$

C. $\tan\alpha = 2$

D. $\tan\alpha = 1$

Answer: A

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16. A projectile has same range for two angules of projection. If times of flight in two cases are t_1 and t_2 then the range of the projectilie is

A. $\frac{1}{2}gt_1t_2$

B. $\frac{1}{4}gt_1t_2$

C. gt_1t_2

D. $\frac{1}{8}gt_1t_2$

Answer: A

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17. A particle is projected with velocity 50 m/s at an angle 60° with the horizontal from the ground. The time after which its velocity will make an angle 45° with the horizontal is

A. 2.5 s

B. 1.83 s

C. 2.37 s

D. 3.72 m

Answer: B

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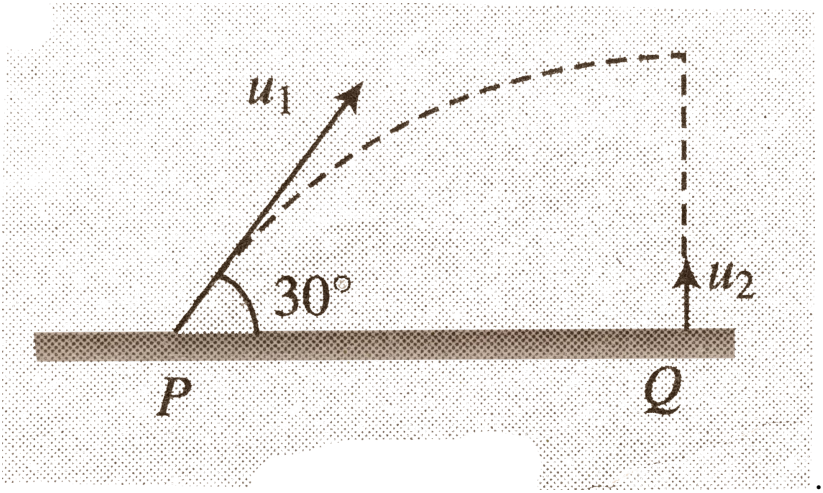
18. A particle P is projected with velocity u_1 at an angle of 30° with the horizontal. Another particle Q is thrown vertically upwards with velocity u_2 from a point vertically below the highest point of path of P. Determine the necessary condition for the two particles to collide at the

highest point.



A. 1

B. 2

C. 0.5

D. 1.5

Answer: B

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19. A projectile is fired to have maximum range 500 m. Maximum height attained by the projectitle in this case will be

A. 1000 m

B. 500 m

C. 250 m

D. 125 m

Answer: D

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20. A particle projected at some angle with velocity 50 m/s crosses a 20 m high wall after 4 s from the time of projection. The angle of porjection of the particle is

A. 30°

B. 45°

C. 60°

D. 53°

Answer: A

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21. Two paper screens A and B are separated by a distance of 100m. A bullet pierces A and then B. the hole in B is 10 cm below the hole in A. if the bullet is travelling horizontally at the time of hitting A, then the velocity of the bullet at A is

A. $980ms^{-1}$

B. $500ms^{-1}$

C. $700ms^{-1}$

D. $490ms^{-1}$

Answer: C

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22. A stone is thrown from the top of a tower at an angle of 30° above the horizontal level with a velocity of 40 m/s. it strikes the ground after 5 second from the time of projection then the height of the tower is

A. 20 m

B. 25 m

C. 40 m

D. 55m

Answer: B

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23. A level flight olane flying at an altitude of 1024 ft with a speed of 240 ft/s is overtaking a motor boat travelling at 80 ft/s in the same direction

as the plane. At what horizontal distance before the boat should a bag be dropped from the plane in order to hit the boat ? $[g = 32 \ \ \text{ft}/\text{s}^2]$

A. 1000 ft

B. 1280 ft

C. 980 ft

D. 1200 ft

Answer: B

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24. A particle is projected from the bottom of an inclined plane of inclination 30°. At what angle α (from the horizontal) should the particle be projected to get the maximum range on the inclined plane.

A. 30°

B. 45°

C. 15°

D. 75°

Answer: A

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25. If time taken by the projectile to reach B is T, then AB is equal to

A. a.$Tv\sin\theta$

B. b.$Tv\cos\theta$

C. c.$Tv\sec\theta$

D. d.$Tv\tan\theta$

Answer: D

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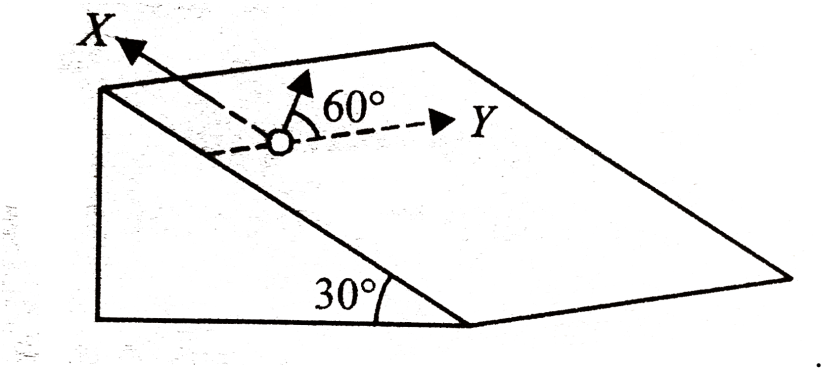
26. A small sphere is projected with a velocity of $3ms^{-1}$ in a direction 60° from the horizontal y - axis, on the smooth inclined plane (Fig. 5.197). The motion of sphere takes place in the x - y plane. Calculate the magnitude v of its velocity after $2s$.



A. 20m/s

B. 15 m/s

C. $10\sqrt{3}m/s$

D. 10 m/s

Answer: D

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27. A man desires to swim across the river in shortest time. The velcoity of river water is $3kmh^{-1}$. He can swim in still water at $6kmh^{-1}$. At what angle with the velocity of flow of the river should he swim ?

A. 30°

B. 60°

C. 90°

D. 120

Answer: C

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28. Two cars A and B cross a point P with velocities $10m/s$ and $15m/s$. After that they move with different uniform accelerations and the car A overtakes B with a speed of $25ms^{-1}$. What is velocity of B at that instant?

A. $20ms^{-1}$

B. $25ms^{-1}$

C. $30ms^{-1}$

D. $40ms^{-1}$

Answer: A

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29. A man can swim at 4 m/s in a still water swimming pool. He enters a 200 m wide river at one bank and swims (w.r.t water) at an angle of 60° to the river flow velocity. The river flow velocity is 5 m/s . In how much - time does he cross the river ? Calculate his drift.

A. $\frac{200}{\sqrt{3}}s, \frac{500}{\sqrt{3}}m$

B. $\frac{100}{\sqrt{3}}s, \frac{700}{\sqrt{3}}m$

C. 50s, 1000 m

D. $\frac{1000}{\sqrt{3}}s, \frac{200}{\sqrt{3}}m$

Answer: B

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Assignement section -C Objective (More than one option is correct)

1. Two particles are projected simultaneously from the same point, with the same speed, in the same vertical plane, and at different angles with the horizontal in a uniform gravitational field acting vertically downwards. A frame of reference is fixed to one particle. The position vector of the other particle , as observed from this frame, is $\vec{r}$. Which of the following statement is correct?

A. The direction of $\vec{r}$ changes with time

B. The magnitude of $\vec{r}$ remains constant with time

C. The magnitude of $\vec{r}$ remains same , with time

D. The magnitude of $\vec{r}$ increases linearly with time

Answer: C::D

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2. The figure shows three paths for a ball projected from ground level. ignore the effects of air on fight . Which of the following statements is correct ?

A. a. The projectile 3 has greatest time of flight

B. b. The initial vertical velocities are same for all

C. c. The projectile 3 has greatest speed of projection

D. d. The initial horizontal velocities are same for all

Answer: B::C

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3. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a and b are constant and x and y are, respectively, horizontal and vertical distances of the projectile from the point of projection. The maximum height attained by the particle and the angle of projectile from the horizontal are.

A. The range of the projectile is $\frac{a}{b}$

B. At $x = \frac{a}{2b}$, the velocity of projectile becomes zero

C. The maximum height attained by projectile is $\frac{a^2}{4b}$

D. The angle of projection is $\tan^{-1}(a)$

Answer: A::C::D

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4. Two particles projected form the same point with same speed u at angles of projection α and β strike the horizontal ground at the same point. If h_1 and h_2 are the maximum heights attained by the projectile, R

is the range for both and t_1 and t_2 are their times of flights, respectively, then

A. $R = 4\sqrt{h_1 h_2}$

B. $\alpha + \beta = \frac{\pi}{2}$

C. $\tan\alpha = \frac{t_1}{t_2}$

D. $\tan\alpha = \sqrt{\frac{h_1}{h_2}}$

Answer: A::B::C::D

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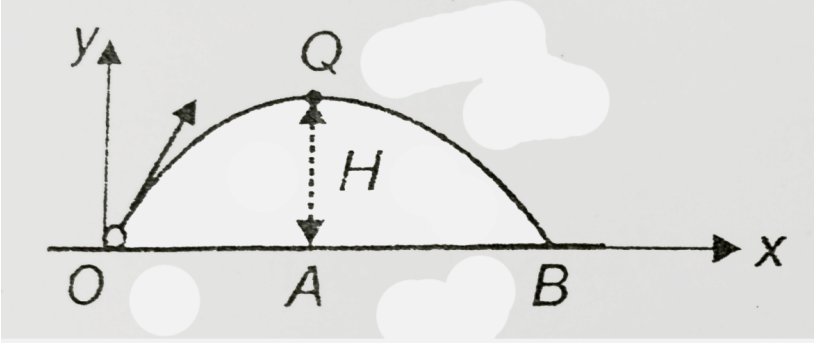
5. Figure shows the path of a projectile thrown near the surface of earth in the absence of air resistance.



If the air resistances is taken into consideration , then

A. The time taken to move from O to Q is greater than the time taken to move from Q to B.

B. At Q , acceleration of projectile is greater than g

C. H decreases

D. speed of the projectile at B is equal to the speed of projection

Answer: B::C

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6. Which of the following statements is corrent ?

A. The net acceleration of a particle in circular motion is always towards the centre of the circle

B. The velocity vector of a particle at a point is always along the tangent to the path of the particle at that point

C. The acceleration vector of a particle in circular path have constant acceleration

D. It is not possible to revolve a particle in circular path with constant acceleration.

Answer: B::C::D

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7. A projectile has the same range R for angles of projections. If T_1 and T_2 be the times of fight in the two cases, then (using θ as the angle of projection corresponding to T_1)

A. $T_1T_2 = 2\frac{R}{g}$

B. $T_1T_2 = R^2$

C. $\frac{T_1}{T_2} = \tan\theta$

D. $\frac{T_1}{T_2} = 1$

Answer: A::C

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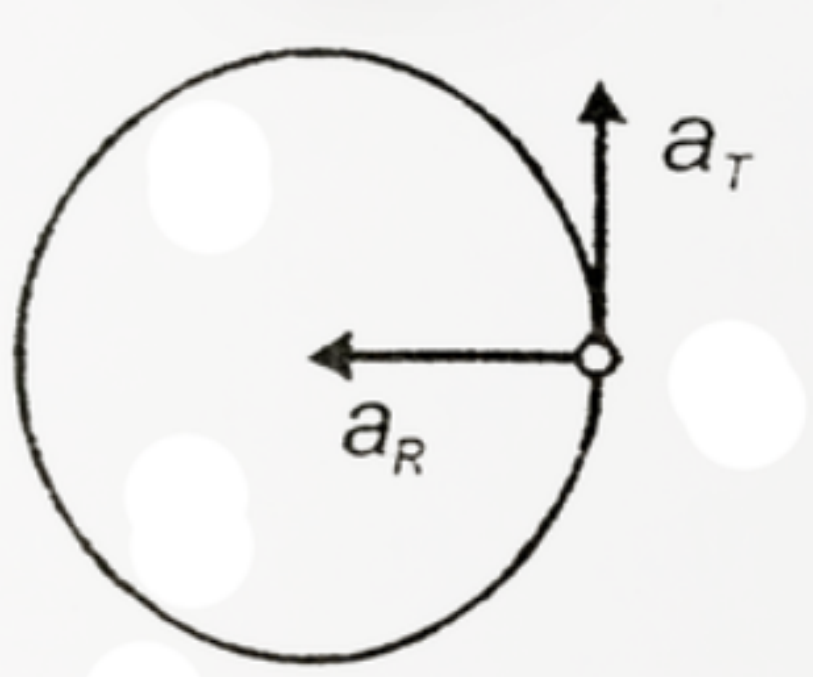
Assignement section -D (Linked Comprehension)

1. A particle moves with decreasing speed along the circle of radius R so that at any moment of time its tangential and centripetal accelerations are equal in magnitude. At the initial moment , t =0 its speed is u.



The time after which the speed of particle reduces to half of its initial value is

A. $\frac{2R}{u}$

B. $\frac{R}{u}$

C. $\frac{R}{2u}$

D. $\frac{3R}{2u}$

Answer: B

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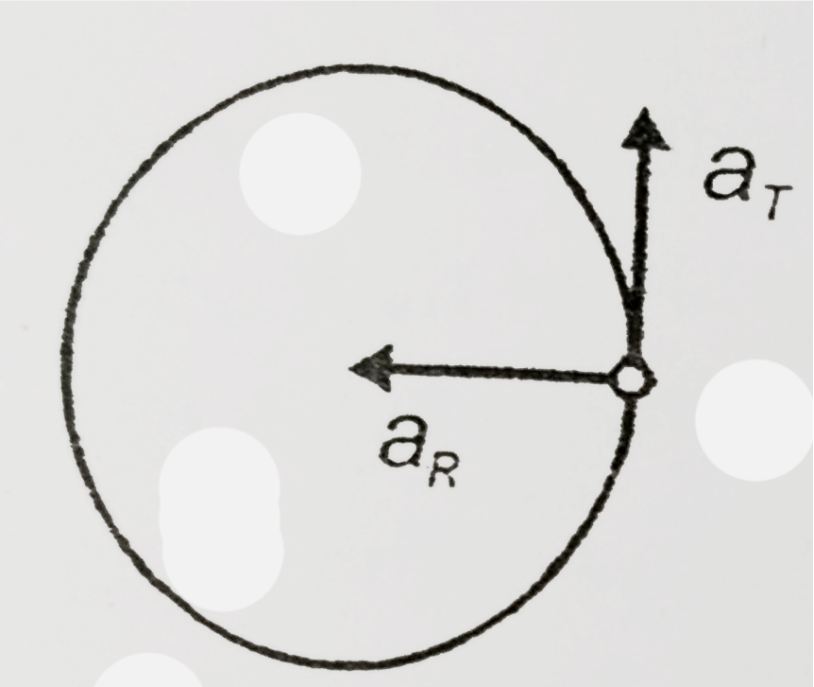
2. A particle moves with decreasing speed along the circle of radius R so that at any moment of time its tangential and centripetal accelerations are equal in magnitude. At the initial moment , t =0 its speed is u.



The magnitude of tangential acceleration at $t = \dfrac{R}{2u}$ is

A. $\dfrac{u^2}{R}$

B. $\dfrac{2u^2}{3R}$

C. $\dfrac{4u^2}{9R}$

D. $\frac{7u^2}{36R}$

Answer: C

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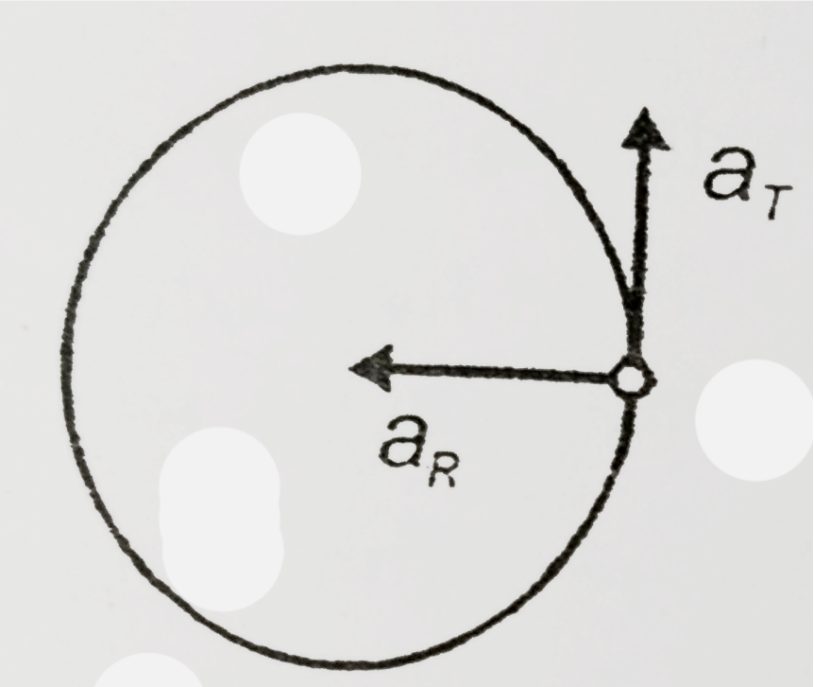
3. A particle moves with decreasing speed along the circle of radius R so that at any moment of time its tangential and centripetal accelerations are equal in magnitude. At the initial moment , t =0 its speed is u.



The magnitude of tangential acceleration at $t = \frac{R}{2u}$ is

A. a. R

B. 2R

C. $2\pi R$

D. πR

Answer: A

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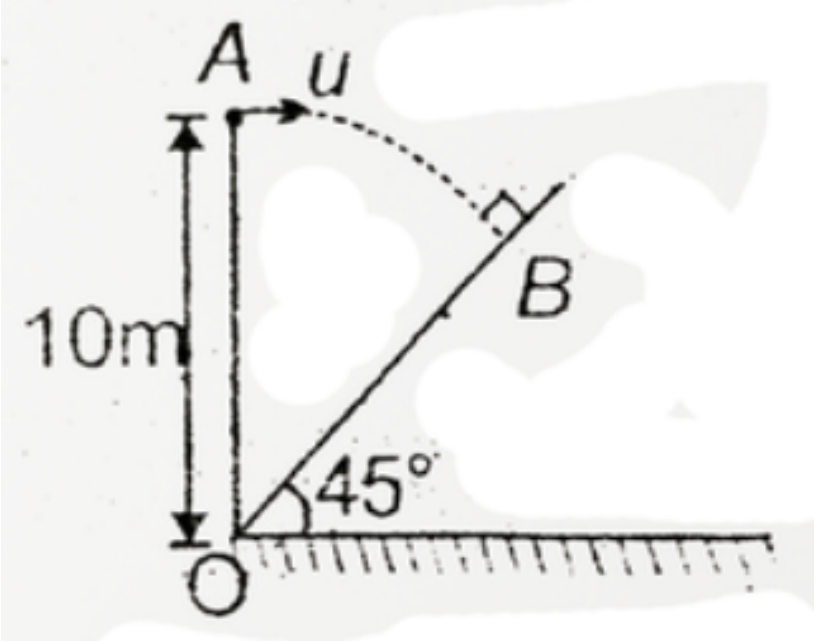
4. A particle is projected horizontally with speed u from point A, which is 10 above the ground . If the particle hits the inclined perpendicularly at point B. [g $= 10m/s^2$]



Find horizontal speed with which the particle was projected

A. a. $\frac{20}{3}$

B. b. $20\frac{\sqrt{20}}{3}$

C. c. $u = 10\frac{\sqrt{2}}{3}$

D. d. $10\frac{\sqrt{3}}{2}$

Answer: C

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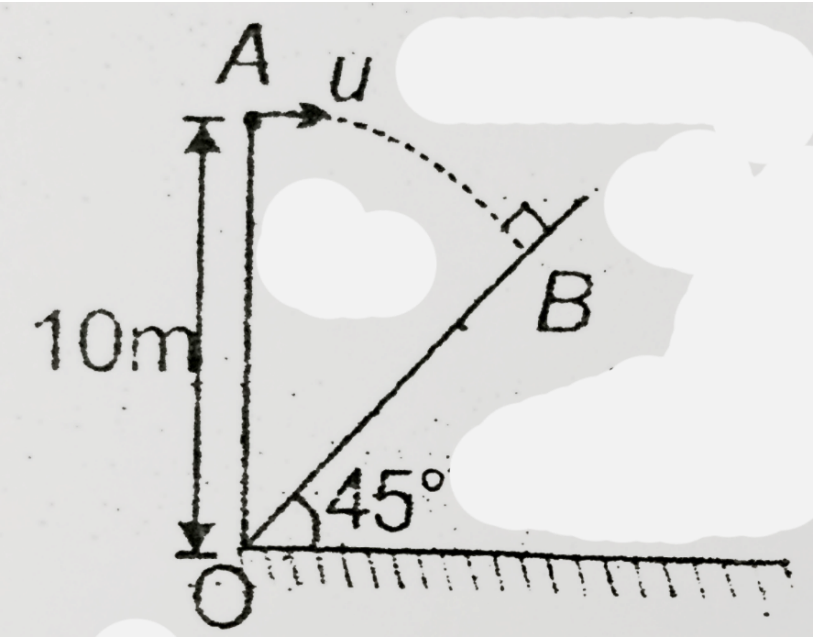
5. A particle is projected horizontally with spee u from point A, which is 10 above the ground . If the particle hits the inclined perpendicularly at point B. [g $= 10m/s^2$]



Find the length OB along the inclined plane

A. $\frac{10}{\sqrt{3}}$

B. $20\sqrt{3}$

C. $\frac{20}{\sqrt{3}}$

D. $\frac{20\sqrt{2}}{3}$

Answer: D

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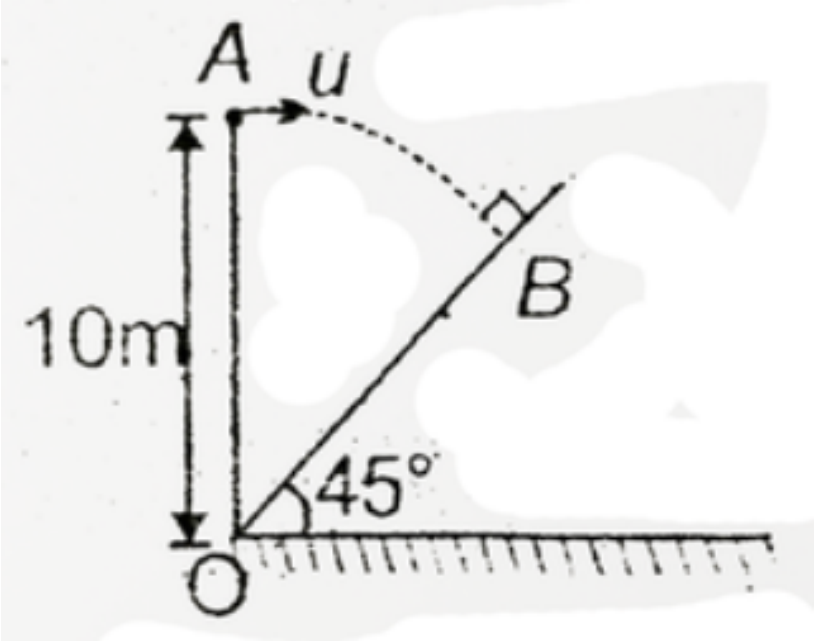
6. A particle is projected horizontally with speed u from point A, which is 10 above the ground . If the particle hits the inclined perpendicularly at point B. [g $= 10m/s^2$]



Find horizontal speed with which the particle was projected

A. $\frac{20}{\sqrt{3}}$

B. $20\sqrt{3}$

C. $\frac{10}{\sqrt{3}}$

D. $10\sqrt{3}$

Answer: A

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7. When a boat travels in a river (strictly in a straight line), it can go either in the direction of flow of river (i.e downstream) or in the direction opposite the flow of river (i.e. upstrem). Thus the boat's actual speed is more than by which it can move in stationary water while travelling downstram (as river's flow speed is added to it) and less while travelling upstream (as the boat moves against the flow of river).Based on the given information answer the following questions A boat going downstream in a following river overcome a raft at a point P. 1 h later it turned back and after some time passed the raft at a distance 6 km from point P.

After reversing its direction ,how much time was taken by the boat to meet the raft again (i.e. 2^{nd} time) ?

A. 2h

B. 1 h

C. 30 min

D. 3h

Answer: B

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8. When a boat travels in a river (strictly in a straight line), it can go either in the direction of flow of river (i.e downstream) or in the direction opposite the flow of river (i.e. upstrem). Thus the boat's actual speed is more than by which it can move in stationary water while travelling downstram (as river's flow speed is added to it) and less while travelling upstream (as the boat moves against the flow of river).Based on the given information answer the following questions A boat going downstream in a following river overcome a raft at a point P. 1 h later it turned back and after some time passed the raft at a distance 6 km from point P.

Find the speed of river

A. 4 km/h

B. 2 km/h

C. 3 km/h

D. 1 km/h

Answer: C

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9. When a boat travels in a river (strictly in a straight line), it can go either in the direction of flow of river (i.e downstream) or in the direction opposite the flow of river (i.e. upstrem). Thus the boat's actual speed is more than by which it can move in stationary water while travelling downstram (as river's flow speed is added to it) and less while travelling upstream (as the boat moves against the flow of river).Based on the given information answer the following questions A boat going downstream in a following river overcome a raft at a point P. 1 h later it turned back and after some time passed the raft at a distance 6 km from point P.

Now, it instead of 6 km they have met at 8 km from point P. Find the speed of river

A. 1 km/h

B. 2 km/h

C. 3 km/h

D. 4 km/h

Answer: D

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10. Raindrops are falling with velocity $10\sqrt{2}$ m/s making and angle 45° with the vertical. The drops appear to be falling vertically to a man running with constant velocity . The velocity of rain drops change such that the rain drops now appear to be falling vertically with $\sqrt{3}$ times the velcoity it appeared earlier to the same person running with same velocity .

The magnitude of velocity of man w.r.t ground is

A. $10\sqrt{2}m/s$

B. $10\sqrt{3}m/s$

C. 10 m/s

D. 20 m/s

Answer: C

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11. Raindrops are falling with velocity $10\sqrt{2}$ m/s making and angle 45° with the vertical. The drops appear to be falling vertically to a man running with constant velocity . The velocity of rain drops change such that the rain drops now appear to be falling vertically with $\sqrt{3}$ times the velcoity it appeared earlier to the same person running with same velocity .

After the velocity of rain drops change the magnitude of velocity of raindrops with respect to ground is

A. $20\sqrt{3}m/s$

B. 10 m/s

C. $10\sqrt{3}m/s$

D. 20 m/s

Answer: D

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12. Raindrops are falling with velocity $10\sqrt{2}$ m/s making and angle 45° with the vertical. The drops appear to be falling vertically to a man running with constant velocity . The velocity of rain drops change such that the rain drops now appear to be falling vertically with $\sqrt{3}$ times the velcoity it appeared earlier to the same person running with same velocity .

The angle (in degrees) between the initial and final velocity of rain drops with respect to ground.

A. 15°

B. 8°

C. 22.5°

D. 37°

Answer: A

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Assignement section -E (Assertion-Reason)

1. Statement -1 : A food packet is dropped from a rescue plane . Path of the food packed will be straight line for the pilot but parabolic for the person on the ground.

Statement - 2: Food packet has initial velocity same as that of plane.

A. Statement -1 is Ture, statement -2 is Ture, Statement -2 is a correct explanation for statement -1 .

B. Statement -1 is True, statement -2 is True, statement - 2 is NOT a correct explanation for statement -1

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is False ,Statement -2 is True.

Answer: A

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2. Statemetnt - 1 : In circular motion, acceleration may be in any direction relative to the velocity .

Statement -2 : Dot product of velocity and acceleration in circular motion may be positive , negative or zero.

A. Statement -1 is Ture, statement -2 is Ture, Statement -2 is a correct explanation for statement -1 .

B. Statement -1 is True, statement -2 is True, statement - 2 is NOT a correct explanation for statement -2

C. Statement -1 is True, Statement -2 si False

D. Statement -1 is False ,Statement -2 is True.

Answer: D

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3. Statement -1 : A man standing on the ground has to hold his umbrella at an angle θ with the vertical to protect himself from rain. It is possible that the man now starts running on the ground with certain speed, but he still has to hold his umbrella at angle θ with the vertical to protect himself from rain.

Statement -2 : Vertical component of velocity of rain w.r.t man does not change. if he starts running on a horizontal ground.

A. Statement -1 is Ture, statement -2 is Ture, Statement -2 is a correct explanation for statement -1 .

B. Statement -1 is True, statement -2 is True, statement - 2 is NOT a correct explanation for statement -3

C. Statement -1 is True, Statement -2 si False

D. Statement -1 is False ,Statement -2 is True.

Answer: B

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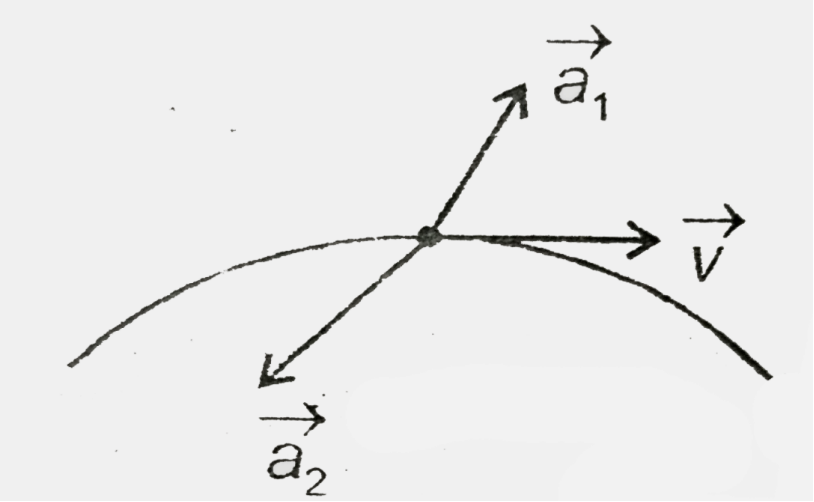
4. A body moves in a curved path as show :



Statement -1 : Its acceleration vector cannot be $\vec{a}_1$ but it may be $\vec{a}_2$.

Statement -2 . The normal acceleratin is awlays directed towards the centre of curvature.

A. Statement -1 is Ture, statement -2 is Ture, Statement -2 is a correct explanation for statement -1 .

B. Statement -1 is True, statement -2 is True, statement - 2 is NOT a correct explanation for statement -4

C. Statement -1 is True, Statement -2 si False

D. Statement -1 is False ,Statement -2 is True.

Answer: A

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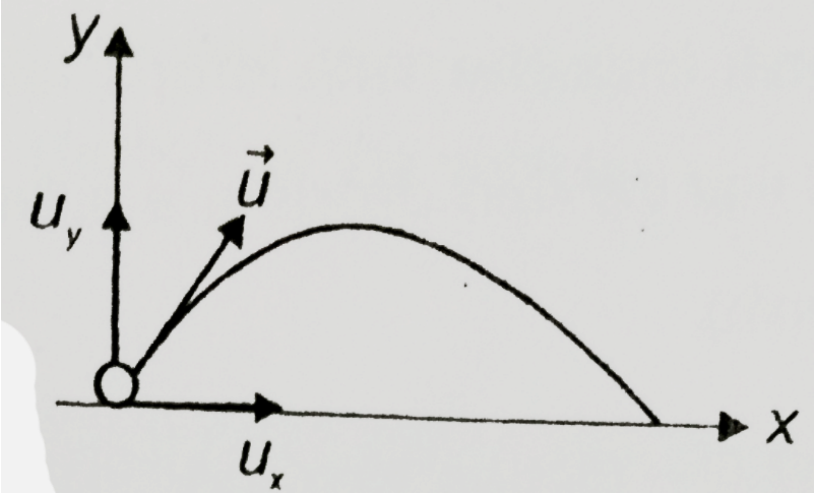
Assignement section -F (Matrix-Match)

1. A particle is projected from level ground near the surface of earth with intitial velocity $\vec{u} = u_x\hat{i} + u_y\hat{j}$,as shown in the figure. If $a(x)$ and a_y are the components of acceleration in horizontal and vertically downward directions then



Match the following columns.

Column I	Column II
(A) Time of flight depends on	(p) u_x
(B) Maximum height depends on	(q) u_y
(C) Range depends on	(r) a_x
D) Speed at the top depends on	(s) a_y

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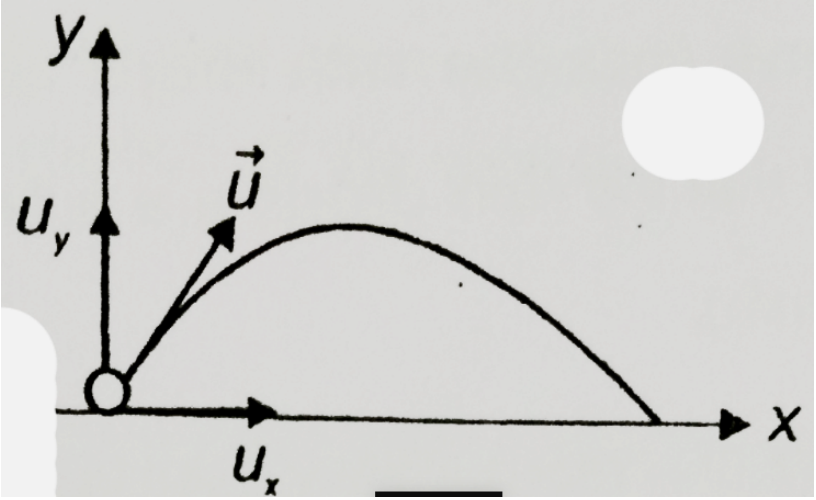
2. A particle is projected from level ground near the surface of earth with intitial velocity $\vec{u} = u_x\hat{i} + u_y\hat{j}$,as shown in the figure. If $a(x)$ and a_y are the components of acceleration in horizontal and vertically downward directions then



Match the following columns.

(Column I, Column II),

((A) Projectile motion, (p) Uniform motion)((B) A block sent sliding on

((C) Unifrom circular motion , (r) motion with non- uniform acceleratio

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Assignement section -G (Integer)

1. An object projected with same speed at two different angles covers the same horizontal range R. If the two times of flight be t_1 and t_2 . The range is $\frac{1}{\alpha}gt_1t_2$, the value of α is

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2. The two graphs of a given projectile show that variation of vertical velocity component with time and with horizontal displacement. What is the x-component of velocity in m/s ?

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3. A man walking with a speed of 3 km/h finds the rain drops falling vertically downwards. When the man increases his speed to 6km/h he find that the rain drops are falling making an angle of 30° with the vertical . Find the speed of the rain drops (in km/h)

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4. six particles are situated at the corners of a regular hexagon. These particles start moving with equal speed of 10 m/s in such that velocity of

any one particle is directed towards the next particle. Find the rate (in m/s) at which length of a side of the hexagon is decreasing.

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Assignement section -H (Multiple True-False)

1. Statement -1 : The graph between - Kinetic energy and vertical displacement is a stright line for a projectile.

Statement -2 : The graph between kinetic energy and horizontal displacement is a straight is straight line for a projectile.

Statement -3 : the graph between kinetic energy and time is a parabola for a projectile.

A. a. F F F

B. b. T T F

C. c. T F T

D. d. F F T

Answer: 3

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Assignement section -I (Subjective)

1. A ball is thrown upward at an angle of 45° with the horizontal and lands on the top edge of a builing that is 20 m away. The top edge is 10 m above the throwing point. The initial speed of the ball in metre/second is (take g =$10m/s^2$)

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2. A vehicle starts from centre O of a circular park of radius 1 km and reaches point A. After travelling $1/4^{\text{th}}$ of the circumference along AB, he returns to the centre of the park. If the total time taken is 10 minute.

(i) Net displacement

(ii) Average velocity

(iii) Average speed in the round trip

(iv) Magnitude of average velocity in the interval when vehicle moves from A to B, considering motion of the vehicle uniform.

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Assignement section -J (Aakash Challengers Questions)

1. The maximum angle to the horizontal at which a stone can be thrown so that it always moves away from the thrower will be :

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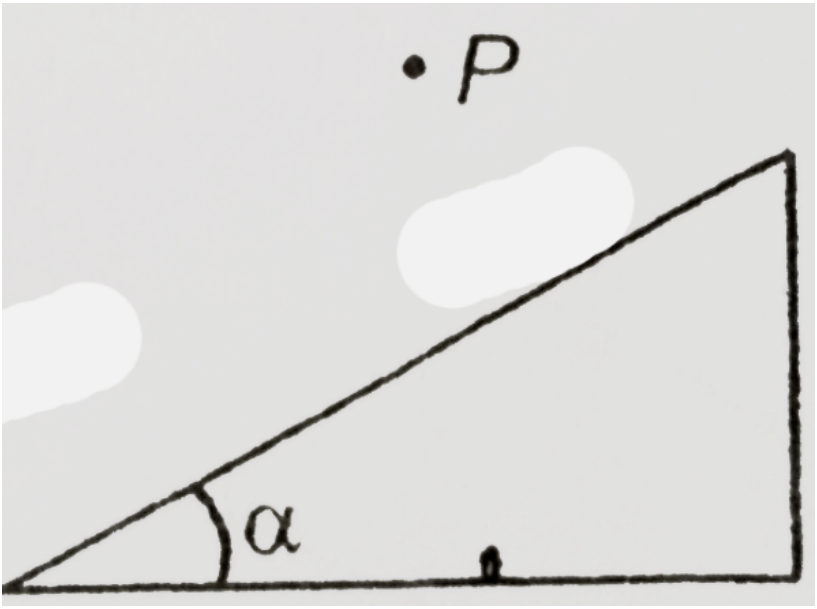
2. A point P is located above an inclined plane. It is possible to reach the plane by sliding under gravity down a straight frictionless wire joining to some point P` on the plane. How should P be chosen so as to minimize

the time taken ?



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3. The viscous drag on a spherical body moving with a speed v is proportional to

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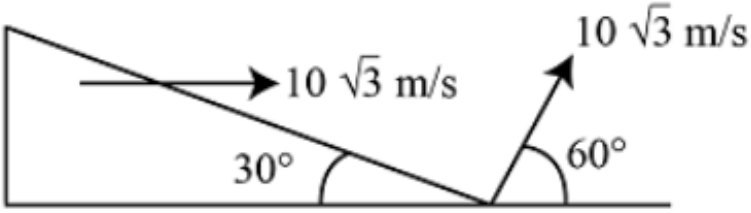
4. Choose the correct option:

A particle is projected at an angle 60° with speed $10(\sqrt{3})m/s$, from the

point A, as shown in the figure. At the same time the wedge is made to move with speed $10(\sqrt{3})m/s$ towards right as shown in the figure. Then the time after which particle will strike with wedge is



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5. A balloon starts rising from the earth's surface. The ascension rate is constant and equal to v_0. Due to the wind. The balloon gathers the horizontal velocity component $v_x = ky$, where k is a constnat and y is the height of ascent. Find how the following quantities depednd on the height of ascent.

(a) the horizontal drift of the balloon x (y)

(b) the total tangential and normal accelrations of the balloon.

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6. The current velocity of river grows in proportion to the distance from its bank and reaches the maximum value v_0 in the middle. Near the banks the velocity is zero. A boat is moving along the river in such a manner that the boatman rows his boat always perpendicular to the current. The speed of the boat in still water is u. Find the distance through which the boat crossing the river will be carried away by the current, if the width of the river is c. Also determine the trajectory of the boat.

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7. Two parallel straight lines are inclined to the horizon at an angle $\propto$. A particle is projected from a point mid way between them so as to graze one of the lines and strikes the other at right angle. Show that if θ is the angle between the direction of projection and either of lines, then $\tan\theta = \left(\sqrt{2-1}\right)\cot \propto$.

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EXERCISE

1. The vector quantity among the following is

A. Mass

B. Time

C. Distance

D. Displacement

Answer: D

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2. A+B can also be written as

A. $\vec{A} - \vec{B}$

B. $\vec{B} - \vec{A}$

C. $\vec{B} + \vec{A}$

D. $\vec{B} \cdot \vec{A}$

Answer: C

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3. Which of the following represents a unit vector ?

A. $\frac{|\vec{A}|}{\vec{A}}$

B. $\frac{\vec{A}}{|\vec{A}|}$

C. $\frac{\vec{A}}{\vec{A}}$

D. $\frac{|\vec{A}|}{|\vec{A}|}$

Answer: B

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4. A vetor is added to an equal and oppsite vector of similar nature,forms a

A. Units vector

B. Position vector

C. Null vector

D. Displacement vector

Answer: C

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5. Unit vector does not have any specified

A. Direction

B. Magnitude

C. Unit

D. All of these

Answer: C

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6. The magnitude of $\hat{i} + \hat{j}$ is

A. 2

B. 0

C. $\sqrt{2}$

D. 4

Answer: C

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7. A vector multiplied by the number 0, results into

A. 0

B. $\overrightarrow{A}$

C. $\overrightarrow{0}$

D. $\overrightarrow{A}$

Answer: C

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8. if $\overrightarrow{P}a + \overrightarrow{Q} = \overrightarrow{0}$, then which of the following is necessarily true ?

A. $\overrightarrow{P} = \overrightarrow{0}$

B. $\overrightarrow{P} = -\overrightarrow{Q}$

C. $\overrightarrow{Q} = 0$

D. $\overrightarrow{P} = \overrightarrow{Q}$

Answer: B

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9. If $\left|\vec{P}+\vec{Q}\right|=\left|\vec{P}-\vec{Q}\right|$ the angle between $\vec{P}$ and $\vec{Q}$ is

A. $\vec{P}=\vec{0}$

B. $\vec{Q}=\vec{0}$

C. $\left|\vec{P}\right|=1$

D. $\left|\vec{Q}\right|=1$

Answer: B

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10. The maximum number of components into which a vector can be resolved in its own plane is

A. Infinite

B. Four

C. Two

D. One

Answer: C

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11. The displacement of a particle from a point having position vector $2\hat{i} + 4\hat{j}$ to another point having position vector $5\hat{i} + 1\hat{j}$ is

A. 3 units

B. $3\sqrt{2}$ units

C. 5 uints

D. $5\sqrt{3}$ units

Answer: B

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12. Three forces given by vectors $2\hat{i} + 2\hat{j}, 2\hat{i} - 2\hat{j}$ and $-4\hat{i}$ are acting together on a point object at rest. The object moves along the direction.

A. x -axis

B. y-axis

C. z-axis

D. Object does not move

Answer: D

Watch Video Solution

13. A body move 6 m north, 8 m east and 10 m vertically upwards, the resultant displacement from its initial position is

A. $10\sqrt{2}$

B. 10 m

C. $\frac{10}{\sqrt{2}}$ m

D. 20 m

Answer: A

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14. A particle has an initial velocity of $4\hat{i} + 3\hat{j}$ and an acceleration of $0.4\hat{i} + 0.3\hat{j}$. Its speed after 10s is

A. $7\sqrt{2}$

B. 7 units

C. 8.5 units

D. 10 units

Answer: A

Watch Video Solution

15. The position vector of an object at any time t is given by $3t^2\hat{i} + 6t\hat{j} + \hat{k}$. Its velocity along y-axis has the magnitude

A. 6 t

B. 6

C. 0

D. 9

Answer: B

Watch Video Solution

16. A body lying initially at point (3,7) starts moving with a constant acceleration of $4\hat{i}$. Its position after 3s is given by the coordinates

A. $(7, 3)$

B. $(7, 18)$

C. $(21, 7)$

D. $(3, 7)$

Answer: C

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17. The initial position of an object at rest is given by $3\hat{i} - 8\hat{j}$. It moves with constant acceleration and reaches to the position $2\hat{i} + 4\hat{j}$ after 4s. What is its acceleration ?

A. $-\frac{1}{8}\hat{j} + \frac{3}{2}\hat{j}$

B. $2\hat{j} - \frac{1}{8}\hat{j}$

C. $-\frac{1}{8}\hat{j} + 8\hat{j}$

D. $8\hat{i} - \frac{3}{2}\hat{j}$

Answer: A

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18. The velocities of A and B are $\vec{v}_A = 2\hat{i} + 4\hat{j}$ and $\vec{v}_B = 3\hat{i} - 7\hat{j}$, velocity of B as observed by A is

A. $5\hat{i} - 3\hat{j}$

B. $\hat{i} - 11\hat{j}$

C. $-\hat{i} + 11\hat{j}$

D. $2\hat{i} - \hat{j}$

Answer: B

Watch Video Solution

19. A bus appears to go with a speed of 25 km/hr to a car driver, driving at the rate 7 km/hr northwards. If the bus actually travels in east direction, its speed is

A. 24 km/h

B. 23 km/h

C. 26 km/h

D. 30 km/h

Answer: A

Watch Video Solution

20. A displacment vector fo magnitude 4 makes an angle 30° with the x-axis. Its rectangular components in x-y plane are

A. $2\sqrt{3}, 2$

B. $4\sqrt{3}, 4$

C. $\frac{2}{\sqrt{3}}, 2$

D. $\frac{4}{\sqrt{3}}, 4$

Answer: A

Watch Video Solution

21. At the topmost point of a projectile trajectory, its velocity and acceleration are an angle of

A. 0°

B. 45°

C. 90°

D. 180°

Answer: C

Watch Video Solution

22. For angle of prijection of projectile at angle$(45^\circ - \theta)$ and $(45^\circ + \theta)$, the horizontal range described by the projectile are in the ratio of

A. $2:1$

B. $1:1$

C. $2:3$

D. $1:2$

Answer: B

Watch Video Solution

23. A cricket ball of mass m is hitted at the angle 45° to the horizontal with velcoity v its kinetic energy at the topmost point is

A. 0

B. $\frac{1}{2}mv^2$

C. $\frac{mv^2}{4}$

D. $\frac{mv^2}{2\sqrt{2}}$

Answer: C

Watch Video Solution

24. What do you understand by projectile ? Show that the path of a projectile is parabolic.

A. Circular

B. Parabolic

C. Linear

D. Hyperbolic

Answer: B

Watch Video Solution

25. Which of the following is not a projectile ?

A. An aircraft taking off

B. A bullet fired from a riffe

C. A ball thrown horizontally from a roof

D. A football kicked by a player

Answer: A

Watch Video Solution

26. If a stone projected from ground, takes 4 s to reach the topmost point, of its trajectory, then time of fight is

A. 4 s

B. 8 s

C. 2 s

D. 10 s

Answer: B

Watch Video Solution

27. The maximum height attained by a ball projected with speed $20ms^{-1}$ at an angle 45° with the horizontal is [take g = $10ms^{-2}$]

A. 40 m

B. 20 m

C. 10 m

D. 30 m

Answer: C

Watch Video Solution

28. The time of fight of an object projected with speed $20ms^{-1}$ at an angle 30° with the horizontal , is

A. 1 s

B. 4 s

C. 2 s

D. 6 s

Answer: C

Watch Video Solution

29. At the topmost point of its path, a projectile has acceleration of magntiude

A. 0

B. g

C. $\frac{g}{2}$

D. $\frac{g}{\sqrt{2}}$

Answer: B

Watch Video Solution

30. At what angle of elevation , should a projectile be projected with velocity with velocity $20ms^{-1}$, so as to reach a maximum height of 10 m ?

A. 0°

B. 90°

C. 45°

D. 60°

Answer: C

Watch Video Solution

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

A. 0°

B. 180°

C. 90°

D. 45°

Answer: C

Watch Video Solution

32. Two cars of masses m_1 and m_2 are moving in circles od radii r_1 and r_2. Their speeds are such that they complete one revolution in the same time. The ratio of their angular speed is :

A. $R_1 : R_2$

B. $R_2 : R_1$

C. $1 : 1$

D. $R_1 R_2 : 1$

Answer: C

Watch Video Solution

33. Angular speed of a uniformly circulating body with time period T is

A. 2πT

B. $\frac{2\pi}{T}$

C. πT

D. $\frac{\pi}{T}$

Answer: B

Watch Video Solution

34. An object moving in a circular path at constant speed has constant

A. Energy

B. Velocity

C. Acceleration

D. Displacement

Answer: A

Watch Video Solution

35. Speed of an object moving in cirular path of radius 10 m with angular speed 2 rad/s is

A. 10 m/s

B. 5 m/s

C. 20 m/s

D. 30 m/s

Answer: C

Watch Video Solution

36. A body performing uniform cicular motion completed 140 revolution in a second. Its angular speed is

A. 880 rad/s

B. 440 rad/s

C. 220 rad/s

D. 240 rad/s

Answer: A

Watch Video Solution

37. Centripetal acceleration of a cyclist completing 7 rounds in a minute along a circular track of radius 5 m with a constant speed ,is

A. 2.7 m/s^2

B. 4 m/s^2

C. 3.78 m/s^2

D. 6 m/s^2

Answer: A

Watch Video Solution

38. If the frequency of an object in unifrom circular motion is doubled, its acceleration becomes

A. Two times

B. four times

C. half

D. one fourth

Answer: B

Watch Video Solution

39. A body is moving on a circle of radius 80 m with a speed 20 m/s which is decreasing at the rate 5 ms^{-2} at an instant. The angle made by its acceleration with its velocity is

A. 45°

B. 90°

C. 135°

D. 0°

Answer: C

Watch Video Solution

40. The distance of a particle moving on a circle of radius 12 m measured from a fixed point on the circle and measured along the circle is given by $s = 2t^3$ (in meters). The ratio of its tangential to centripetal acceleration at t = 2s is

A. $1:1$

B. $1:2$

C. $2:1$

D. $3:1$

Answer: B

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ASSIGNMENT SECTION -A

1. Which of the following is a vector ?

A. Current

B. time

C. Acceleration

D. Volume

Answer: C

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2. The change ina vector may occur due to

A. Rotation of frame of reference

B. Translation of frame of eference

C. Rotation of vector

D. Both (1)/ & (3)

Answer: C

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3. Which one of the following pair cannot be the rectangular components of force vector of 10 N ?

A. $6N \& 8N$

B. $7N \& \sqrt{51}N$

C. $6\sqrt{2}N \& 2\sqrt{7}N$

D. $9N \& 1N$

Answer: D

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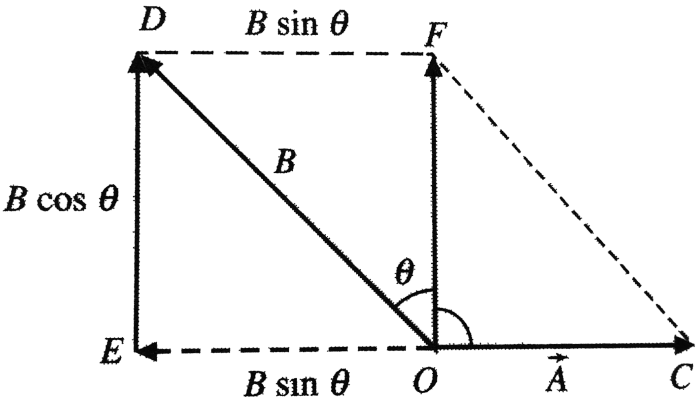
4. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to the vector $\vec{A}$ and its magnitude is equal to half of the magnitude of the vector $\vec{B}$. Find out the angles between $\vec{A}$ and $\vec{B}$.



A. 10 units

B. $10\sqrt{3}$ units

C. $10\sqrt{2}$ units

D. $5\sqrt{3}$ units

Answer: B

Watch Video Solution

5. Two forces, each of magnitude F have a resultant of the same magnitude F. The angle between the two forces is

A. 30°

B. 60°

C. 120°

D. 150°

Answer: C

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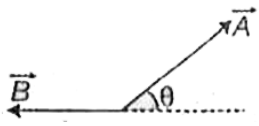
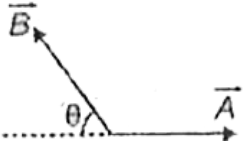
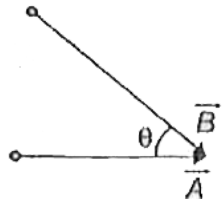
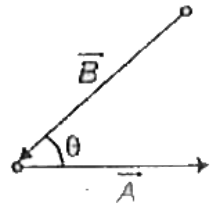
6. Let θ be the angle between vectors $\vec{A}$ and $\vec{B}$. Which of the following figures correctly represent the angle θ ?

A. 

B. 

C. 

D. 

Answer: C

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7. $\vec{A}$ is a vector of magnitude 2.7 units due east . What is the magnitude and direction of vector 4 $\vec{A}$?

A. 4 units due east

B. 4 units due west

C. 2.7 units due east

D. 10.8 units due east

Answer: D

Watch Video Solution

8. Two forces of magnitude 8 N and 15 N respectively act at a point . If the resultant force is 17 N , the angle between the forces has to be

A. 60°

B. 45°

C. 90°

D. 30°

Answer: C

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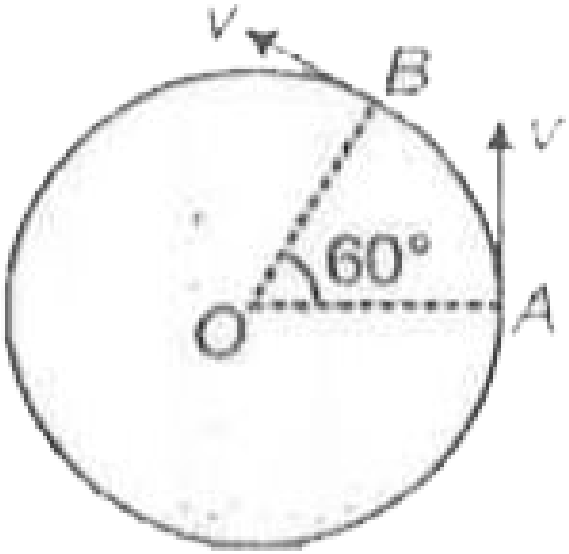
9. A particle is moving in a circle of radius r having centre at O with a constant speed v . The magnitude of change in velocity in moving from A to B is



A. 2 v

B. Zero

C. $\sqrt{3}$v

D. v

Answer: D

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10. Two non-collinear forces, one of 10 N and another of 6 N act upon a body. The directions of the forces are unknown. The resultant force on the body is :

A. 15 N

B. 3 N

C. 17 N

D. 2 N

Answer: A

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11. The vector $\overrightarrow{OA}$ where O is origin is given by $\overrightarrow{OA} = 2\hat{i} + 2\hat{j}$. Now it is rotated by 45° anticlockwise about O . What will be the new vector . ?

A. $2\sqrt{2}\hat{j}$

B. $2\hat{j}$

C. $2\hat{j}$

D. $2\sqrt{2}\hat{j}$

Answer: A

Watch Video Solution

12. A car moves towards north at a speed of 54 km/h for 1 h. Then jt moves eastward with same speed for same duration . The average speed and velocity of car for complete journey is

A. 54 km/m 0

B. 15 m/s , $\frac{15}{\sqrt{2}}$ m/s

C. 0,0

D. $0, \frac{54}{\sqrt{2}}$ km/h

Answer: B

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13. If the sum of two unit vectors is also a unit vector. Then magnituce of their difference and angle between the two given unit vectors is

A. $\sqrt{3}, 60^\circ$

B. $\sqrt{3}, 120^\circ$

C. $\sqrt{2}, 60^\circ$

D. $\sqrt{2}, 120^\circ$

Answer: B

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14. A particle projected from origin moves in x-y plane with a velocity $\overrightarrow{v} = 3\hat{i} + 6x\hat{j}$, where $\hat{i}$ and $\hat{j}$ are the unit vectors along x and y axis. Find the equation of path followed by the particle :-

A. $y = x^2$

B. $y = \frac{1}{x^2}$

C. $y = 2x^2$

D. $y = \frac{1}{x}$

Answer: A

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15. Ram moves in east direction at a speed of 6 m/s and Shyam moves 30° east of north at a speed of 6 m/s. The magnitude of their relative velocity is

A. 3 m/s

B. 6 m/s

C. $6\sqrt{3}$ m/s

D. $6\sqrt{2}$ m/s

Answer: B

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16. A train is running at a constant speed of 90 km/h on a straight track. A person standing at the top of a boggey moves in the direction of motion of the train such that he covers 1 meters on the train each second. The speed of the person with respect to ground to -

A. 25 m/s

B. 91 km/h

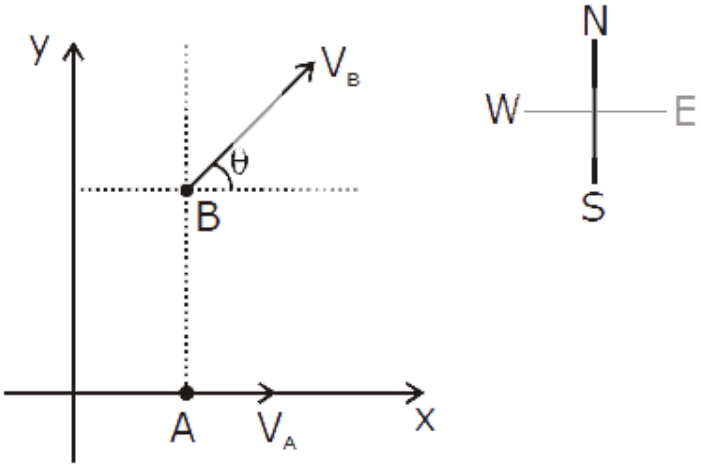
C. 26 km/h

D. 26 m/s

Answer: D

Watch Video Solution

17. Figure shows two ships moving in x-y plane with velocity V_A and V_B. The ships move such that B always remains north of A. The ratio $\frac{V_A}{V_B}$ is eqal to -



A. cos θ

B. sin θ

C. sec θ

D. cosec θ

Answer: A

Watch Video Solution

18. 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. $\frac{d}{2v}$

B. $\frac{d}{v}$

C. $\frac{3d}{2v}$

D. They will never meet

Answer: B

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19. A person, reaches a point directly opposite on the other bank of a flowing river, while swimming at a speed of 5 m/s at an angle of 120° with

the flow. The speed of the flow must be

A. 2.5 m/s

B. 3 m/s

C. 4 m/s

D. 1.5 m/s

Answer: A

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20. A particle of mass 1 kg is projected at an angle of 30° with horizontal with velocity v = 40 m/s . The change in linear momentum of the particle after time t = 1 s will be (g = 10 m/s^2)

A. 50 kg ms^{-1}

B. 100 kg ms^{-1}

C. 25 kg ms^{-1}

D. zero

Answer: A

Watch Video Solution

21. A car with a vertical windshield moves in a rain storm at a speed of 40 km/hr. The rain drops fall vertically with constant speed of 20 m/s. The angle at which rain drops strike the windshield is -

A. $\tan^{-1}\frac{5}{9}$

B. $\tan^{-1}\frac{9}{5}$

C. $\tan^{-1}\frac{3}{2}$

D. $\tan^{-1}\frac{2}{3}$

Answer: A

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22. Two projectiles are projected angle $\left(\frac{\pi}{4}+\theta\right)$ and $\left(\frac{\pi}{4}-\theta\right)$ with the horizontal , where $\theta<\frac{\pi}{4}$, with same speed. The ratio of horizontal ranges described by them is

A. $\tan\theta:1$

B. $1:\tan^2\theta$

C. $1:1$

D. $1:\sqrt{3}$

Answer: C

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23. A shell is fired vertically upwards with a velocity v_1 from a trolley moving horizontally with velocity v_2. A person on the the ground observes the motion of the shell as a parabole, whose horizontal range is

A. $\frac{2v_1^2v_2}{g}$

B. $\frac{2v_1^2}{g}$

C. $\frac{2v_2^2}{g}$

D. $\frac{2v_1v_2}{g}$

Answer: D

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24. The position coordinates of a projectile projected from ground on a certain planet (with an atmosphere) are given by $y = \left(4t - 2t^2\right)$ m and $x = (3t)$ metre, where t is in second and point of projection is taken as origin. The angle of projection of projectile with vertical is -

A. 30°

B. 37°

C. 45°

D. 60°

Answer: B

Watch Video Solution

25. A particle is projected from ground with speed 80 m/s at an angle 30° with horizontal from ground. The magnitude of average velocity of particle in time interval t = 2 s to t = 6 s is [Take g = 10 m/s^2]

A. $40\sqrt{2}$ m/s

B. 40 m/s

C. zero

D. $40\sqrt{3}$ m/s

Answer: D

Watch Video Solution

26. A stone projected from ground with certain speed at an angle θ with horizontal attains maximum height h_1 when it is projected with same

speed at an angle θ with vertical attains height h_2. The horizontal range of projectile is

A. $\frac{h_1 + h_2}{2}$

B. $2h_1h_2$

C. $4\sqrt{h_1h_2}$

D. $h_1 + h_2$

Answer: C

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27. Two bodies are thrown up at angles of 45° and 60°, respectively, with the horizontal. If both bodies attain same vertical height, then the ratio of velocities with which these are thrown is

A. $\sqrt{\frac{5}{3}}$

B. $\sqrt{\frac{3}{5}}$

C. $\sqrt{\frac{2}{3}}$

D. $\sqrt{\frac{3}{2}}$

Answer: D

Watch Video Solution

28. For an object projected from ground with speed u horizontal range is two times the maximum height attained by it. The horizontal range of object is

A. $\frac{2u^2}{3g}$

B. $\frac{3u^2}{4g}$

C. $\frac{3u^2}{2g}$

D. $\frac{4u^2}{5g}$

Answer: D

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29. The speed at the maximum height of a projectile is $\frac{\sqrt{3}}{2}$ times of its initial speed 'u' of projection Its range on the horizontal plane:-

A. $\frac{\sqrt{3}u^2}{2g}$

B. $\frac{3u^2}{2g}$

C. $\frac{3u^2}{g}$

D. $\frac{u^2}{2g}$

Answer: A

Watch Video Solution

30. A projectile is thrown into space so as to have maximum horizontal range R. Taking the point of projection as origin, find out the co-ordinates of the point where the speed of the particle is minimum.

A. $(400, 100)$

B. $(200, 100)$

C. $(400, 200)$

D. $(200, 200)$

Answer: B

Watch Video Solution

31. If the time of flight of a bullet over a horizontal range R is T, then the angle of projection with horizontal is -

A. $\tan^{-1}\left(\frac{gT^2}{2R}\right)$

B. $\tan^{-1}\left(\frac{2R^2}{gT}\right)$

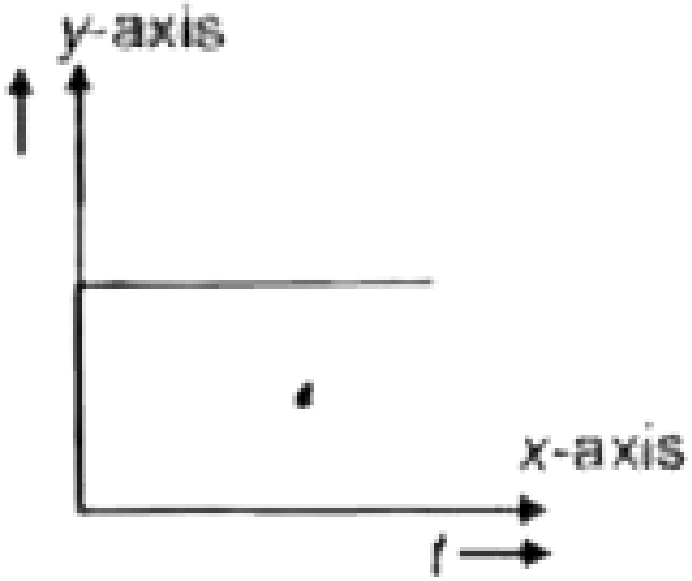
C. $\tan^{-1}\left(\frac{2R}{g^2T}\right)$

D. $\tan^{-1}\left(\frac{2R}{gT}\right)$

Answer: A

Watch Video Solution

32. In the graph shown in figure, which quanitity associated with projectile motion is plotted along y-axis ?



A. Kinetic energy

B. Momentum

C. Horizontal velocity

D. None of these

Answer: C

Watch Video Solution

33. The equation of a projectile is y = ax - bx^2. Its horizontal range is

A. $\frac{a}{b}$

B. $\frac{b}{a}$

C. a + b

D. b - a

Answer: A

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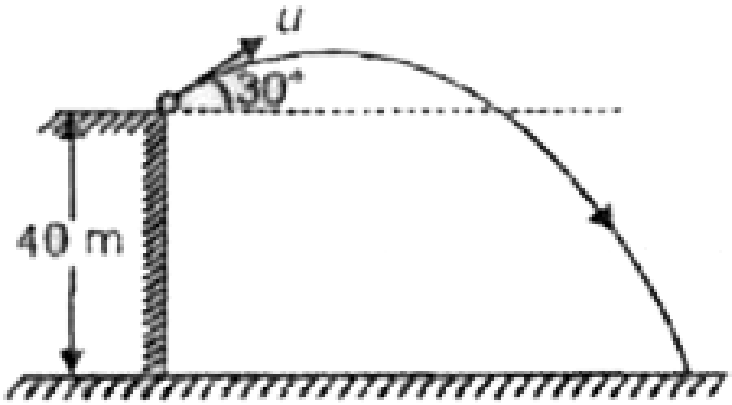
34. Figure shows a projectile thrown with speed u = 20 m/s at an angle 30° with horizontal from the top of a building 40 m high. Then the

horizontal range of projectile is



A. $20\sqrt{3}$ m

B. $40\sqrt{3}$ m

C. 40 m

D. 20 m

Answer: B

Watch Video Solution

35. When a particle is projected at an angle to the horizontal, it has range R and time of flight t_1. If the same projectile is projected with same speed

at another angle to have the saem range, time of flight is t_2. Show that:

$t_1 t_2 = (2R/g)$

A. $t_1 + t_2 = \frac{2R}{g}$

B. $t_1 - t_2 = \frac{R}{g}$

C. $t_1 t_2 = \frac{2R}{g}$

D. $t_1 t_2 = \frac{R}{g}$

Answer: C

Watch Video Solution

36. A projectile is thrown with velocity v at an angle θ with the horizontal. When the projectile is at a height equal to half of the maximum height,. The vertical component of the velocity of projectile is.

A. v sin 0 $\times$ 3

B. $\frac{v \sin \theta}{3}$

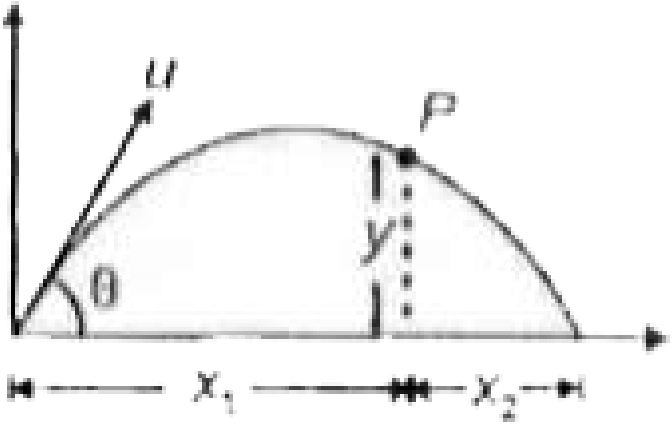
C. $\frac{v \sin \theta}{\sqrt{2}}$

D. $\frac{v \sin \theta}{\sqrt{3}}$

Answer: C

Watch Video Solution

37. In the given figure for a projectile



A. $y = \left[\frac{x_1 x_2}{x_1 - x_2}\right] \tan \theta$

B. $y = \left[\frac{x_1 x_2}{x_1 + x_2}\right] \tan \theta$

C. $y = \left[\frac{2x_1 x_2}{x_1 + x_2}\right] \cos \theta$

D. $y = \left[\frac{2x_1 x_2}{x_1 + x_2}\right] \tan \theta$

Answer: B

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38. Two paper screens A and B are separated by $150m$. A bullet pierces A and B. The hole in B is $15cm$ below the hole in A. If the bullet is travelling horizontally at the time of hitting A, then the velocity of the bullet at A is $\left(g = 10ms^{-2}\right)$

A. 100 m/s

B. 200 m/s

C. 600 m/s

D. 700 m/s

Answer: D

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39. A car is going round a circle of radius R_1 with constant speed. Another car is going round a circle of radius R_2 with constant speed. If both of them take same time to complete the circles, the ratio of their angular speeds and linear speeds will be

A. $\sqrt{\frac{R_1}{R_2}}, \frac{R_1}{R_2}$

B. 1,1

C. $1, \frac{R_1}{R_2}$

D. $\frac{R_1}{R_2}, 1$

Answer: C

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40. A body revolves with constant speed v in a circular path of radius r. the magnitude of its average acceleration during motion between two points in diametrically opposite direction is

A. Zero

B. $\frac{v^2}{r}$

C. $\frac{2v^2}{\pi r}$

D. $\frac{v^2}{2r}$

Answer: C

Watch Video Solution

41. An object of mass m moves with constant speed in a circular path of radius r under the action of a force of constant magnitude F. the kinetic energy of object is

A. $\frac{1}{2}$FR

B. FR

C. 2FR

D. $\frac{1}{4}$FR

Answer: A

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42. The angular speed of earth around its own axis is

A. $\frac{\pi}{43200}$ rad/s

B. $\frac{\pi}{3600}$ rad/s

C. $\frac{\pi}{86400}$ rad/s

D. $\frac{\pi}{1800}$ rad/s

Answer: A

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43. A particle moves in a circle of radius 25 cm at 2 revolution per second.

The acceleration of the particle in meter per second^2 is

A. π^2

B. $8\pi^2$

C. $4\pi^2$

D. $2\pi^2$

Answer: C

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44. A particle is revoiving in a circular path of radius 25 m with constant angular speed 12 rev/min. then the angular acceleration of particle is

A. $2\pi^2$ rad/s^2

B. $4\pi^2 \text{rad}/s^2$

C. π^2 rad/s^2

D. zero

Answer: D

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45. Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively with the same speed. The ratio of their centripetal foces is

A. $1:1$

B. $r_1:r_2$

C. $r_2:r_1$

D. $r_2^2:r_1^2$

Answer: B

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46. A particle 'P' is moving in a circle of radius 'a' with a uniform speed 'u' 'C' is the centre of the circle and AB is a diameter. The angular velocity of P about A and C are in the ratio

A. $4:1$

B. $2:1$

C. $1:2$

D. $1:1$

Answer: C

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47. A car is moving at a speed of 40 m/s on a circular track of radius 400 m. this speed is increasing at the rate of 3 m/s^2. The acceleration of car is

A. 4 m/s^2

B. 7 m/s^2

C. 5 m/s^2

D. 3 m/s^2

Answer: C

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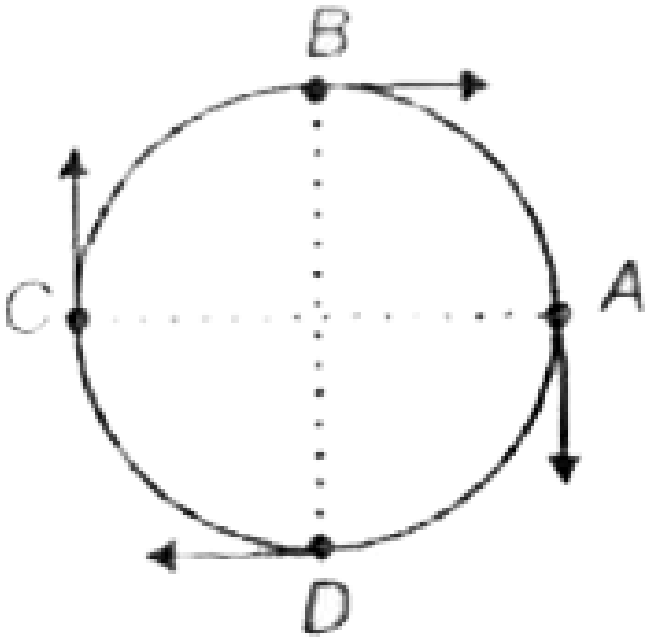
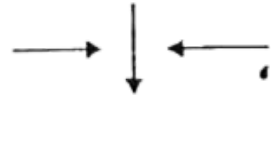
48. Four particles A, B, C and D are moving with constant speed v each at the instant shown relative velocity of A with respect to B, C and D are in directions



A.

B.

C.



D.

Answer: A

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49. The ration of angular speeds of minute hand and hour hand of a watch is

A. $6:1$

B. $12:1$

C. $60:1$

D. $1:60$

Answer: B

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50. if θ is angle between the velocity and acceleration of a particle moving on a circular path with decreasing speed, then

A. $\theta = 90^\circ$

B. $0^\circ < \theta < 90^\circ$

C. $90^\circ < \theta < 180^\circ$

D. $0^\circ \leq \theta \leq 180^\circ$

Answer: C

Watch Video Solution

51. if speed of an object revolving in a circular path is dobled and angular speed is reduced to half of original value, then centripetal acceleration will becom/remain

A. same

B. double

C. half

D. quadruple

Answer: A

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ASSIGNMENT SECTION - A

1. A particle is projected with speed u at angle θ to the horizontal. Find the radius of curvature at highest point of its trajectory

A. $\frac{u^2 \sin 2\theta}{g}$

B. $\frac{u^2 \cos^2 \theta}{g}$

C. $\frac{u^2 \sin^2 \theta}{g}$

D. $\frac{u^2 \sin^2 \theta}{2g}$

Answer: B

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ASSIGNMENT SECTION - B

1. Two particles A and B start moving with velocities 20 m/s and $30\sqrt{2}$ m/s along x-axis and at an angle 45° with x- axis respectively in xy-plane from origin the relative velocity of B w.r.t A

A. $\left(10\hat{i} + 30\hat{j}\right)$ m/s

B. $\left(30\hat{i} + 10\hat{j}\right)$ m/s

C. $\left(30\hat{i} - 20\sqrt{2}\hat{j}\right)$ m/s

D. $\left(30\sqrt{2}\hat{i}+10\sqrt{2}\hat{j}\right)$ m/s

Answer: A

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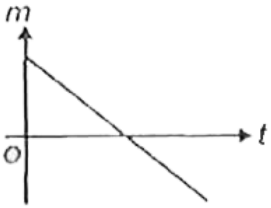
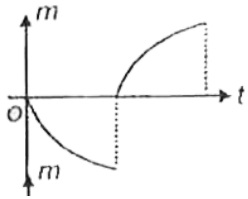
2. A particle is projected at angle θ with horizontal from ground. The slop (m) of the trajectory of the particle varies with time (t) as

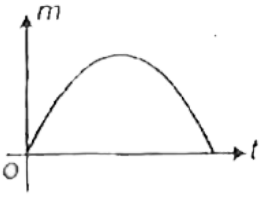
A.

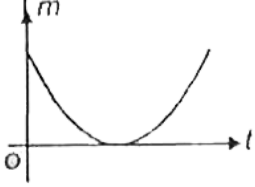


B.



C.



D. 

Answer: A

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3. If H_1 and H_2 be the greatest heights of a projectile in two paths for a given value of range, then the horizontal range of projectile is given by

A. $\frac{H_1 + H_2}{2}$

B. $\frac{H_1 + H_2}{4}$

C. $4\sqrt{H_1 H_2}$

D. $4[H_1 + H_2]$

Answer: C

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4. If R and H are the horizontal range and maximum height attained by a projectile , than its speed of prjection is

A. $\sqrt{2gR + \frac{4R^2}{gH}}$

B. $\sqrt{2gH + \frac{R^2 g}{8H}}$

C. $\sqrt{2gH + \frac{8H}{Rg}}$

D. $\sqrt{2gH + \frac{R^2}{H}}$

Answer: B

Watch Video Solution

5. A particle projected from ground moves at angle 45° with horizontal one second after projection and speed is minimum two seconds after the projection The angle of projection of particle is [Neglect the effect of air resistance)

A. $\tan^{-1}(3)$

B. $\tan^{-1}(2)$

C. $\tan^{-1}(\sqrt{2})$

D. $\tan^{-1}(4)$

Answer: B

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6. From a point on the ground at a distance a from the foot of a pole, a ball is thrown at an angle of 45°, which just touches the top of the pole and strikes the ground at a distance of b, on the outer side of it. Find the height of the pole.

A. $2\sqrt{d_1 d_2}$

B. $\frac{d_1 + d_2}{4}$

C. $\frac{2d_1 d_2}{d_1 + d_2}$

D. $\frac{d_1 d_2}{d_1 + d_2}$

Answer: D

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7. A particle is projected with speed u at angle θ with horizontal from ground . If it is at same height from ground at time t_1 and t_2 , then its average velocity in time interval t_1 to t_2 is

A. Zero

B. u sin θ

C. u cos θ

D. $\frac{1}{2}[\ \text{u}\cos\ \theta]$

Answer: C

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8. A particle is projected from ground at an angle θ with horizontal with speed u. The ratio of radius of curvature of its trajectory at point of projection to radius of curvature at maximum height is -

A. $\frac{1}{\sin^2\theta\cos\theta}$

B. $\cos^2\theta$

C. $\frac{1}{\sin^3\theta}$

D. $\frac{1}{\cos^3\theta}$

Answer: D

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9. An object of mass 10 kg is projected from ground with speed 40 m/s at an angle 60° with horizontal the rate of change of momentum of object one second after projection in SI unit is

[Take g = 9.8 m/s^2]

A. 73

B. 98

C. 176

D. 140

Answer: B

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10. An object is projected from ground with speed 20 m/s at angle 30° with horizontal. Its centripetal acceleration one second after the projection is

[Take g = 10 m/s^2]

A. 10 m/s^2

B. zero

C. 5 m/s^2

D. 12 m/s^2

Answer: A

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11. A particle is moving on a circular path with constant speed v. it moves between two points A and B, which subtends and angle 60° at the centre of circle, The magnitude of change in tis velocity and change and magnitude of its speed during motion from A to B are respectively

A. Zero,zero

B. v,0

C. 0,v

D. 2v, v

Answer: B

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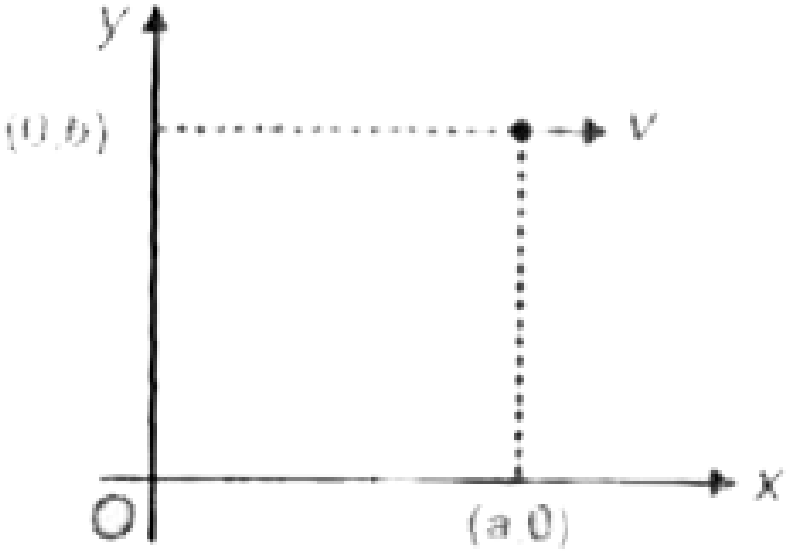
12. A particle is moving with constant speed v in xy plane as shown in figure. The magnitude of its angular velocity about point O is



A. $\frac{v}{\sqrt{a^2+b^2}}$

B. $\frac{v}{b}$

C. $\frac{vb}{(a^2+b^2)}$

D. $\frac{v}{a}$

Answer: C

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13. A particle is moving in xy-plane in a circular path with centre at origin. If at an instant the position of particle is given by $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$, then velocity of particle is along

A. $\frac{1}{\sqrt{2}}\left(\hat{i}-\hat{j}\right)$

B. $\frac{1}{\sqrt{2}}\left(\hat{j}-\hat{i}\right)$

C. $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$

D. Either (1) or (2)

Answer: D

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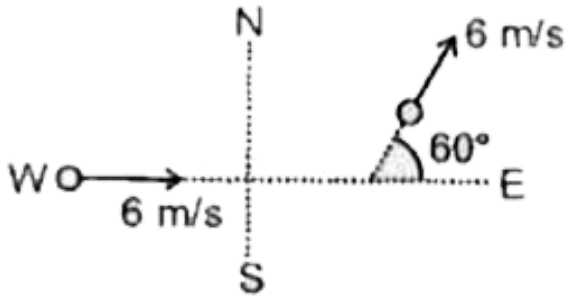
14. A particle is moving eastwards with a speed of 6 m/s. After 6 s, the particle is found to be moving with same speed in a direction 60° north

of east. The magnitude of average acceleration in this interval of time is



A. 6 m/s^2

B. 3 m/s^2

C. 1 m/s^2

D. zero

Answer: C

Watch Video Solution

15. What is the path followed by a moving body, on which a constant force acts in a direction other than initial velocity (i.e. excluding parallel and

antiparallel direction) ?

A. Straight line

B. Parabolic

C. Circular

D. Elliptical

Answer: B

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16. Two stones are thrown with same speed u at different angles from ground n air if both stones have same range and height attained by them are h_1 and h_2, then $h_1 + h_2$ is equal to

A. $\frac{u^2}{g}$

B. $\frac{u^2}{2g}$

C. $\frac{u^2}{3g}$

D. $\frac{u^2}{4g}$

Answer: B

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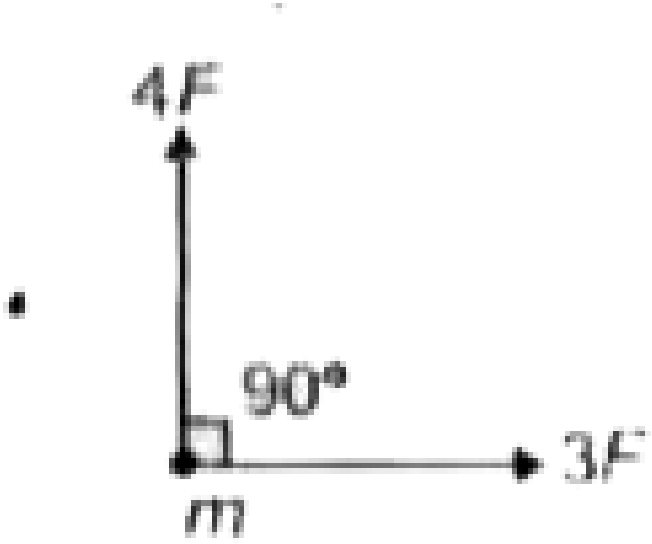
17. When a force F acts on a particle of mass m, the acceleration of particle becomes a. now if two forces of magnitude 3F and 4F acts on the particle simultaneously as shown in figure, then the acceleration of the particle is



A. a

B. 2a

C. 5a

D. 8a

Answer: C

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18. Consider the two statements related to circular motion in usual notations

A. In uniform circular motion $\vec{\omega}, \vec{v}$ and $\vec{a}$ are always mutually perpendicular

B. In non-uniform circular motion $\vec{\omega}, \vec{v}$ and $\vec{a}$ are always mutually perpendicular

A. both A and B are true

B. both A and B are false

C. A is true but B is false

D. A is false but B is true

Answer: C

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19. Which of the following quantities remains constant during uniform circular motion ?

A. Centripetal acceleration

B. Velocity

C. Momentum

D. Speed

Answer: D

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20. A projectile is projected with speed u at an angle θ with the horizontal . The average velocity of the projectile between the instants it crosses the same level is

A. u cos θ

B. u sin θ

C. u cot θ

D. u tan θ

Answer: A

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21. A ball is thrown at an angle θ with the horizontal and the range is maximum. The value of $\tan\theta$ is:-

A. 4

B. 2

C. 1

D. 0.5

Answer: A

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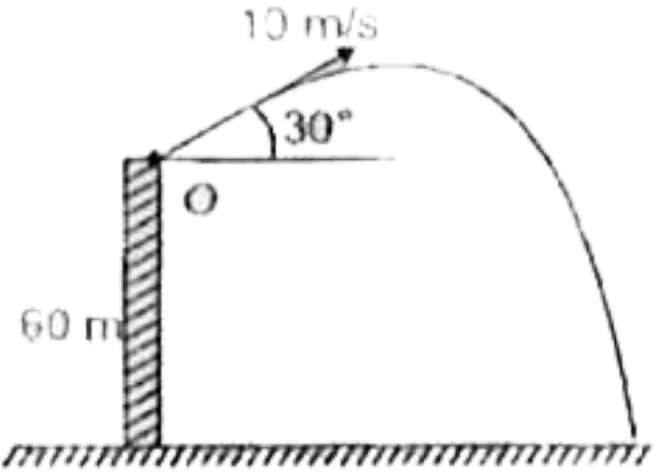
22. A ball is projected from a point O as shown in figure it will strike the ground after (g = 10 m/s^2)



A. 4 s

B. 3 s

C. 2 s

D. 5 s

Answer: A

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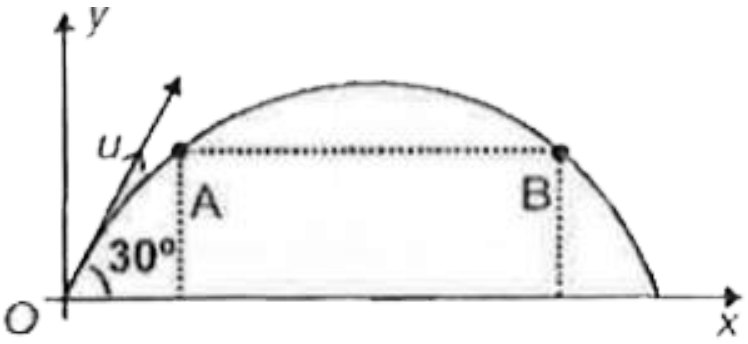
23. A particle is thrown with a velocity of u m/s. it passes A and B as shown in figure at time $t_1 = 1 \text{ s}$ and $t_2 = 3$ s . The value of u is (g = 10 m/s^2)



A. 20 m/s

B. 10 m/s

C. 40 m/s

D. 5 m/ s

Answer: C

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24. Which one of the following statements is NOT true about the motion of a projectile ?

A. The time of flight of a projectile is proportional to the speed with which it is projected at a given angle of projection

B. The horizontal range of a projectile is proportional to the square root of the speed with which it is . Projected

C. For a given speed of projection, the angle of projection for maximum range is 45°

D. At maximum height, the acceleration due to gravity is perpendicular to the velocity of the projectile

Answer: B

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25. Out of the two cars A and B car A is moving towards east with velocity of 10 m/s whereas B is moving towards north with a velocity 20 m/s, then velocity of A w.r.t B is (nearly)

A. 30 m/s

B. 10 m/s

C. 22 m/s

D. 42 m/s

Answer: C

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26. A projectile is thrown with speed 40 ms^{-1} at angle θ from horizontal . It is found that projectile is at same height at 1s and 3s. What is the angle of projection ?

A. $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

B. $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

C. $\tan^{-1}(\sqrt{3})$

D. $\tan^{-1}(\sqrt{2})$

Answer: B

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27. A man moves in an open field such that after moving 10 m on a straight line , he makes a sharp turn of 60° to his left. The total displacement just at the start of 8^{th} turn is equal to

A. 12 m

B. 15 m

C. 17.32 m

D. 14. 14 m

Answer: C

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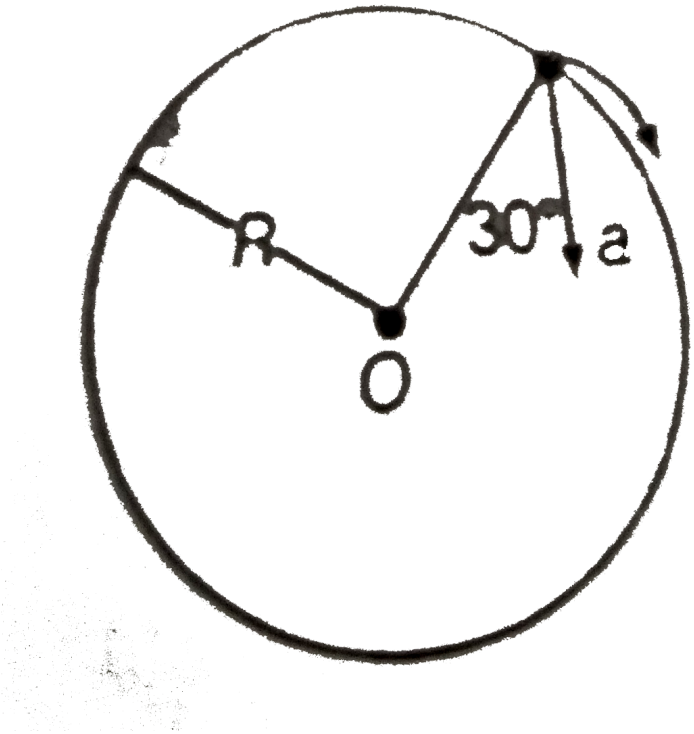
ASSIGNMENT SECTION -C

1. in the given figure, $\alpha = 15m/s^2$ represents the total accleration of a particle moving in the clockwise direction on a circle radius R = 2.5m aat a

given of time The speed of the particle is



A. 4.5 m/s

B. 5.0 m/s

C. 5.7 m/s

D. 6.2 m/s

Answer: C

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2. If the magnitude of sum of two vectors is equal to the magnitude of different of the two vectors. The angle between these vectors is

A. 180°

B. 0°

C. 90°

D. 45°

Answer: C

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3. A particle moves such that its position vector $\vec{r}(t) = \cos\omega\hat{i} + \sin\omega t\hat{j}$ where ω is a constant and t is time . Then which of the following statements is ture for the velocity $\vec{v}$ (t) and acceleration $\vec{a}$ (t) fo the particle:

A. Velocity is perpendicular to $\vec{r}$ and acceleration is directec away from the origin

B. Velocity and acceleration both are perpendicular to $\vec{r}$

C. Velocity and acceleration both are parallel to $\vec{r}$

D. Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin

Answer: D

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4. A particle of mass 10 g moves along a circle of radius 6.4 cm with a constant tangential acceleration. What is the magnitude of this acceleration, if the kinetic energy of the particle becomes equal to 8×10^{-4}J by the end of the second revolution after the beginning of the motion?

A. $0.2m/s^2$

B. $0.1m/s^2$

C. $0.15m/s^2$

D. $0.18m/s^2$

Answer: B

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5. The position vector of a particle R as a function of time is given by

$R = 4\sin(2\pi)\hat{i} + 4\cos(2\pi)\hat{j}$

where R is in meter, is in second and $\hat{i}$ and $\hat{j}$ denote unit cvectors along x along a and y- direction, respectively. Which one of the following statement is wrong of particle ?

A. Path of the particle is a circle of radius 4 m

B. Acceleration vector is along $-\vec{R}$

C. Magnitude of acceleration vector is $\frac{v^2}{R}$

D. Magnitude of the velocity of particle is 8 meter /second

Answer: D

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6. Two point masses 1 and 2 move with uniform velocities $\vec{v}_1$ and $\vec{v}_2$, respectively. Their initial position vectors are $\vec{r}_1$ and $\vec{r}_2$, respectively. Which of the following should be satisfied for the collision of the point masses?

A. $\vec{r}_1 - \vec{r}_2 = \vec{v}_1 - \vec{v}_2$

B. $\frac{\vec{r}_1 - \vec{r}_2}{\left|\vec{r}_1 - \vec{r}_2\right|} = \frac{\vec{v}_2 - \vec{v}_1}{\left|\vec{v}_2 - \vec{v}_1\right|}$

C. $\vec{r}_1, \vec{v}_1 = \vec{r}_2 . \vec{v}_2$

D. $\vec{r}_1 \times \vec{v}_1 = \vec{r}_2 \times \vec{v}_2$

Answer: B

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7. A ship A is moving Westwards with a speed of $10kmh^{-10}$ and a ship B 100 km South of A, moving Northwards with a speed of $10kmh^{-1}$ The time after which the distance between them becomes shortest is

A. $10\sqrt{2}$ h

B. 0 h

C. 5 h

D. $5\sqrt{2}$ h

Answer: C

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8. A projectile is fired from the surface of the earth eith velocity of $5ms^{-10}$ at angle $\theta$with the horizontal Another projectile fired from another planet with velocity of trajectory which is identical with the trajectory of the projectile fired from the eart.The value of palnet is (in ms^{-2}) is (given, g = 9.8 ms^{-2})

A. 3.5

B. 5.9

C. 16.3

D. 110.8

Answer: A

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9. 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 (13 m, 14m) at time t = 5s. Average velocity vector (v_{av}) from t = 0 to t = 5s is

A. $\frac{1}{5}\left(13\hat{j}+14\hat{j}\right)$

B. $\frac{7}{3}\left(\hat{i}+\hat{j}\right)$

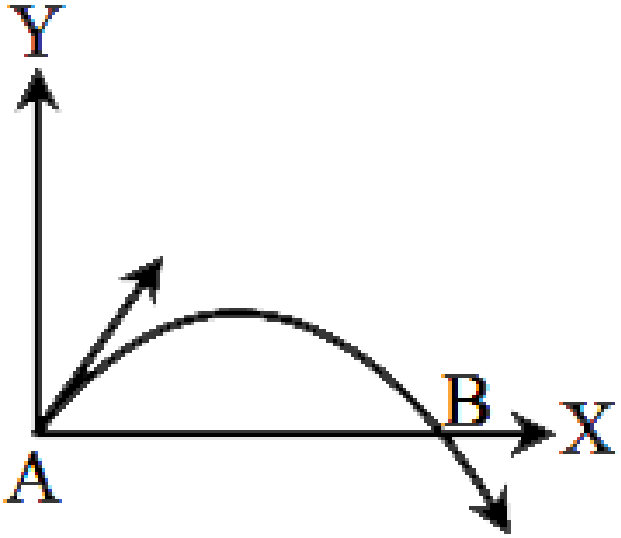
C. $2\left(\hat{i}+\hat{j}\right)$

D. $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

Answer: D

Watch Video Solution

10. The velocity of a projectile at the initial point A is $\left(2\hat{i}+3\hat{j}\right)\frac{m}{s}$. It's velocity (in m/s) at point B is -



A. $-2\hat{i}+3\hat{j}$

B. $2\hat{i}-3\hat{j}$

C. $2\hat{i}+3\hat{j}$

D. $-2\hat{i}-3\hat{j}$

Answer: B

Watch Video Solution

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

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

B. $\theta=45^{\circ}$

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

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

Answer: D

Watch Video Solution

12. A particle has initial velocity $\left(2\vec{i}+3\vec{j}\right)$ and acceleration $\left(0.3\vec{i}+0.2\vec{j}\right)$. The magnitude of velocity after 10 seconds will be

A. 5 units

B. 9 units

C. $9\sqrt{2}$ units

D. $5\sqrt{2}$ units

Answer: D

Watch Video Solution

13. A particle moves in a circule of radius 5 cm with constant speed and time period $0.2\pi s$. The acceleration of the particle is

A. $5m/s^2$

B. $15m/s^2$

C. $25m/s^2$

D. $36m/s^2$

Answer: A

Watch Video Solution

14. A boy 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. $5m/s^2$

B. $1m/s^2$

C. $7m/s^2$

D. $\sqrt{7}m/s^2$

Answer: A

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15. A missile is fired for maximum range with an initial velocity of $20m/s$. If $g = 10m/s^2$, the range of the missile is

A. 20 m

B. 40 m

C. 50 m

D. 60 m

Answer: B

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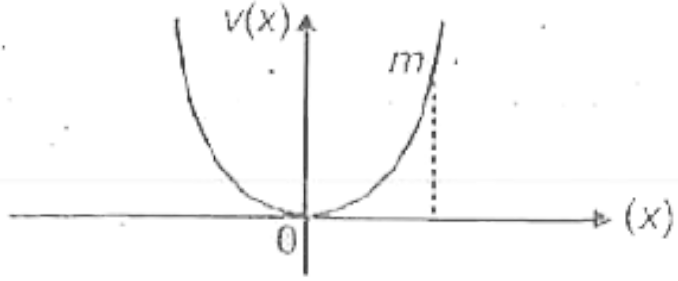
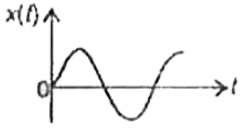
16. A particle of mass m is released from rest and follows a parabolic path as shown. Assuming that the displacement of the mass from the origin is small. Which graph correctly depicts the position of the particle as a

function of time?



A.


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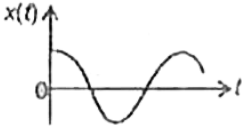
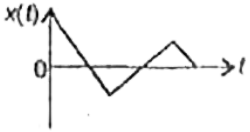


C.


D.


Answer: B

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17. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection, is :

A. $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

B. 45°

C. 60°

D. $\tan^{-1}\frac{1}{2}$

Answer: D

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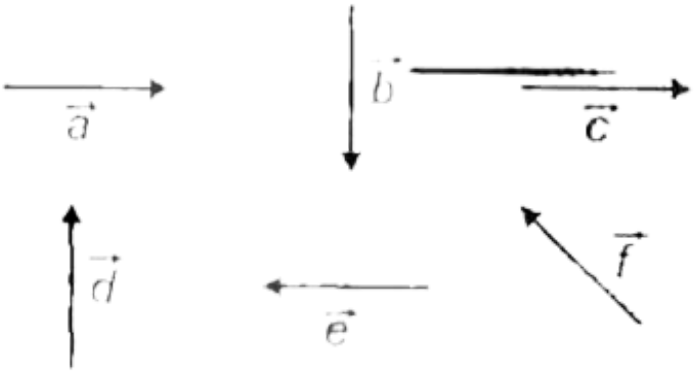
18. Six vectors $\hat{a}$ to $\hat{i}$ have the magnitude and directions indicated in the figure . Which of the following statement is true ?



A. $\vec{b} + \vec{c} = \vec{f}$

B. $\vec{d} + \vec{c} = \vec{f}$

C. $\vec{d} + \vec{e} = \vec{f}$

D. $\vec{b} + \vec{e} = \vec{f}$

Answer: C

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19. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is -

A. 60°

B. 15°

C. 30°

D. 45°

Answer: A

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20. A particule moves in x - y plane acording to rule x = a sin ωt and y = a cos ωt. The particle follows

A. An elliptical path

B. A circular path

C. A parabolic path

D. A straight line inclined equally to x and y-axes

Answer: B

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21. A particle has initial velocity velocity $\left(3\hat{i}+4\hat{j}\right)$and has acceleration $\left(0.4\hat{i}+0.3\hat{j}\right)$Its speed after 10 s is

A. 7 units

B. $7\sqrt{2}$

C. 8.5 units

D. 10 units

Answer: B

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22. A particle of mass m is projectile with veoocity u making an angle of 45° with the horizontal.When the particle lands on the level ground, the magnitude of the change in its momentum will be

A. zero

B. 2 mv

C. $\frac{mv}{\sqrt{2}}$

D. $mv\sqrt{2}$

Answer: D

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23. A paricle stating from the (o,o) moves in a stainght line in the (x,y) The path of the particle makes with the X-axis an angle of

A. 0°

B. 30°

C. 45°

D. 60°

Answer: D

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24. $\vec{A}$ and $\vec{B}$ are two vectors and θ is the angle between them, if $\left|\vec{A} \times \vec{B}\right| = \sqrt{3}\left(\vec{A} . \vec{B}\right)$ the value of θ is:-

A. 90°

B. 60°

C. 45°

D. 30°

Answer: B

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25. For angle of prijection of projectile at angle$(45^\circ - \theta)$ and $(45^\circ + \theta)$, the horizontal range described by the projectile are in the ratio of

A. $1:1$

B. $2:3$

C. $1:2$

D. $2:1$

Answer: A

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26. A car runs at a constant speed os a circular track of radius 100 m , taking 62.8 s for every circular lab.The average velocity and average speed for each circular lab respectively is

A. 0,0

B. 0,10 m/s

C. 10 m/s , 10 m/s

D. 10 m/s ,0

Answer: B

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27. If $\left|\vec{A}+\vec{B}\right|=\left|\vec{A}-\vec{B}\right|$, then the angle between $\vec{A}$ and $\vec{B}$ will be

A. 90°

B. 60°

C. 75°

D. 45°

Answer: A

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28. If a vector $2\hat{i}+3\hat{j}+\hat{k}$ is perpendicular to the vector $4\widehat{+}4\hat{i}+\alpha\hat{k}$, then the value of $\alpha$is

A. -1

B. $\frac{1}{2}$

C. $\frac{1}{2}$

D. 1

Answer: C

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29. A stone trid to the end of a string of 1 m long is whirled in a horizontal circle eith a constant speed, If the stone the makes 22 revolutions in 44 s , what is the magnitude and direction of acceleration of the stone ?

A. $\frac{\pi^2}{4} ms^{-2}$ and direction along the radius towards the centre

B. $\pi^2 ms^{-2}$ and direction along the radius away from centre

C. $\pi^2 ms^{-2}$ and direction along the radius towards the centre

D. $\pi^2 ms^{-2}$ and direction along the tangent to the circle

Answer: C

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30. 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 $upsuilon_1$. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t,where t is

A. $\frac{a}{\sqrt{v^2+v_1^2}}$

B. $\sqrt{\frac{a^2}{v^2-v_1^2}}$

C. $\frac{a}{(v-v_1)}$

D. $\frac{a}{(v+v_1)}$

Answer: B

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31. If the angle between the vectors $\vec{A}$ and $\vec{B}$ is θ, the value of the product $\left(\vec{B}\times\vec{A}\right)\cdot\vec{A}$ is equal to

A. $BA^2\cos\theta$

B. $BA^2 \sin\theta$

C. $BA^2 \sin\theta \cos\theta$

D. zero

Answer: D

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32. A boat is sent across a river with a velocity 8 kmh^{-1} If the resultant velocity of boat is $10h^{-1}$,then velocity of the river is

A. 8 km/h

B. 10 km/h

C. 12.8 km/h

D. 6 km/h

Answer: D

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33. Which of the following is correct relation between an arbitrary vector A and null vector O ?

A. $\vec{A} + \vec{0} + \vec{A} \times \vec{0} = \vec{A}$

B. $\vec{A} + \vec{0} + \vec{A} \times \vec{0} \neq \vec{A}$

C. $\vec{A} + \vec{0} + \vec{A} \times \vec{0} = \vec{0}$

D. None of these

Answer: A

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34. An object is being thrown at a speed of 20 m/s in a direction 45° above the horizontal . The time taken by the object to return to the same level is

A. 20 /g

B. 20 g

C. $20\sqrt{2}/g$

D. $20\sqrt{2}$g

Answer: C

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35. A body is whirled in a horizontal circle of radius 20 cm.It has an angular velocity of 10 rad/s. What is its linear velocity at any point on circualr path ?

A. 20 m/s

B. $\sqrt{2}$ m/s

C. 10 m/s

D. 2 m/s

Answer: D

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36. The base quantity among the following is

A. Distance

B. Angular momentum

C. Heat

D. Energy

Answer: B

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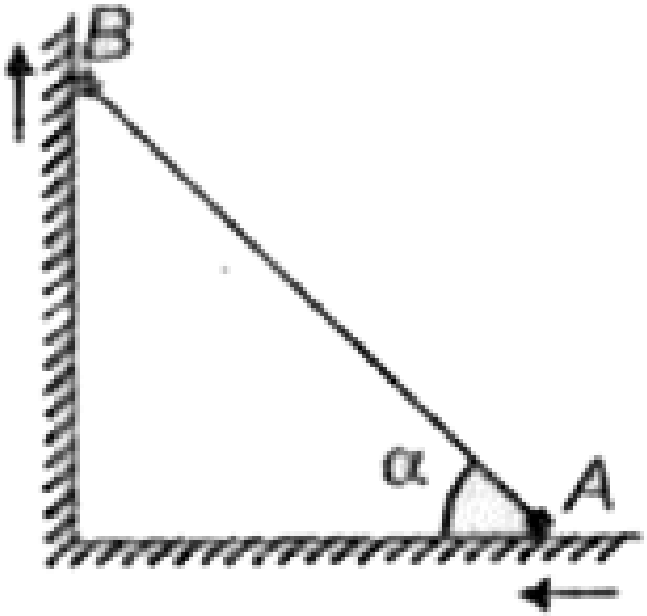
37. Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity of A to the left is 10

m/s . What is the velocity of B when angle $\alpha = 60^\circ$?



A. 10 m/s

B. 9.8 m/s

C. 5.8 m/s

D. 17.8 m/s

Answer: C

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38. A boat which has a speed of $5kmh^{-1}$ in still water crosses a river of width 1 km along the shortest possible path in 15 min. The velocity of the river water in kmh^{-1} is

A. 3

B. 1

C. 5

D. 5

Answer: A

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39. Two cars of masses m_1 andm_2 are moving in circles od radii $r_1$andr_2. Their speeds are such that they complete one revolution in the same time. The ratio of their angular speed is :

A. $r_1 : r_2$

B. $m_1 : m_2$

C. $1:1$

D. $m_1 m_2 : r_1 r_2$

Answer: C

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40. A person aiming to reach exactly opposite point on the bank of a stream is swimming with a speed of 0.6 m/s at an angle of 120° with the direction of flow of water . The speed of water in the stream is

A. 0.3 m/s

B. 0.5 m/s

C. 1.0 m/s

D. 0.433 m/s

Answer: A

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41. Two projectiles of same mass and with same velocity are thrown at an angular 60° & 30° with the horizontal, then which quantity will remain same:

A. Time of flight

B. Range of projectile

C. maximum height acquired

D. All of these

Answer: B

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42. Two particles having mass 'M' and 'm' are moving in a circular path having radius R & r respectively. If their time period are same then the ratio of angular velocity will be : -

A. $\frac{r}{R}$

B. $\frac{R}{r}$

C. 1

D. $\sqrt{\frac{R}{r}}$

Answer: C

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43. If $\left|\vec{A}+\vec{B}\right| = \left|\vec{A}\right| = \left|\vec{B}\right|$ then angle between A and B will be

A. 90°

B. 120°

C. 0°

D. 60°

Answer: B

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44. A particle moves along a circle of radius $\left(\frac{20}{\pi}\right)$ m with constant tangential acceleration. If the velocity of the particle is 80 m/s at the end of the second revolution after motion has begun, the tangential acceleration is : -

A. 40 m/s^2

B. $640\pi m/s^2$

C. $160\pi m/s^2$

D. $40\pi m/s^2$

Answer: A

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45. The vector sum of two forces is perpendicular to their vector differences .In that case , the forces

A. Are equal to each other

B. Are equal to each other in magnitude

C. Are not equal to each other in magnitude

D. Cannot be predicted

Answer: B

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46. A wheel has angular acceleration of $3.0 rad / s^2$ and an initial angular speed of $2.00 rad / s$. In a time of $2s$ it has rotated through an angle (in radian) of

A. 10

B. 12

C. 4

D. 6

Answer: A

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47. 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 (13 m, 14m) at time t = 5s. Average velocity vector (v_{av}) from t = 0 to t = 5s is

A. $\frac{1}{5}\left(13\hat{i}+14\hat{j}\right)$

B. $\frac{7}{3}\left(\hat{i}+\hat{j}\right)$

C. $2\left(\hat{i}+\hat{j}\right)$

D. $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

Answer: D

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ASSIGNMENT SECTION -D

1. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A : If $\vec{A} \perp \vec{B}$, then $\left|\vec{A}+\vec{B}\right| = \left|A-\vec{B}\right|$.

R: If $\vec{A} \perp \vec{B}$ then $\left(\vec{A}+\vec{B}\right)$ is perpendicular to $\vec{A}-\vec{B}$.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: C

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2. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A : The addition of two vectors $\vec{P}$ and $\vec{Q}$ is commutative

R: By triangle law of vector addition we can prove $\vec{P} + \vec{Q} = \vec{Q} + \vec{P}$.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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3. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A: A vector cannot be divided by other by other vector .

R: A vector can be divided by a scalar .

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: B

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4. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A : At the highest point the velocity of projectile is zero .

R: At maximum height projectile comes to rest.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: D

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5. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A: Horizontal range of a projectile is always same for angle of projection θ with horizontal or θ with vertical .

R : Horizontal range depends only on angle of projection .

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: D

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6. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A : Horizontal metion of projectile without effect of air is uniform motion.

R : Without air effect the horizontal acceleration of projectile is zero .

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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7. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A: Path of a projectile with respect of another projectile is straight line .

R : Acceleration of a projectile with respect to another projectile is zero.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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8. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A : In the case of ground to ground projection of a projectile from ground the angle of projection with horizontal is $\theta = 30^\circ$. There is no point on its path such that instantaneous velocity is normal to the initial velocity .

R : Maximum deviation of the projectile is $2\theta = 60^\circ$.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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9. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A: Three vectors having magnitudes 10,10 and 25 cannot produce zero resultant.

R: If three vectors are producing zero resultant then sum of magnitude of any two is more then or equal to magnitude of third and difference is less than or equal to the magnitude of third.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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10. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A: Unifrom circular motion is accelerated motion stil speed remains unchanged .

R: Instantaneous velocity is always normal to instantaneous acceleration in uniform circular motion.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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11. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A: When a body moves on a curved path with increasing speed then angle between instantaneous velocity and acceleration is acute angle.

R: When the speed is increasing its tangential acceleration is in the direction of instaneous velocity .

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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12. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A : A uniform circular motion have non uniform acceleration .

R: The direction of acceleration of a particle in uniform circular motion changes continuously .

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: A

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13. In the following questions a statement of assertion (A) is followed by a statement of reason (R).

A: Angular displacement is vector quntity only for small values .

R: The direction of angular displacement is perpendicular to plane of rotation of object .

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion then mark (1) .

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion then mark (2)

C. If Assertion is true statement but Reason is false then mark (3).

D. If both Assertion and Reason are false statements then mark (4) .

Answer: B

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