PHYSICS

BOOKS - MTG PHYSICS (ENGLISH)

MOTION IN A PLANE

Mcqs

1. Which of the following is not a scalar quantity ? a) temperature b) Coefficient of friction c) charge d) Impulse

A. Temperature

B. Coefficient of friction

C. Charge

D. Impulse

Answer: D

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2. In Latin, the word vector means a) magnitude b) direction c) carrier d) cap

A. magnitude

B. direction

C. carrier

D. cap

Answer: C

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3. A vector is not changed if

A. It is displaced parallel to itself.

B. it is rotated through an arbitrary angle.

C. it is cross-multiplied by a unit vector.

D. it is multiplied by an arbitrary scalar.

Answer: A

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4. Which one of the following statements is false regarding the vectors ?

A. The magnitude of a vector is always a scalar.

B. Each component of a vector is always a scalar.

C. Two vectors having different magnitudes cannot have their resultant zero.

D. Vectors obey triangle law of addition.

Answer: B

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5. Which of the following pairs of vectors are parallel ?

A. $\vec{A} = \hat{i} - 2\hat{j}, \vec{B} = \hat{i} - 5\hat{j}$

B. $\vec{A} = \hat{i} - 10\hat{j}, \vec{B} = 2\hat{i} - 5\hat{j}$

C. $\vec{A} = \hat{i} - 5\hat{j}, \vec{B} = \hat{i} - 10\hat{j}$

D. $\vec{A} = \hat{i} - 5\hat{j}, \vec{B} = 2\hat{i} - 10\hat{j}$

Answer: D

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6. Which of the following is not a property of a null vector ?

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

B. $\lambda \vec{0} = \vec{0}$ where λ is a scalar

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

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

Answer: C

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7. Given $\vec{A} + \vec{B} + \vec{C} + \vec{D} = \vec{0}$, which of the following statements is not correct ?

A. $\vec{A}, \vec{B}, \vec{C}$ and $\vec{D}$ must each be a null vector.

B. The magnitude of $\left(\vec{A}+\vec{C}\right)$ equals the magnitude of $\left(\vec{B}+\vec{D}\right)$.

C. The magnitude of $\vec{A}$ can never be greater than the sum of the magnitudes of $\vec{B}$, $\vec{C}$ and $\vec{D}$.

D. $\vec{B}+\vec{C}$ must lie in the plane of $\vec{A}$ and $\vec{D}$ if $\vec{A}$ and $\vec{D}$ are not collinear and in the line of $\vec{A}$ and $\vec{D}$, if they are collinear.

Answer: A

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8. Two vectors $\vec{A}$ and $\vec{B}$ inclined at an angle θ have a resultant $\vec{R}$ which makes an angle α with $\vec{A}$. If the directions of $\vec{A}$ and $\vec{B}$ are interchanged, the resultant will have the same

A. direction

B. magnitude

C. direction as well as magnitude

D. none of these

Answer: B

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9. 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 ?

A. $\sin^{-1}\left(\frac{12}{35}\right)$

B. $\cos^{-1}\left(\frac{12}{35}\right)$

C. $\tan^{-1}\left(\frac{12}{35}\right)$

D. $\cot^{-1}\left(\frac{12}{35}\right)$

Answer: C

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10. A river is flowing due east with a speed $3ms^{-1}$. A swimmer can swim in still water at a speed of $4ms^{-1}$. If swimmer starts swimming due north, then the resultant velocity of the swimmer is a) 3 m/s b) 5 m/s c) 7 m/s d) 2 m/s

A. 3 m s^{-1}

B. 5 m s^{-1}

C. 7 m s^{-1}

D. 2 m s^{-1}

Answer: B

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11. If $\hat{n}$ is a unit vector in the direction of the vector $\vec{A}$, them :

A. $\hat{n} = \dfrac{\vec{A}}{\left|\vec{A}\right|}$

B. $\hat{n} = \dfrac{\left|\vec{A}\right|}{\vec{A}}$

C. $\hat{n} = \left|\vec{A}\right|\vec{A}$

D. $\hat{n} = \vec{A}$

Answer: A

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12. The component of vector $\vec{A} = 2\hat{i} + 3\hat{j}$ along the direction of $\left(\hat{i} - \hat{j}\right)$ is

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

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

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

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

Answer: B

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13. The magnitude of the x-component of vector $\vec{A}$ is 3 and the magnitude of vector $\vec{A}$ is 5. What is the magnitude of the y-component of vector $\vec{A}$?

A. 3

B. 4

C. 5

D. 8

Answer: B

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14. The direction cosines of $\hat{i} + \hat{j} + \hat{k}$ are

A. $1, 1, 1$

B. $2, 2, 2$

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

D. $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

Answer: D

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15. If $\vec{A}$ makes an angle α, β and γ from x,y and z axis respectively then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

A. 0

B. 1

C. 2

D. 3

Answer: C

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16. Which of the following qauntities is dependent of the choice of orientation of coordinates axes?

A. $\overrightarrow{A} + \overrightarrow{B}$

B. $A_x + B_y$

C. $\left|\overrightarrow{A}+\overrightarrow{B}\right|$

D. Angle between $\overrightarrow{A}$ and $\overrightarrow{B}$

Answer: B

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17. Two vectors $\overrightarrow{A}$ and $\overrightarrow{B}$ inclined at an angle θ have a resultant $\overrightarrow{R}$ which makes an angle α with $\overrightarrow{A}$ and angle β with $\overrightarrow{B}$. Let the magnitudes of the vectors $\overrightarrow{A}$, $\overrightarrow{B}$ and $\overrightarrow{R}$ be represented by A, B and R respectively. Which of the following relations is not correct ?

A. $\frac{R}{\sin(\alpha+\beta)} = \frac{A}{\sin\alpha} = \frac{B}{\sin\beta}$

B. $R\sin\alpha = B\sin(\alpha+\beta)$

C. $A\sin\alpha = B\sin\beta$

D. $R\sin\beta = A\sin(\alpha+\beta)$

Answer: A

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18. Vectors $\vec{A}$ and $\vec{B}$ include an angle θ between them. If $\left(\vec{A}+\vec{B}\right)$ and $\left(\vec{A}-\vec{B}\right)$ respectively subtend angles α and β with $\vec{A}$, then $(\tan\alpha+\tan\beta)$ is

A. $\frac{(A\sin\theta)}{(A^2+B^2\cos^2\theta)}$

B. $\frac{(2AB\sin\theta)}{(A^2-B^2\cos^2\theta)}$

C. $\frac{(A^2\sin^2\theta)}{(A^2+B^2\cos^2\theta)}$

D. $\frac{(B^2\sin^2\theta)}{(A^2-B^2\cos^2\theta)}$

Answer: B

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19. A unit vector in the direction of resultant vector of $\vec{A} = -2\hat{i}+3\hat{j}+\hat{k}$ and $\vec{B} = \hat{i}+2\hat{j}-4\hat{k}$ is

A. $\frac{-2\hat{i}+3\hat{j}+\hat{k}}{\sqrt{35}}$

B. $\frac{\hat{i}+2\hat{j}-4\hat{k}}{\sqrt{35}}$

C. $\frac{-\hat{i}+5\hat{j}-3\hat{k}}{\sqrt{35}}$

D. $\frac{-3\hat{i}+\hat{j}+5\hat{k}}{\sqrt{35}}$

Answer: C

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20. In the question number 20, a unit vector perpendicular to the direction of $\vec{A}$ and $\vec{B}$ is

A. $\frac{-2\hat{i}-\hat{j}-\hat{k}}{\sqrt{6}}$

B. $\frac{2\hat{i}+\hat{j}+\hat{k}}{\sqrt{6}}$

C. $\frac{2\hat{i}-\hat{j}-\hat{k}}{\sqrt{6}}$

D. $\frac{2\hat{i}-\hat{j}+\hat{k}}{\sqrt{6}}$

Answer: A

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21. Resultant of two vectors $\overrightarrow{A}$ and $\overrightarrow{B}$ is of magnitude P, If $\overrightarrow{B}$ is reversed, then resultant is of magnitude Q. What is the value of P^2+Q^2 ?

A. $2\left(A^2+B^2\right)$

B. $2\left(A^2-B^2\right)$

C. A^2-B^2

D. $A^2 + B^2$

Answer: A

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22. 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. 30°

B. 45°

C. $(60)^\circ$

D. 90°

Answer: D

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

A. 11 km h^{-1}

B. 22 km h^{-1}

C. 33 km h^{-1}

D. 44 km h^{-1}

Answer: B

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24. A magnitude of vector $\vec{A}, \vec{B}$ and $\vec{C}$ are respectively $12, 5$ and 13 units and $\vec{A} + \vec{B} = \vec{C}$ then the angle between $\vec{A}$ and $\vec{B}$ is

A. 0

B. $\pi/2$

C. $\pi/4$

D. π

Answer: B

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25. The driver of a car moving towards a rocket launching pad with a speed of 6 m s^{-1} observed that the rocket is moving with speed of 10 m s^{-1}. The upward speed of the rocket as seen by the stationery observer is nearly

A. 4 m s^{-1}

B. 6 m s^{-1}

C. 8 m s^{-1}

D. 11 m s^{-1}

Answer: D

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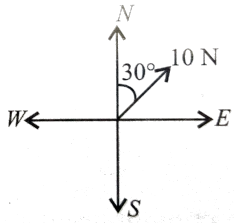
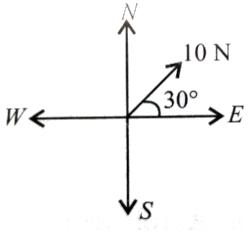
26. Which of the following figure represents the force of $10N$ in a direction of 30° east of north?

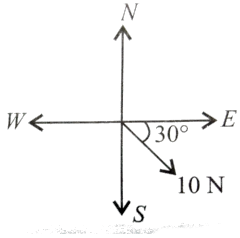
A.



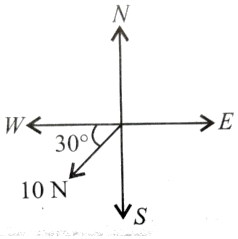
B.



C.



D.



Answer: A

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27. The (x, y, z) coordinates of two points A and B are given respectively as $(0, 4, -2)$ and $(-2, 8, -4)$. The displacement vector form A to B is

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

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

C. $2\hat{i}+4\hat{j}-2\hat{k}$

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

Answer: A

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28. A person moves 30 m north. Then 30 m east, then $30\sqrt{2}$ m south-west. His displacement from the original position is

A. zero

B. 28 m towards south

C. 10 m towards west

D. 15 m towards east

Answer: A

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29. A bird flies from (-3m, 4m, -3 m) to (7m, -2m, -3m) in the xyz-coordinates. The bird's displacement vector is given by

A. $\left(4\hat{i}+2\hat{j}-6\hat{k}\right)$

B. $\left(10\hat{i}-6\hat{j}\right)$

C. $\left(4\hat{i}-2\hat{j}\right)$

D. $\left(10\hat{i}+6\hat{j}-6\hat{k}\right)$

Answer: B

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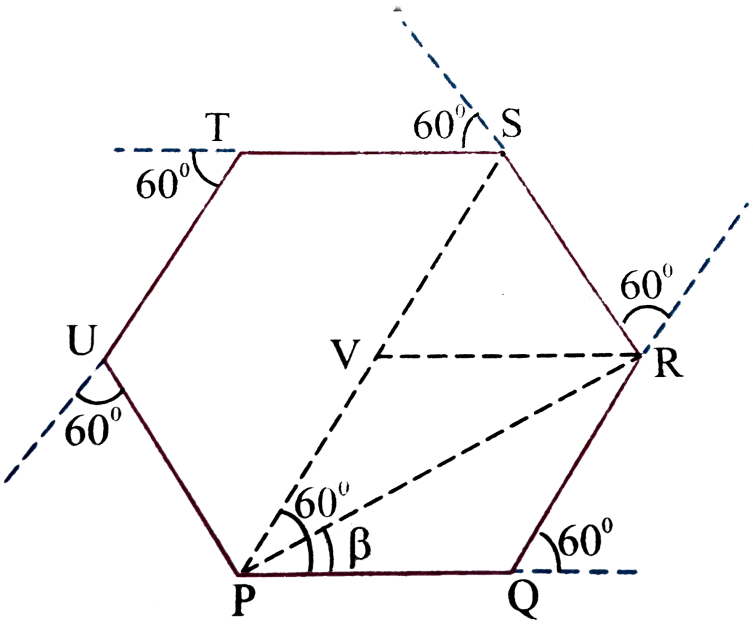
30. On an open ground, a motorist follows a track that turns to his left by an angle of 60° after every $500m$. Starting from a given turn, The path followed by the motorist is a regular hexagon with side $500m$, as shown in the given figure specify the displacement of the motorist at the end of third turn



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A. 500 m

B. $500\sqrt{3}$ m

C. 1000 m

D. $1000\sqrt{3}$ m

Answer: C

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31. A particle starts moving from point (2, 10, 1). Displacement for the particle is $8\hat{i} - 2\hat{j} + \hat{k}$. The final coordinates of the particle is

A. $(10, 8, 2)$

B. $(8, 10, 2)$

C. $(2, 10, 8)$

D. $(8, 2, 10)$

Answer: A

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32. For any arbitrary motion in space, which of the following relations are true?

a) $v_{\text{average}} = (1/2)(v(t_1 + v(t_2)$

b) $v_{\text{average}} = \left[r(t_2) - r\dfrac{t_1}{t_2 - t_1} \right.$

$v(t) = v(0) + at$

d) $a_{\text{average}} = \left[v(t_2) - v\dfrac{t_1}{t_2 - t_1} \right.$

The average stands for average of the quantity over time interval t_1 to t_(2)`

A. $\vec{v}_{\text{average}} = \dfrac{1}{2}\left[\vec{v}(t_1) + \vec{v}(t_2)\right]$

B. $\vec{v}_{\text{average}} = \dfrac{\vec{r}(t_2) - \vec{r}(t_1)}{t_2 - t_1}$

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

D. $\vec{r}(t) = \vec{r}(0) + \vec{v}(0)t + \dfrac{1}{2}\vec{a}t^2$

Answer: B

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33. The position of a particle is given by $\vec{r} = 3t\hat{i} + 2t^2\hat{j} + 5\hat{k}$, where t is in seconds and the coefficients have the proper units for $\vec{r}$ to be in meters. The direction of velocity of the particle at $t = 1$ s is

A. 53° with x-axis

B. 37° with x-axis

C. 30° with y-axis

D. 60° with y-axis

Answer: A

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34. In the question number 35, the acceleration of the particle at $t = 1$ is

A. $2\hat{j}ms^{-2}$

B. $-2\hat{j}ms^{-2}$

C. $4\hat{j}ms^{-2}$

D. $-4\hat{j}ms^{-2}$

Answer: C

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35. If $x = 5t + 3t^2$ and $y = 4t$ are the x and y co-ordinates of a particle at any time t second where x and y are in metre, then the acceleration of the particle

A. is zero throughout its motion

B. is a constant throughout its motion

C. depends only on its y component

D. varies along both x and y direction

Answer: B

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36. A particle starts from origin at $t = 0$ with a constant velocity $5\hat{i}m/s$ and moves in $x - y$ plane under action of a force which produce a constant acceleration of $\left(3\hat{i} + 2\hat{j}\right)m/s^2$ the y-coordinate of the particle at the instant its x co-ordinate is $84m$ in m is

A. 12 m

B. 24 m

C. 36 m

D. 48 m

Answer: C

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37. In the question number 38, the speed of the particle at this time is

A. 16 m s^{-1}

B. 26 m s^{-1}

C. 36 m s^{-1}

D. 46 m s^{-1}

Answer: B

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38. Suppose that two objects A and B are moving with velocities $\vec{v}_A$ and $\vec{v}_B$ (each with respect to some common frame of reference). Let $\vec{v}_{AB}$ represent the velocity of A with respect to B. Then

A. $\vec{v}_{AB} + \vec{v}_{BA} = 0$

B. $\vec{v}_{AB} - \vec{v}_{BA} = 0$

C. $\vec{v}_{AB} = \vec{v}_A + \vec{v}_B$

D. $\left|\vec{v}_{AB}\right| \neq \left|\vec{v}_{BA}\right|$

Answer: A

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39. Rain is falling vertically with a speed of $30ms^{-1}$. A woman rides a bicycle with a speed of $12ms^{-1}$ in east to west direction. In which direction should she hold her umbrella ?

A. At an angle of $\tan^{-1}\left(\frac{2}{5}\right)$ with the vertical towards the east.

B. At angle of $\tan^{-1}\left(\frac{2}{5}\right)$ with the vertical towards the west.

C. At angle of $\tan^{-1}\left(\frac{5}{2}\right)$ with the vertical towards the west

D. At angle of $\tan^{-1}\left(\frac{5}{2}\right)$ with the vertical towards the west.

Answer: B

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40. A girl riding a bicycle with a speed of $5m/s$ to wards Noth direction, observes rain falling vertically down. If she increases her speed to $10m/s$, rain appeard to meet her at 45° to the vertical . What is

the speed ot the rain ? In what direction does rain fall as observed by a ground based observer ?

A. $5\sqrt{2}ms^{-1}$

B. $5ms^{-1}$

C. $10\sqrt{2}ms^{-1}$

D. $10ms^{-1}$

Answer: A

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41. Which of the following is true regarding projectile motion ?

A. Horizontal velocity of projectile is constant.

B. Vertical velocity of projectile is constant.

C. Acceleration is not constant.

D. Momentum is constant.

Answer: A

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42. A bomb is released by a horizontal flying aeroplane. The trajectory of the bomb is

A. a parabola

B. a straight line

C. a circle

D. a hyperbola

Answer: A

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43. In case of a projectile motion, what is the angle between the velocity and acceleration at the highest point?

A. 0°

B. 45°

C. 90°

D. 180°

Answer: C

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44. If a body is projected with an angle θ to the horizontal, then

A. its velocity is always perpendicular to its acceleration then

B. its velocity becomes zero at its maximum height.

C. its velocity makes zero angle with the horizontal at its maximum height.

D. the body just before hitting the ground, the direction of velocity coincides with the acceleration.

Answer: C

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45. Two particles are projected simultaneously in the same vertical plane from the same point, with different speeds u_1 and u_2, making angles θ_1 and θ_2 respectively with the horizontal, such that $u_1 \cos\theta_1 = u_2 \cos\theta_2$. The path followed by one, as seen by the other (as long as both are in flight), is

A. a vertical line

B. a parabola

C. a hyperbola

D. a straight line making a constant angle $(\neq 90^{\circ})$ with horizontal

Answer: D

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

A. a. g b. u

B. a. $g/2$ b. 2u

C. a. g b. zero

D. a. zero b.4u

Answer: C

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47. The equations of motion of a projectile are given by $x = 36tm$ and $2y = 96t - 9.8t^2m$. The angle of projection is

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

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

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

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

Answer: A

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48. The relation between the time of flight of projectile T_f and the time to reach the maximum height t_m is

A. $T_f = 2t_m$

B. $T_f = t_m$

C. $T_f = \frac{t_m}{2}$

D. $T_f = \sqrt{2}(t_m)$

Answer: A

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49. From the top of a 490 m high cliff, a boy throws a stone horizontally with a initial speed of $15ms^{-1}$. What is the time taken by the stone to reach the ground.

A. 5 s

B. 10 s

C. 12 s

D. 15 s

Answer: B

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50. In the question number 52, the speed with which the stone hits the ground is

A. 15 m s^{-1}

B. 90 m s^{-1}

C. 99 m s^{-1}

D. 49 m s^{-1}

Answer: C

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51. Two balls are projected at an angle θ and $(90^\circ - \theta)$ to the horizontal with the same speed. The ratio of their maximum vertical heights is

A. $1:1$

B. $\tan\theta:1$

C. $1:\tan\theta$

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

Answer: D

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52. Two particls are projected in air with speed u at angles θ_1 and θ_2 (both acute) to the horizontal, respectively. If the height reached by the first particle is greater than that of the second, then which one of the following is correct? where T_1 and T_2 are the time of flight.

A. $\theta_1 > \theta_2$

B. $\theta_1 = \theta_2$

C. $T_1 < T_2$

D. $T_1 = T_2$

Answer: A

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53. The ceiling of a hall is 40m high. For maximum horizontal distance, the angle at which the ball may be thrown with a speed of $56ms^{-1}$ without hitting the ceiling of the hall is

A. 25°

B. 30°

C. 45°

D. 60°

Answer: B

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54. In the question number 56, the maximum horizontal distance covered by the ball will be

A. $160\sqrt{3}$ m

B. $140\sqrt{3}$ m

C. $120\sqrt{3}$ m

D. $100\sqrt{3}$ m

Answer: A

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55. If R and H represent horizontal range and maximum height of the projectile, then the angle of projection with the horizontal is

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

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

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

D. $\tan^{-1}\left(\frac{4H}{H}\right)$

Answer: C

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56. When air resistance is taken into account while dealing with the motion of the projectile which of the following properties of the projectile, shows an increases?

A. range

B. maximum height

C. speed at which it strikes the ground

D. the angle at which the projectile strikes the ground.

Answer: D

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57. Two projectiles are fired from the same point with the same speed at angles of projection 60° and 30° respectively. Which one of the following is true?

A. Their range will be the same.

B. Their maximum height will be the same.

C. Their velocity at the heighest point will be the same.

D. Their time of flight will be the same.

Answer: A

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58. Galileo writes that for angles of projection of a projectile at angles $(45+\theta)$ and $(45-\theta)$, the horizontal ranges described by the projectile are in the ratio of (if $\theta \leq 45$)

A. $2:1$

B. $1:2$

C. $1:1$

D. $2:3$

Answer: C

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59. A cricket ball is thrown at a speed of 30 m s^{-1} in a direction 30° above the horizontal. The time taken by the ball to return to the same level is

A. 2 s

B. 3 s

C. 4 s

D. 5 s

Answer: B

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60. In the question number 62, the distance from the thrower to the point where the ball returns to the same level is

A. 58 m

B. 68 m

C. 78 m

D. 88 m

Answer: C

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61. In the question number 62. the maximum height attained by the ball is

A. 11.25 m

B. 48.2 m

C. 23. 5 m

D. 68 m

Answer: A

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

A. 50 m

B. 100 m

C. 150 m

D. 200 m

Answer: A

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63. An aeroplane flying horizontally with a speed of 360 km h^{-1} releases a bomb at a height of 490 m from the ground. If g = 9. 8 m s^{-2} , it will strike the ground at

A. 10 km

B. 100 km

C. 1 km

D. 16 km

Answer: C

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64. A ball is thrown from the top of a tower with an initial velocity of $10m/s$ at an angle of 30° above the horizontal. It hits the ground at a distance of 17.3 m from the base of the tower. The height of the tower $(g = 10m/s^2)$ will be

A. 5 m

B. 20 m

C. 15 m

D. 10 m

Answer: D

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65. The speed of a projectile at its maximum height is $\sqrt{3}/2$ times its initial speed. If the range of the projectile is n times the maximum height attained by it, n is equal to :

A. $\frac{4}{3}$

B. $2\sqrt{3}$

C. $4\sqrt{3}$

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

Answer: C

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66. Four bodies A,B,C and D are projected with equal velocities having angles of projection $15^\circ, 30^\circ, 45^\circ \text{ and } 60^\circ$ with the horizontal respectively. The body having the shortest range is

A. A

B. B

C. C

D. D

Answer: A

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67. A player kicks a ball at a speed of $20ms^{-1}$ so that its horizontal range is maximum. Another players 24m away in the direction of kick starts running in the same direction at the same instant of hit. If he has to catch the ball just before it reaches the ground, he should run with a velocity equal to $(takeg = 10ms^{-2})$

A. $2\sqrt{2}ms^{-1}$

B. $4\sqrt{2}ms^{-1}$

C. $6\sqrt{2}ms^{-1}$

D. $10\sqrt{2}ms^{-1}$

Answer: B

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68. The term centripetal acceleration was proposed by

A. Huygens

B. Kepler

C. Newton

D. Galileo

Answer: C

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69. Centripetal acceleration is

A. a constant vector

B. a constant scalar

C. a magnitude changing vector

D. not a constant vector

Answer: D

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70. What is approximately the centripetal acceleration

(in units of acceleration due to gravity on earth, g = 10

m s^{-2} of an air-craft flying at a speed of 400 m s^{-1} through a circular arc of radius 0.6 km ?

A. 26.7

B. 16.9

C. 13.5

D. 30.2

Answer: A

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

A. both in the same direction

B. perpendicular to each other

C. both in opposite direction

D. not related to each other

Answer: B

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72. A body executing uniform circular motion has its position vector and acceleration vector

A. along the same direction

B. in opposite direction

C. normal to each other

D. not related to each other

Answer: B

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73. For a particle performing uniform circular motion, choose the incorrect statement form the following.

A. Magnitude of particle velocity (speed) remains constant.

B. Particle velocity remains directed perpendicular to radius vector.

C. Direction of acceleration keeps changing as particle moves.

D. Magnitudes of acceleration does not remain constant.

Answer: D

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74. Which of the following statements is incorrect ?

A. In one dimension motion, the velocity and the acceleration of an object are always along the

same line.

B. In two or three dimensions, the angle between velocity and acceleration vectors may have any value between 0° and 180°

C. The kinematic equations for uniform acceleration can be applied in case of a uniform circular motion.

D. The resultant acceleration of an object in circular motion is towards the centre only if the speed is constant.

Answer: C

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75. A particle is moving on a circular path of radius r with uniform speed v. What is the displacement of the particle after it has described an angle of 60°?

A. $r\sqrt{2}$

B. $r\sqrt{3}$

C. r

D. 2r

Answer: C

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

A. 0.68 m s^{-2}

B. 0.86 m s^{-2}

C. 0.56 m s^{-2}

D. 0.76 m s^{-2}

Answer: B

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77. A stone tied to the end of string 100cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolution in 22s, then the acceleration of the stone is

A. 16 m s^{-2}

B. 4 m s^{-2}

C. 12 m s^{-2}

D. 8 m s^{-2}

Answer: A

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78. An insect trapped in circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100s. The linear speed of the insect is

A. 4.3 cm s^{-1}

B. 5.3 cm s^{-1}

C. 6.3 cm s^{-1}

D. 7.3 cm s^{-1}

Answer: B

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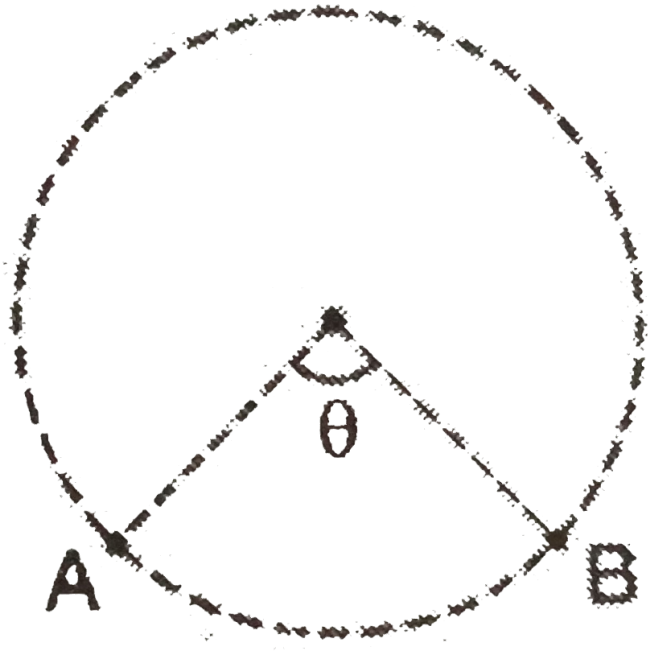
79. A particle is moving on a circular path with a constant speed v. Its change of velocity as it moves from A to B is:



A. $2v\sin(2\theta)$

B. zero

C. $2v\sin\left(\frac{\theta}{2}\right)$

D. $2v\cos\left(\frac{\theta}{2}\right)$

Answer: C

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80. $\vec{A}$ and $\vec{B}$ are two vectors. $\left(\vec{A}+\vec{B}\right)\times\left(\vec{A}-\vec{B}\right)$ can be expressed as :

A. $2\left(\vec{B}\times\vec{A}\right)$

B. $-2\left(\vec{B}\times\vec{A}\right)$

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

D. $\overrightarrow{A} \times \overrightarrow{B}$

Answer: A

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81. If $\overrightarrow{A} \times \overrightarrow{B} = \overrightarrow{C} + \overrightarrow{D}$, them select the correct alternative:

A. $\overrightarrow{B}$ is parallel to $\overrightarrow{C} + \overrightarrow{D}$.

B. $\overrightarrow{A}$ is perpendicular to $\overrightarrow{C}$.

C. Component of $\overrightarrow{C}$ along $\overrightarrow{A}$ = component of $\overrightarrow{D}$ along $\overrightarrow{A}$

D. Component of $\vec{C}$ along $\vec{A}$ = - component of $\vec{D}$ along $\vec{A}$

Answer: D

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82. सिद्ध कीजिए कि $\left|\vec{A} \times \vec{B}\right|^2 + \left|\vec{A} \cdot \vec{B}\right|^2 = (AB)^2$.

A. zero

B. A^2B^2

C. AB

D. $\sqrt{AB}$

Answer: B

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83. If $\vec{A}$ and $\vec{B}$ are two vectors, then which of the following is wrong?

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

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

C. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$

D. $\vec{A} - \vec{B} = -\left(\vec{B} - \vec{A}\right)$

Answer: C

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84. If vector A and B have an angle θ between them, then value of $\left|\hat{A}-\hat{B}\right|$ will be

A. $2\sin\frac{\theta}{2}$

B. $2\cos\frac{\theta}{2}$

C. $2\tan\frac{\theta}{2}$

D. $\tan\theta$

Answer: A

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85. 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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86. The projection of the vector $\vec{A} = \hat{i} - 2\hat{j} + \hat{k}$ on the vector $\vec{B} = 4\hat{i} - 4\hat{j} + 7\hat{k}$ is

A. $\frac{19}{9}$

B. $\frac{38}{9}$

C. $\frac{8}{9}$

D. $\frac{4}{9}$

Answer: A

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87. The area of the triangle formed by the adjacent sides with $\vec{A} = 3\hat{i} + 2\hat{j} - 4\hat{k}$ and $\vec{B} = -\hat{i} + 2\hat{j} + \hat{k}$ is

A. $\frac{\sqrt{165}}{2}$ units

B. $\frac{\sqrt{137}}{2}$ units

C. $\sqrt{165}$ units

D. $\sqrt{137}$ units

Answer: A

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88. A Body moves 6m north, 8m east and 10m vertically upwards, what is its resultant displacement from initial position

A. $10\sqrt{2}$ m

B. 10 m

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

D. 20 m

Answer: A

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89. A man can swim with a speed 4km/hr in still water.

(a) How long does he takes to cross a river 1 km wide if the river flows steadily at 3 km/hr and makes his strokes normal to the river current?

(b) How far down the river does he go when he go when he reaches the other bank?

A. 500 m, 15 min

B. 600 m, 0.25 min

C. 750 m, 15 min

D. 850 m, 0.25min

Answer: C

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90. An aircraft is flying at a height of 3400 m above the ground. If the angle subtended at a ground observation point by the aircraft positions 10 s apart is 30° , what is the speed of the aircraft ?

A. 10 .8 m s^{-1}

B. 1963 m s^{-1}

C. 108 m s^{-1}

D. 196.3 m s^{-1}

Answer: D

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91. A fighter plane flying horizontally at an altitude of $1.5km$ with speed $720kmh^{-1}$ passes directly over head an anticraft gun.

At what angle from the vertical should the gun be fired from the shell with muzzle speed $600ms^{-1}$ to hit plane.

At what minimum altitude should the pilot fly the plane to avoid being hit ? (Take g= 10 ms^{-2}).

A. $\sin^{-1}\left(\frac{1}{3}\right)$, 16km

B. $\sin^{-1}\left(\frac{2}{3}\right)$,16 km

C. $\cos^{-1}\left(\frac{1}{3}\right)$ 16m

D. $\cos^{-1}\left(\frac{2}{3}\right)$,16m

Answer: A

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92. From a building two balls A and B are thrown such that A is thrown upwards and B downwards (both vertically with the same speed). If v_A and v_B are their respective velocities on reaching the ground , then

A. $v_B > v_A$

B. $v_A = v_B$

C. $v_A = v_B$

D. their velocities depend on their masses.

Answer: B

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Hots

1. A stone is projected from level ground with speed u and ann at angle θ with horizontal. Somehow the acceleration due to gravity (g) becomes double (that is 2g) immediately after the stone reaches the maximum height and remains same thereafter.

Assume direction of acceleration due to gravity always vertically downwards.

Q. The horizontal range of particle is

A. $\frac{3}{4}\frac{u^2 \sin 2\theta}{g}$

B. $\frac{u^2 \sin 2\theta}{2g}\left(1+\frac{1}{\sqrt{2}}\right)$

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

D. $\frac{u^2 \sin 2\theta}{2g}\left(2+\frac{1}{\sqrt{2}}\right)$

Answer: B

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2. In the question number 1, the angle ϕ which the velocity vector of stone makes with horizontal just before hitting the ground is given by

A. $\tan\phi = 2\tan\theta$

B. $\tan\phi = 2\cot\theta$

C. $\tan\phi = \sqrt{2}\tan\theta$

D. $\tan\phi = \sqrt{2}\cot\theta$

Answer: C

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3. in the question number 4, if the horizontal displacement of the particle as seen by an observer on the ground is zero, the speed of the box with respect to the ground at the instant when particle was projected is

A. $u \cos \alpha$

B. $\frac{u \sin \alpha}{\cos \theta}$

C. $\frac{u \cos(\alpha + \theta)}{\cos \theta}$

D. $\frac{u \sin \theta \sin \alpha}{\cos \theta}$

Answer: C

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4. A train is moving along a straight line with a constant acceleration 'a' . A boy standing in the train throws a ball forward with a speed of $10m/s$, at an angle of $60(\circ)$ to the horizontal. The boy has to move forward by $1.15m$ inside the train to catch the ball back at the initial height . the acceleration of the train , in m/s^2 , is

A. 3 m s^{-2}

B. 5 m s^{-2}

C. 8 m s^{-2}

D. 6 m s^{-2}

Answer: B

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5. A body falling freely from a given height H hits an inlclined plane in its path at a height h. As a result of this impact the direction of the velocity of the body becomes horizontal. For what value of h/H, the body will take the maximum time to reach the ground.

A. $\frac{1}{3}$

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

C. $\frac{2}{5}$

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

Answer: B

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6. A body is projected with the velocity u_1 from the point A as shown in Figure. At the same time another body is projectd vertically upwards with the velocity u_2 from the point B. What shold be the value of $\frac{u_1}{u_2}$

for both the bodies to collide.

A. 2

B. $1/2$

C. $\sqrt{3/2}$

D. 1

Answer: B

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Exempler Problems

1. The angle between $\vec{A} = \hat{i} + \hat{j}$ and $\vec{B} = \hat{i} - \hat{j}$ is

A. 45°

B. 90°

C. -45°

D. 180°

Answer: B

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2. Which one of the following statements is true?

A. A scalar quantity is the one that is conserved in a process.

B. A scalar quantity is the one that can never take negative values.

C. A scalar quantity is the one that does not vary from one point to antother in space.

D. A scalar quantity has the same value for observers with different orientations of the axes.

Answer: D

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3. The component of a vector r along X-axis will have maximum value if

A. $\overrightarrow{r}$ is along positive y-axis

B. $\overrightarrow{r}$ is along positive x-axis

C. $\overrightarrow{r}$ makes an angle of 45° with the x-axis

D. $\overrightarrow{r}$ is along negative y-axis

Answer: B

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4. The range of a projectile fired at an angle of 15° is 50 m. If it is fired with the same speed at an angle of 45° its range will be

A. 60 m

B. 71 m

C. 100 m

D. 141 m

Answer: C

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5. Consider the quantities, pressure, power, energy, impulse, gravitational potential , electrical charge, temperature , area. Out of these, the only vector quantities are

A. Impulse, pressure and area

B. Impulse and area

C. Area of gravitational potential

D. Impulse and pressure

Answer: B

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6. In a two dimensional motion,instantaneous speed v_0 is a positive constant.Then which of the following are necessarily true?

A. The average velocity is not zero at any time.

B. Average acceleration must always vanish.

C. Displacements is equal time intervals are equal.

D. Equal path lengths are traversed in equal intervals.

Answer: D

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7. In a two dimensional motion, instantaneous speed v_0 is a positive constant. Then which of the following are neccessarily true?

A. The acceleration of the particle is zero.

B. The acceleration of the particle is bounded.

C. The acceleration of the particle is necessarily in the plane of motion.

D. The particle must be undergoing a uniform circular motion.

Answer: C

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8. Three vectors A, B and C add upto zero. Find which is false.

A. $\left(\overrightarrow{A} \times \overrightarrow{B}\right) \times \overrightarrow{C}$ is not zero unless $\overrightarrow{B}, \overrightarrow{C}$ are parallel.

B. $\left(\overrightarrow{A} \times \overrightarrow{B}\right) \cdot \overrightarrow{C}$ is not zero unless $\overrightarrow{B}, \overrightarrow{C}$ are parallel.

C. If $\overrightarrow{A}, \overrightarrow{B}, \overrightarrow{C}$ define a plane, $\left(\overrightarrow{A} \times \overrightarrow{B}\right) \times \overrightarrow{C}$ is in that plane.

D.

$$\left(\overrightarrow{A} \times \overrightarrow{B}\right) \cdot \overrightarrow{C} = \left|\overrightarrow{A}\right|\left|\overrightarrow{B}\right|\left|\overrightarrow{C}\right| \rightarrow C^2 = A^2 + B^2.$$

Answer: C

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9. It is found that $|A+B|=|A|$,This necessarily implies.

A. $\overrightarrow{B}=0$

B. $\overrightarrow{A}$, $\overrightarrow{B}$ are antiparallel

C. $\overrightarrow{A}$, $\overrightarrow{B}$ are perpendicular

D. $\overrightarrow{A}\cdot\overrightarrow{B}\leq 0$

Answer: B

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Assertion Reason

1. Assertion: Two vectors are said to be equal if , and only if, they have the same magnitude and the same dirction.

Reason: Addition and subtraction of scalars make sense only for quantities with same units.

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2. Assertion: Vector addition is commutative.

Reason: Two vectors may be added graphically using

head- to-tail method or parallelogram method.

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3. Assertion: The difference of two vectors A and B can be treated as the sum of two vectors.

Subtraction of vectors can be defined in terms of addition of vectors.

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4. Assertion: For motion in two or three diemensions, velocity and acceleration vecotrs must have any angle between $0^\circ \text{ and } 90^\circ$ between them.

Reason: For such motion velocity and acceleration of an object is always in the opposite direction.

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5. Asserion: Magnitude of the resultant of two vectors may be less than the magnitude of either vector.

Reason: The resultant of two vectors is obtained by means of law of parallelogram of Vectors.

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6. Assertion : An object has given two velocities $\vec{v}_1$ and $\vec{v}_2$ has a resultant velocity $\vec{v} = \vec{v}_1 + \vec{v}_2$.

Reason : $\vec{v}_1$ and $\vec{v}_2$ should be velocities with reference to some common reference frame.

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7. Assertion : A vector $\vec{A}$ can be resolved into component along with given vectors $\vec{a}$ and $\vec{b}$ lying in the same plane.

Reason : $\vec{A} = \lambda\vec{a} + \mu\vec{b}$ where λ and μ are real numbers.

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8. Assertion: If $\hat{i}$ and $\hat{j}$ are unit Vectors along x-axis and y-axis respectively, the magnitude of Vector $\hat{i}+\hat{j}$ will be $\sqrt{2}$

Reason: Unit vectors are used to indicate a direction only.

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9. Assertion: Rain is falling vertically with a certain speed. A boy holding an umbrella rides a bicycle in east to west direction and does not get wet.

Reason: The boy is holding his umbrella (at some angles) with the vertical towards the west.

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10. Assertion : The instantaneous velocity is given by the limiting value of the average velocity as the time interval approaches zero.

Reason : The direction of the average velocity is same as that of displacement.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer: B

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11. Assertion: The trajectory of an object moving under the same accleration due to gravity can be straight line or a parabola depending on the initial conditions.

Reason: The shape of the trajectory of the motion of an object is determined by the acceleration alone.

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12. Assertion: A projectile that traverses a parabolic path show deviation from its idealised trajectory in the presence of air resistance.

Reason: Air resistance affect the motion of the projectile.

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13. Assertion : A projectile should have two component velocities in two mutually perpendicular directions .

Reason : A body is said to be projectile if it has motion in two dimensions.

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14. Assertion: Centripetal acceleration is always direction towards the centre of rotation of an object undergoing uniform circular motion

Reason: Centripetal acceleration is a constant vector

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15. Assertion: A uniform circular motion is an acceleration motion.

Reason: Direction of acceleration is parallel to velocity vector.

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Scalars And Vectors

1. Which of the following is not a scalar quantity ? a) temperature b) Coefficient of friction c) charge d) Impulse

A. Temperature

B. Coefficient of friction

C. Charge

D. Impulse

Answer: D

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2. In Latin, the word vector means a) magnitude b) direction c) carrier d) cap

A. magnitude

B. direction

C. carrier

D. cap

Answer: C

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3. A vector is not changed if

A. It is displaced parallel to itself.

B. it is rotated through an arbitrary angle.

C. it is cross-multiplied by a unit vector.

D. it is multiplied by an arbitrary scalar.

Answer: A

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4. Which one of the following statements is false regarding the vectors ?

A. The magnitude of a vector is always a scalar.

B. Each component of a vector is always a scalar.

C. Two vectors having different magnitudes cannot have their resultant zero.

D. Vectors obey triangle law of addition.

Answer: B

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5. Which of the following pairs of vectors are parallel ?

A. $\vec{A} = \hat{i} - 2\hat{j}, \vec{B} = \hat{i} - 5\hat{j}$

B. $\vec{A} = \hat{i} - 10\hat{j}, \vec{B} = 2\hat{i} - 5\hat{j}$

C. $\vec{A} = \hat{i} - 5\hat{j}, \vec{B} = \hat{i} - 10\hat{j}$

D. $\vec{A} = \hat{i} - 5\hat{j}, \vec{B} = 2\hat{i} - 10\hat{j}$

Answer: D

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Addition And Subtraction Of Vectors Graphical Method

1. Which of the following is not a property of a null vector ?

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

B. $\lambda\vec{0} = \vec{0}$ where λ is a scalar

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

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

Answer: C

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2. Given $\vec{A} + \vec{B} + \vec{C} + \vec{D} = \vec{0}$, which of the following statements is not correct ?

A. $\vec{A}, \vec{B}, \vec{C}$ and $\vec{D}$ must each be a null vector.

B. The magnitude of $\left(\vec{A} + \vec{C}\right)$ equals the magnitude of $\left(\vec{B} + \vec{D}\right)$.

C. The magnitude of $\vec{A}$ can never be greater than the sum of the magnitudes of $\vec{B}, \vec{C}$ and $\vec{D}$.

D. $\vec{B} + \vec{C}$ must lie in the plane of $\vec{A}$ and $\vec{D}$ if $\vec{A}$ and $\vec{D}$ are not collinear and in the line of $\vec{A}$ and $\vec{D}$, if they are collinear.

Answer: A

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3. Two vectors $\vec{A}$ and $\vec{B}$ inclined at an angle θ have a resultant $\vec{R}$ which makes an angle α with $\vec{A}$. If the directions of $\vec{A}$ and $\vec{B}$ are interchanged, the resultant will have the same

A. direction

B. magnitude

C. direction as well as magnitude

D. none of these

Answer: B

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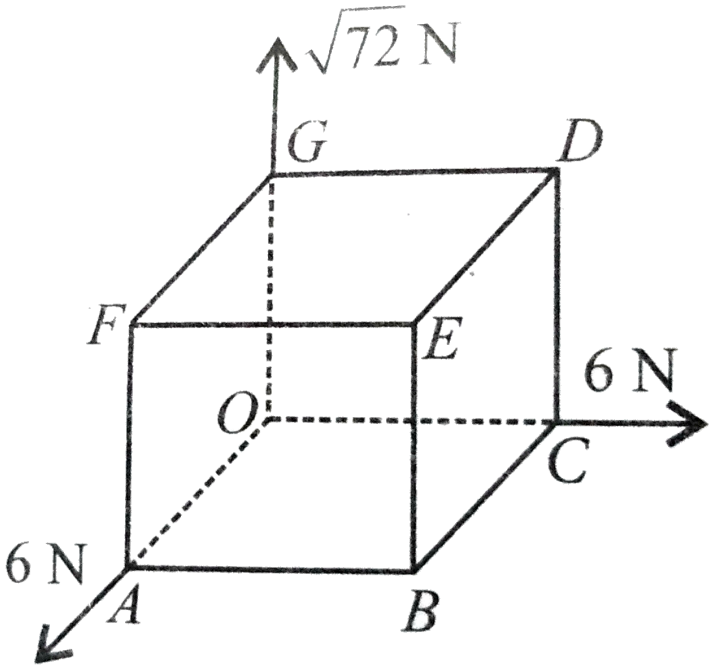
4. Three forces of magnitudes 6 N, 6 N an d $\sqrt{72}$ N act at corner of cube along three sides as shown in figure.

Resultant of these forces is



A. 12 N angle OB

B. 18 N along OA

C. 18 N along OC

D. 12 N along OE

Answer: D

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5. 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 ?

A. $\sin^{-1}\left(\frac{12}{35}\right)$

B. $\cos^{-1}\left(\frac{12}{35}\right)$

C. $\tan^{-1}\left(\frac{12}{35}\right)$

D. $\cot^{-1}\left(\frac{12}{35}\right)$

Answer: C

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6. A river is flowing due east with a speed $3ms^{-1}$. A swimmer can swim in still water at a speed of $4ms^{-1}$. If swimmer starts swimming due north, then the resultant velocity of the swimmer is a) 3 m/s b) 5 m/s c) 7 m/s d) 2 m/s

A. 3 m s^{-1}

B. 5 m s^{-1}

C. 7 m s^{-1}

D. 2 m s^{-1}

Answer: B

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Resolution Of Vectors

1. If $\hat{n}$ is a unit vector in the direction of the vector $\vec{A}$, them :

A. $\hat{n} = \frac{\vec{A}}{|\vec{A}|}$

B. $\hat{n} = \frac{|\vec{A}|}{\vec{A}}$

C. $\hat{n} = \left|\overrightarrow{A}\right|\overrightarrow{A}$

D. $\hat{n} = \overrightarrow{A}$

Answer: A

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2. The component of vector $\overrightarrow{A} = 2\hat{i} + 3\hat{j}$ along the direction of $\left(\hat{i} - \hat{j}\right)$ is

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

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

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

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

Answer: B

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3. The magnitude of the x-component of vector $\vec{A}$ is 3 and the magnitude of vector $\vec{A}$ is 5. What is the magnitude of the y-component of vector $\vec{A}$?

A. 3

B. 4

C. 5

D. 8

Answer: B

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4. The direction cosines of $\hat{i}+\hat{j}+\hat{k}$ are

A. $1, 1, 1$

B. $2, 2, 2$

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

D. $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

Answer: D

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5. If $\vec{A}$ makes an angle α, β and γ from x,y and z axis respectively then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

A. 0

B. 1

C. 2

D. 3

Answer: C

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Vector Addition Analytical Method

1. Which of the following qauntities is dependent of the choice of orientation of coordinates axes?

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

B. $A_x + B_y$

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

D. Angle between $\vec{A}$ and $\vec{B}$

Answer: B

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2. Two vectors $\vec{A}$ and $\vec{B}$ inclined at an angle θ have a resultant $\vec{R}$ which makes an angle α with $\vec{A}$ and

angle β with $\overrightarrow{B}$. Let the magnitudes of the vectors $\overrightarrow{A}$, $\overrightarrow{B}$ and $\overrightarrow{R}$ be represented by A, B and R respectively. Which of the following relations is not correct ?

A. $\frac{R}{\sin(\alpha+\beta)} = \frac{A}{\sin\alpha} = \frac{B}{\sin\beta}$

B. $R\sin\alpha = B\sin(\alpha+\beta)$

C. $A\sin\alpha = B\sin\beta$

D. $R\sin\beta = A\sin(\alpha+\beta)$

Answer: A

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3. Vectors $\vec{A}$ and $\vec{B}$ include an angle θ between them. If $\left(\vec{A}+\vec{B}\right)$ and $\left(\vec{A}-\vec{B}\right)$ respectively subtend angles α and β with $\vec{A}$, then $(\tan\alpha+\tan\beta)$ is

A. $\dfrac{(A\sin\theta)}{(A^2+B^2\cos^2\theta)}$

B. $\dfrac{(2AB\sin\theta)}{(A^2-B^2\cos^2\theta)}$

C. $\dfrac{\left(A^2\sin^2\theta\right)}{(A^2+B^2\cos^2\theta)}$

D. $\dfrac{\left(B^2\sin^2\theta\right)}{(A^2-B^2\cos^2\theta)}$

Answer: B

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4. A unit vector in the direction of resultant vector of $\vec{A} = -2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - 4\hat{k}$ is

A. $\frac{-2\hat{i} + 3\hat{j} + \hat{k}}{\sqrt{35}}$

B. $\frac{\hat{i} + 2\hat{j} - 4\hat{k}}{\sqrt{35}}$

C. $\frac{-\hat{i} + 5\hat{j} - 3\hat{k}}{\sqrt{35}}$

D. $\frac{-3\hat{i} + \hat{j} + 5\hat{k}}{\sqrt{35}}$

Answer: C

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5. In the question number 20, a unit vector perpendicular to the direction of $\vec{A}$ and $\vec{B}$ is

A. $\frac{-2\hat{i}-\hat{j}-\hat{k}}{\sqrt{6}}$

B. $\frac{2\hat{i}+\hat{j}+\hat{k}}{\sqrt{6}}$

C. $\frac{2\hat{i}-\hat{j}-\hat{k}}{\sqrt{6}}$

D. $\frac{2\hat{i}-\hat{j}+\hat{k}}{\sqrt{6}}$

Answer: A

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6. Resultant of two vectors $\vec{A}$ and $\vec{B}$ is of magnitude P, If $\vec{B}$ is reversed, then resultant is of magnitude Q. What is the value of $P^2 + Q^2$?

A. $2\left(A^2 + B^2\right)$

B. $2\left(A^2 - B^2\right)$

C. $A^2 - B^2$

D. $A^2 + B^2$

Answer: A

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7. 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. 30°

B. 45°

C. $(60)^{\circ}$

D. 90°

Answer: D

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

A. 11 km h^{-1}

B. 22 km h^{-1}

C. 33 km h^{-1}

D. 44 km h^{-1}

Answer: B

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9. A magnitude of vector $\vec{A}, \vec{B}$ and $\vec{C}$ are respectively $12, 5$ and 13 units and $\vec{A} + \vec{B} = \vec{C}$ then the angle between $\vec{A}$ and $\vec{B}$ is

A. 0

B. $\pi/2$

C. $\pi/4$

D. π

Answer: B

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10. The driver of a car moving towards a rocket launching pad with a speed of 6 m s^{-1} observed that the rocket is moving with speed of 10 m s^{-1}. The upward speed of the rocket as seen by the stationery observer is nearly

A. 4 m s^{-1}

B. 6 m s^{-1}

C. 8 m s^{-1}

D. 11 m s^{-1}

Answer: D

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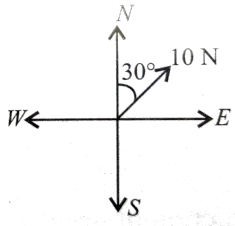
11. Which of the following figure represents the force of $10N$ in a direction of 30° east of north?

A.



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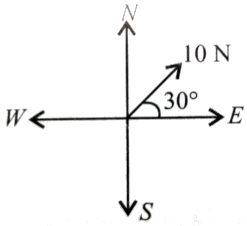
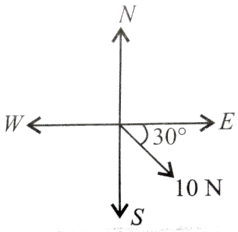
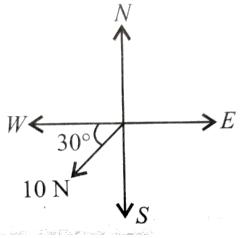


C.



D.



Answer: A

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Motion In A Plane

1. The (x, y, z) coordinates of two points A and B are given respectively as $(0, 4, -2)$ and $(-2, 8, -4)$. The displacement vector form A to B is

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

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

C. $2\hat{i} + 4\hat{j} - 2\hat{k}$

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

Answer: A

Watch Video Solution

2. A person moves 30 m north. Then 30 m east, then $30\sqrt{2}$ m south-west. His displacement from the original position is

A. zero

B. 28 m towards south

C. 10 m towards west

D. 15 m towards east

Answer: A

Watch Video Solution

3. A bird flies from (-3m, 4m, -3 m) to (7m, -2m, -3m) in the xyz-coordinates. The bird's displacement vector is given by

A. $\left(4\hat{i}+2\hat{j}-6\hat{k}\right)$

B. $\left(10\hat{i}-6\hat{j}\right)$

C. $\left(4\hat{i}-2\hat{j}\right)$

D. $\left(10\hat{i}+6\hat{j}-6\hat{k}\right)$

Answer: B

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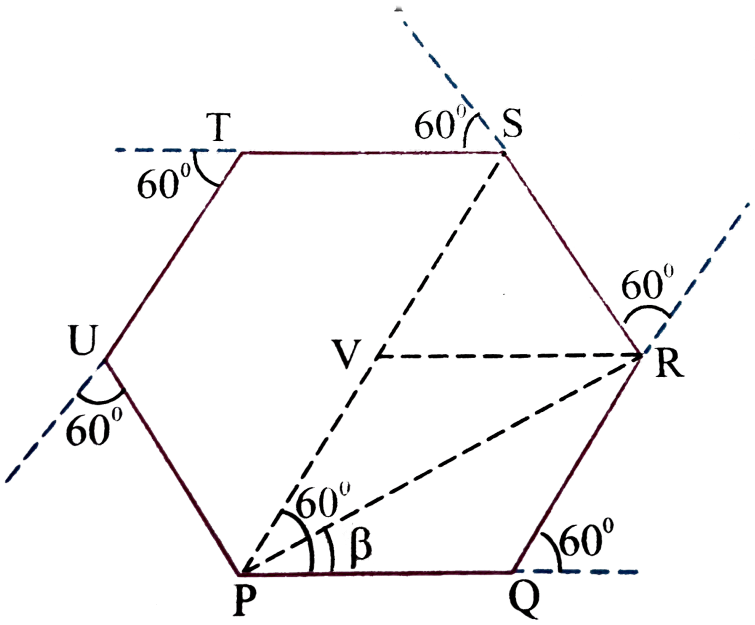
4. On an open ground, a motorist follows a track that turns to his left by an angle of 60° after every $500m$. Starting from a given turn, The path followed by the motorist is a regular hexagon with side $500m$, as shown in the given figure specify the displacement of the motorist at the end of third turn



.

A. 500 m

B. $500\sqrt{3}$ m

C. 1000 m

D. $1000\sqrt{3}$ m

Answer: C

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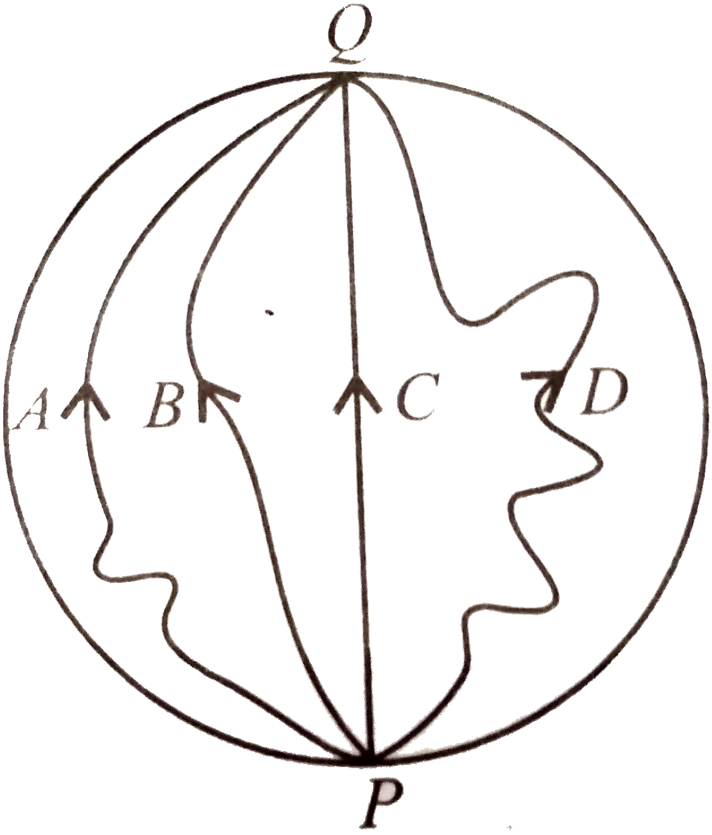
5. Four girls skating on circular ice ground of radius 200 m start from a point P on the edge of the ground and reach a point Q diametrically opposite to P following different paths as shown in figure. For which girls displacement is equal to the actual length of

path ?



A. A

B. B

C. C

D. D

Answer: C

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6. A particle starts moving from point (2, 10, 1). Displacement for the particle is $8\hat{i} - 2\hat{j} + \hat{k}$. The final coordinates of the particle is

A. $(10, 8, 2)$

B. $(8, 10, 2)$

C. $(2, 10, 8)$

D. $(8, 2, 10)$

Answer: A

Watch Video Solution

7. For any arbitrary motion in space, which of the following relations are true?

a) $v_{\text{average}} = (1/2)(v(t_1 + v(t_2)$

b) $v_{\text{average}} = \left[r(t_2) - r\frac{t_1}{t_2 - t_1}\right.$

$v(t) = v(0) + at$

d) $a_{\text{average}} = \left[v(t_2) - v\frac{t_1}{t_2 - t_1}\right.$

The average stands for average of the quantity over time interval t_1 to t_(2)`

A. $\vec{v}_{\text{average}} = \frac{1}{2}\left[\vec{v}(t_1) + \vec{v}(t_2)\right]$

B. $\vec{v}_{\text{average}} = \dfrac{\vec{r}(t_2) - \vec{r}(t_1)}{t_2 - t_1}$

C. $\vec{v}(t) = \vec{v}(0) + \vec{a}\,t$

D. $\vec{r}(t) = \vec{r}(0) + \vec{v}(0)t + \dfrac{1}{2}\vec{a}\,t^2$

Answer: B

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8. The position of a particle is given by $\vec{r} = 3t\hat{i} + 2t^2\hat{j} + 5\hat{k}$, where t is in seconds and the coefficients have the proper units for $\vec{r}$ to be in meters. The direction of velocity of the particle at $t = 1$ s is

A. 53° with x-axis

B. 37° with x-axis

C. 30° with y-axis

D. 60° with y-axis

Answer: A

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9. In the question number 35, the acceleration of the particle at $t = 1$ is

A. $2\hat{j}ms^{-2}$

B. $-2\hat{j}ms^{-2}$

C. $4\hat{j}ms^{-2}$

D. $-4\hat{j}ms^{-2}$

Answer: C

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10. If $x = 5t + 3t^2$ and $y = 4t$ are the x and y co-ordinates of a particle at any time t second where x and y are in metre, then the acceleration of the particle

A. is zero throughout its motion

B. is a constant throughout its motion

C. depends only on its y component

D. varies along both x and y direction

Answer: B

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Motion In A Plane With A Constant Acceleration

1. A particle starts from origin at $t = 0$ with a constant velocity $5\hat{i}m/s$ and moves in $x - y$ plane under action of a force which produce a constant acceleration of $\left(3\hat{i} + 2\hat{j}\right)m/s^2$ the y-coordinate of

the particle at the instant its x co-ordinate is $84m$ in m is

A. 12 m

B. 24 m

C. 36 m

D. 48 m

Answer: C

Watch Video Solution

2. In the question number 38, the speed of the particle at this time is

A. 16 m s^{-1}

B. 26 m s^{-1}

C. 36 m s^{-1}

D. 46 m s^{-1}

Answer: B

View Text Solution

Relative Velocity In Two Dimensions

1. Suppose that two objects A and B are moving with velocities $\overrightarrow{v}_A$ and $\overrightarrow{v}_B$ (each with respect to some

common frame of reference). Let $\vec{v}_{AB}$ represent the velocity of A with respect to B. Then

A. $\vec{v}_{AB} + \vec{v}_{BA} = 0$

B. $\vec{v}_{AB} - \vec{v}_{BA} = 0$

C. $\vec{v}_{AB} = \vec{v}_{A} + \vec{v}_{B}$

D. $\left|\vec{v}_{AB}\right| \neq \left|\vec{v}_{BA}\right|$

Answer: A

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2. Rain is falling vertically with a speed of $30ms^{-1}$. A woman rides a bicycle with a speed of $12ms^{-1}$ in east

to west direction. In which direction should she hold her umbrella ?

A. At an angle of $\tan^{-1}\left(\frac{2}{5}\right)$ with the vertical towards the east.

B. At angle of $\tan^{-1}\left(\frac{2}{5}\right)$ with the vertical towards the west.

C. At angle of $\tan^{-1}\left(\frac{5}{2}\right)$ with the vertical towards the west

D. At angle of $\tan^{-1}\left(\frac{5}{2}\right)$ with the vertical towards the west.

Answer: B

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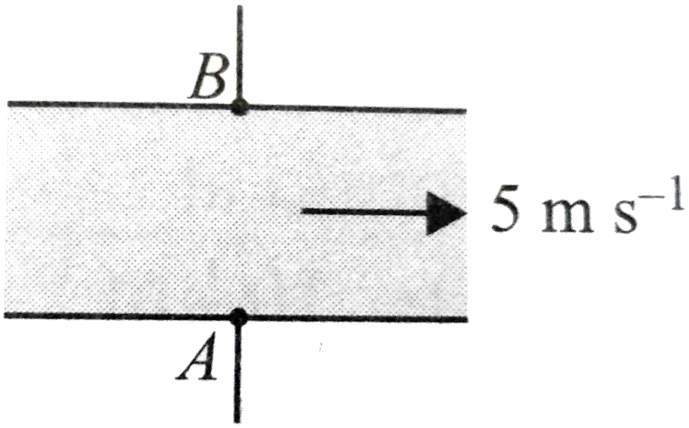
3. A river is flowing from west to east with a speed $5m/s$. A swimmer can swim in still water at a speed of $10m/s$.

If he wants to start from point A on south bank and reach opposite point B on north bank. In what direction direction should he swim ?



A. 30° east of north

B. 60° east of north

C. 30° west of north

D. 60° west of north

Answer: C

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4. A girl riding a bicycle with a speed of $5m/s$ to wards Noth direction, observes rain falling vertically down. If she increases her speed to $10m/s$, rain appeard to meet her at 45° to the vertical . What is

the speed ot the rain ? In what direction does rain fall as observed by a ground based observer ?

A. $5\sqrt{2}ms^{-1}$

B. $5ms^{-1}$

C. $10\sqrt{2}ms^{-1}$

D. $10ms^{-1}$

Answer: A

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Projectile Motion

1. Which of the following is true regarding projectile motion ?

A. Horizontal velocity of projectile is constant.

B. Vertical velocity of projectile is constant.

C. Acceleration is not constant.

D. Momentum is constant.

Answer: A

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2. A bomb is released by a horizontal flying aeroplane.

The trajectory of the bomb is

A. a parabola

B. a straight line

C. a circle

D. a hyperbola

Answer: A

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3. In case of a projectile motion, what is the angle between the velocity and acceleration at the highest point?

A. 0°

B. 45°

C. 90°

D. 180°

Answer: C

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4. If a body is projected with an angle θ to the horizontal, then

A. its velocity is always perpendicular to its acceleration then

B. its velocity becomes zero at its maximum height.

C. its velocity makes zero angle with the horizontal at its maximum height.

D. the body just before hitting the ground, the direction of velocity coincides with the acceleration.

Answer: C

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5. Two particles are projected simultaneously in the same vertical plane from the same point, with different speeds u_1 and u_2, making angles θ_1 and θ_2 respectively with the horizontal, such that $u_1 \cos\theta_1 = u_2 \cos\theta_2$. The path followed by one, as seen by the other (as long as both are in flight), is

A. a vertical line

B. a parabola

C. a hyperbola

D. a straight line making a constant angle $(\neq 90^\circ)$ with horizontal

Answer: D

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

A. a. g b. u

B. a. $g/2$ b. 2u

C. a. g b. zero

D. a. zero b.4u

Answer: C

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7. The equations of motion of a projectile are given by $x = 36tm$ and $2y = 96t - 9.8t^2m$. The angle of projection is

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

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

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

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

Answer: A

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8. The relation between the time of flight of projectile T_f and the time to reach the maximum height t_m is

A. $T_f = 2t_m$

B. $T_f = t_m$

C. $T_f = \frac{t_m}{2}$

D. $T_f = \sqrt{2}(t_m)$

Answer: A

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9. From the top of a 490 m high cliff, a boy throws a stone horizontally with a initial speed of $15ms^{-1}$. What is the time taken by the stone to reach the ground.

A. 5 s

B. 10 s

C. 12 s

D. 15 s

Answer: B

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10. In the question number 52, the speed with which the stone hits the ground is

A. 15 m s^{-1}

B. 90 m s^{-1}

C. 99 m s^{-1}

D. 49 m s^{-1}

Answer: C

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11. Two balls are projected at an angle θ and $(90^\circ - \theta)$ to the horizontal with the same speed. The ratio of their maximum vertical heights is

A. $1:1$

B. $\tan\theta:1$

C. $1:\tan\theta$

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

Answer: D

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12. Two particls are projected in air with speed u at angles θ_1 and θ_2 (both acute) to the horizontal, respectively. If the height reached by the first particle is greater than that of the second, then which one of the following is correct? where T_1 and T_2 are the time of flight.

A. $\theta_1 > \theta_2$

B. $\theta_1 = \theta_2$

C. $T_1 < T_2$

D. $T_1 = T_2$

Answer: A

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13. The ceiling of a hall is 40m high. For maximum horizontal distance, the angle at which the ball may be thrown with a speed of $56ms^{-1}$ without hitting the ceiling of the hall is

A. 25°

B. 30°

C. 45°

D. 60°

Answer: B

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14. In the question number 56, the maximum horizontal distance covered by the ball will be

A. $160\sqrt{3}$ m

B. $140\sqrt{3}$ m

C. $120\sqrt{3}$ m

D. $100\sqrt{3}$ m

Answer: A

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15. If R and H represent horizontal range and maximum height of the projectile, then the angle of projection with the horizontal is

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

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

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

D. $\tan^{-1}\left(\frac{4H}{H}\right)$

Answer: C

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16. When air resistance is taken into account while dealing with the motion of the projectile which of the following properties of the projectile, shows an increases?

A. range

B. maximum height

C. speed at which it strikes the ground

D. the angle at which the projectile strikes the ground.

Answer: D

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17. Two projectiles are fired from the same point with the same speed at angles of projection 60° and 30° respectively. Which one of the following is true?

A. Their range will be the same.

B. Their maximum height will be the same.

C. Their velocity at the heighest point will be the same.

D. Their time of flight will be the same.

Answer: A

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18. Galileo writes that for angles of projection of a projectile at angles $(45+\theta)$ and $(45-\theta)$, the horizontal ranges described by the projectile are in the ratio of (if $\theta \leq 45$)

A. $2:1$

B. $1:2$

C. $1:1$

D. $2:3$

Answer: C

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19. A cricket ball is thrown at a speed of 30 m s^{-1} in a direction 30° above the horizontal. The time taken by the ball to return to the same level is

A. 2 s

B. 3 s

C. 4 s

D. 5 s

Answer: B

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20. In the question number 62, the distance from the thrower to the point where the ball returns to the same level is

A. 58 m

B. 68 m

C. 78 m

D. 88 m

Answer: C

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21. In the question number 62. the maximum height attained by the ball is

A. 11.25 m

B. 48.2 m

C. 23. 5 m

D. 68 m

Answer: A

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

A. 50 m

B. 100 m

C. 150 m

D. 200 m

Answer: A

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23. An aeroplane flying horizontally with a speed of 360 km h^{-1} releases a bomb at a height of 490 m from the ground. If g = 9. 8 m s^{-2} , it will strike the ground at

A. 10 km

B. 100 km

C. 1 km

D. 16 km

Answer: C

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24. A ball is thrown from the top of a tower with an initial velocity of $10m/s$ at an angle of 30° above the horizontal. It hits the ground at a distance of 17.3 m from the base of the tower. The height of the tower $(g = 10m/s^2)$ will be

A. 5 m

B. 20 m

C. 15 m

D. 10 m

Answer: D

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25. The speed of a projectile at its maximum height is $\sqrt{3}/2$ times its initial speed. If the range of the projectile is n times the maximum height attained by it, n is equal to :

A. $\frac{4}{3}$

B. $2\sqrt{3}$

C. $4\sqrt{3}$

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

Answer: C

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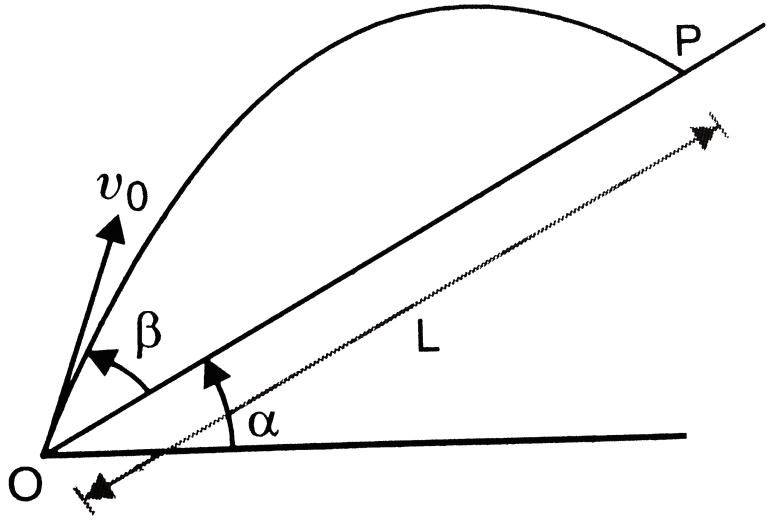
26. A particle is projected in air an angle β to a surface which itself is inclined at an angle α to the horizontal (Fig. 2 (EP). 26)

(a) Find an expression for range on the plane surface (distance on the plane from the point of projection at which particle will hit the surface). (b) Time of flight. 9c) β at which range will be maximum.



A. $\dfrac{2u^2 \sin\alpha \cos(\alpha+\beta)}{g\cos^2\alpha}$

B. $\frac{2u^2 \sin\beta \cos(\alpha+\beta)}{g\cos^2\beta}$

C. $\frac{2u^2 \sin\beta \cos(\alpha+\beta)}{g\cos^2\alpha}$

D. $\frac{2u^2 \sin\alpha \cos(\alpha+\beta)}{g\cos^2\beta}$

Answer: C

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27. Four bodies A,B,C and D are projected with equal velocities having angles of projection $15^\circ, 30^\circ, 45^\circ$ and 60° with the horizontal respectively. The body having the shortest range is

A. A

B. B

C. C

D. D

Answer: A

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28. A player kicks a ball at a speed of $20ms^{-1}$ so that its horizontal range is maximum. Another players 24m away in the direction of kick starts running in the same direction at the same instant of hit. If he has to catch the ball just before it reaches the ground, he

should run with a velocity equal to $(takeg = 10ms^{-2})$

A. $2\sqrt{2}ms^{-1}$

B. $4\sqrt{2}ms^{-1}$

C. $6\sqrt{2}ms^{-1}$

D. $10\sqrt{2}ms^{-1}$

Answer: B

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29. The equation of motion of a projectile is $y = ax - bx^2$, where a and b are constants of motion.

Match the quantities in Column I with the relations in Column II.

Column I		Column II	
(A)	The initial velocity of projection	(p)	$\frac{a}{b}$
(B)	The horizontal range of projectile	(q)	$a\sqrt{\frac{2}{bg}}$
(C)	The maximum vertical height attained by projectile	(r)	$\frac{a^2}{4b}$
(D)	The time of flight of projectile	(s)	$\sqrt{\frac{g(1+a^2)}{2b}}$

A. $A-p, B-q, C-r, D-s$

B. $A-s, B-p, C-q, D-r$

C. $A-s, B-p, C-r, D-q$

D. $A-p, B-s, C-r, D-q$

Answer: C

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Uniform Circular Motion

1. The term centripetal acceleration was proposed by

A. Huygens

B. Kepler

C. Newton

D. Galileo

Answer: C

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2. Centripetal acceleration is

A. a constant vector

B. a constant scalar

C. a magnitude changing vector

D. not a constant vector

Answer: D

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3. What is approximately the centripetal acceleration (in units of acceleration due to gravity on earth, g = 10 m s^{-2} of an air-craft flying at a speed of 400 m s^{-1} through a circular arc of radius 0.6 km ?

A. 26.7

B. 16.9

C. 13.5

D. 30.2

Answer: A

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

A. both in the same direction

B. perpendicular to each other

C. both in opposite direction

D. not related to each other

Answer: B

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5. A body executing uniform circular motion has its position vector and acceleration vector

A. along the same direction

B. in opposite direction

C. normal to each other

D. not related to each other

Answer: B

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6. For a particle performing uniform circular motion, choose the incorrect statement form the following.

A. Magnitude of particle velocity (speed) remains constant.

B. Particle velocity remains directed perpendicular to radius vector.

C. Direction of acceleration keeps changing as particle moves.

D. Magnitudes of acceleration does not remain constant.

Answer: D

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7. Which of the following statements is incorrect ?

A. In one dimension motion, the velocity and the acceleration of an object are always along the same line.

B. In two or three dimensions, the angle between velocity and acceleration vectors may have any value between 0° and 180°

C. The kinematic equations for uniform acceleration can be applied in case of a uniform circular motion.

D. The resultant acceleration of an object in circular motion is towards the centre only if the speed is constant.

Answer: C

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8. A particle is moving on a circular path of radius r with uniform speed v. What is the displacement of the particle after it has described an angle of 60°?

A. $r\sqrt{2}$

B. $r\sqrt{3}$

C. r

D. 2r

Answer: C

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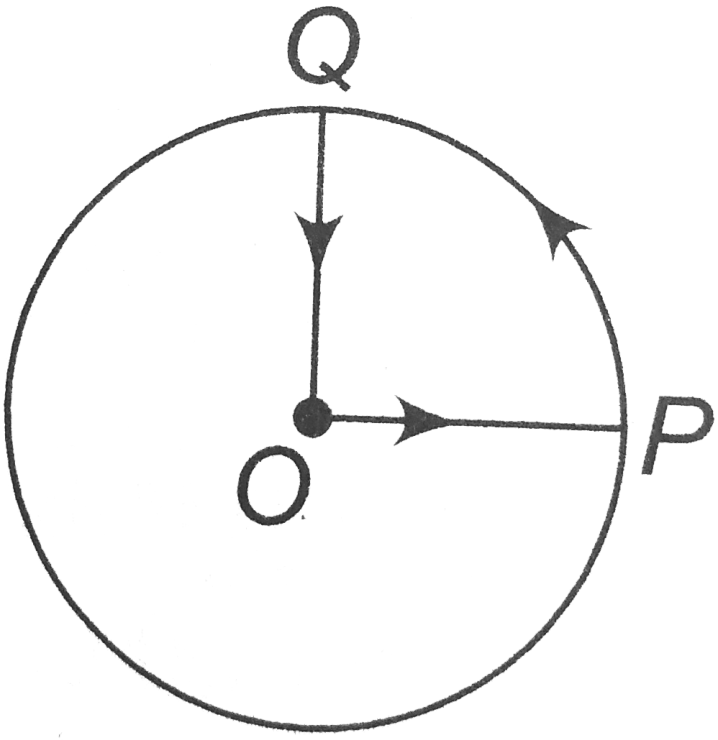
9. A cyclist starts from the centre O of a circular park of radius 1km, reaches the edge P of the park, then cycles along the PQ cicumference and returns to the centre along OQ as shown in fig. If the round trip taken ten minute, the net displacement and average speed of the cylists (in kilometer and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

is



A. 0,1

B. $\frac{\pi + 4}{2}, 0$

C. $21.4, \frac{\pi + 4}{2}$

D. 0,21.4

Answer: D

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

A. 0.68 m s^{-2}

B. 0.86 m s^{-2}

C. 0.56 m s^{-2}

D. 0.76 m s^{-2}

Answer: B

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11. A stone tied to the end of string 100cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolution in 22s, then the acceleration of the stone is

A. 16 m s^{-2}

B. 4 m s^{-2}

C. 12 m s^{-2}

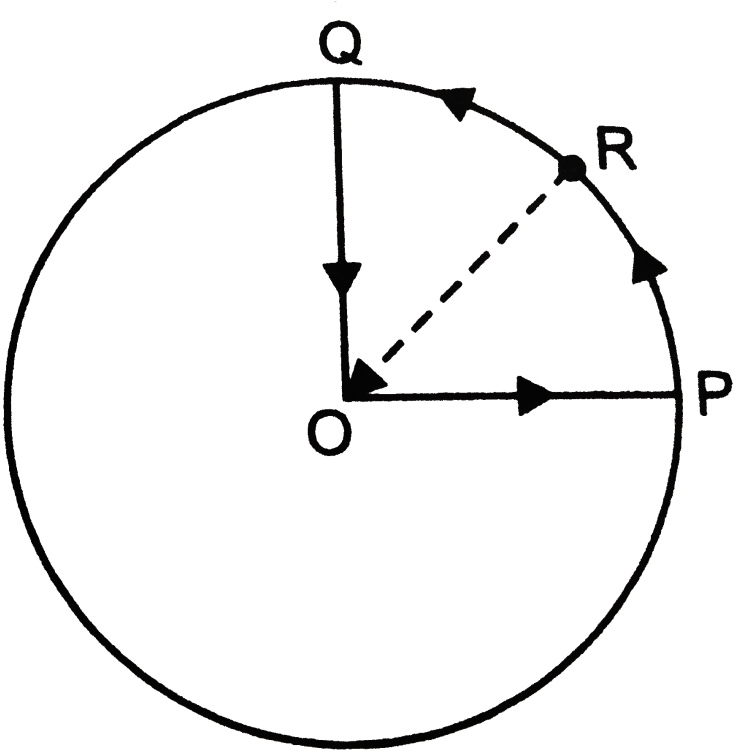
D. 8 m s^{-2}

Answer: A

Watch Video Solution

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

magnitude and direction ?



A. 10 m s^{-2}

B. 0.1 m s^{-2}

C. 0.01 m s^{-2}

D. 1 m s^{-2}

Answer: B

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13. An insect trapped in circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100s. The linear speed of the insect is

A. 4.3 cm s^{-1}

B. 5.3 cm s^{-1}

C. 6.3 cm s^{-1}

D. 7.3 cm s^{-1}

Answer: B

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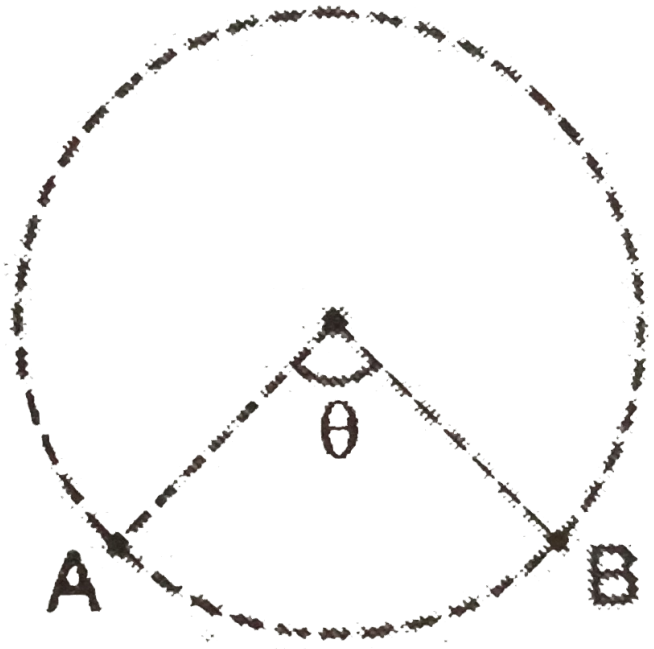
14. A particle is moving on a circular path with a constant speed v. Its change of velocity as it moves from A to B is:



A. $2v\sin(2\theta)$

B. zero

C. $2v\sin\left(\frac{\theta}{2}\right)$

D. $2v\cos\left(\frac{\theta}{2}\right)$

Answer: C

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Miscellaneous Questions

1. $\overrightarrow{A}$ and $\overrightarrow{B}$ are two vectors. $\left(\overrightarrow{A}+\overrightarrow{B}\right)\times\left(\overrightarrow{A}-\overrightarrow{B}\right)$ can be expressed as :

A. $2\left(\overrightarrow{B} \times \overrightarrow{A}\right)$

B. $-2\left(\overrightarrow{B} \times \overrightarrow{A}\right)$

C. $\overrightarrow{B} \times \overrightarrow{A}$

D. $\overrightarrow{A} \times \overrightarrow{B}$

Answer: A

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2. If $\overrightarrow{A} \times \overrightarrow{B} = \overrightarrow{C} + \overrightarrow{D}$, them select the correct alternative:

A. $\overrightarrow{B}$ is parallel to $\overrightarrow{C} + \overrightarrow{D}$.

B. $\overrightarrow{A}$ is perpendicular to $\overrightarrow{C}$.

C. Component of $\vec{C}$ along $\vec{A}$ = component of $\vec{D}$ along $\vec{A}$

D. Component of $\vec{C}$ along $\vec{A}$ = - component of $\vec{D}$ along $\vec{A}$

Answer: D

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3. सिद्ध कीजिए कि $\left|\vec{A} \times \vec{B}\right|^2 + \left|\vec{A} \cdot \vec{B}\right|^2 = (AB)^2.$

A. zero

B. A^2B^2

C. AB

D. $\sqrt{AB}$

Answer: B

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4. If $\vec{A}$ and $\vec{B}$ are two vectors, then which of the following is wrong?

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

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

C. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$

D. $\vec{A} - \vec{B} = -\left(\vec{B} - \vec{A}\right)$

Answer: C

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5. If vector A and B have an angle θ between them, then value of $\left|\hat{A}-\hat{B}\right|$ will be

A. $2\sin\frac{\theta}{2}$

B. $2\cos\frac{\theta}{2}$

C. $2\tan\frac{\theta}{2}$

D. $\tan\theta$

Answer: A

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6. 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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7. The projection of the vector $\vec{A} = \hat{i} - 2\hat{j} + \hat{k}$ on the vector $\vec{B} = 4\hat{i} - 4\hat{j} + 7\hat{k}$ is

A. $\frac{19}{9}$

B. $\frac{38}{9}$

C. $\frac{8}{9}$

D. $\frac{4}{9}$

Answer: A

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8. The area of the triangle formed by the adjacent sides with $\vec{A} = 3\hat{i} + 2\hat{j} - 4\hat{k}$ and $\vec{B} = -\hat{i} + 2\hat{j} + \hat{k}$ is

A. $\frac{\sqrt{165}}{2}$ units

B. $\frac{\sqrt{137}}{2}$ units

C. $\sqrt{165}$ units

D. $\sqrt{137}$ units

Answer: A

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9. A Body moves 6m north, 8m east and 10m vertically upwards, what is its resultant displacement from initial position

A. $10\sqrt{2}$ m

B. 10 m

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

D. 20 m

Answer: A

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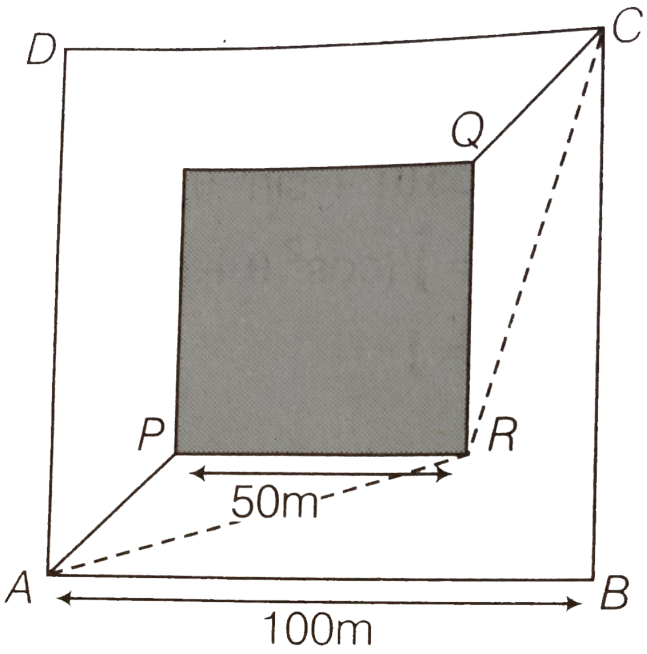
10. A man wants to reach from A to the opposite corner of the square C. The sides of the square are 100 m. A central square of $50m \times 50m$ is filled with sand. Outside this square, he can walk at a speed 1 m/s. In the central square , he can walk only at a speed of v m/s $(v < 1)$. What is smallest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

than any path in the square outside the sand ?



A. 0.18 m s^{-1}

B. 0.81 m s^{-1}

C. 0.5 m s^{-1}

D. 0.95 m s^{-1}

Answer: B

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11. A man can swim with a speed 4km/hr in still water.

(a) How long does he takes to cross a river 1 km wide if the river flows steadily at 3 km/hr and makes his strokes normal to the river current?

(b) How far down the river does he go when he go when he reaches the other bank?

A. 500 m, 15 min

B. 600 m, 0.25 min

C. 750 m, 15 min

D. 850 m, 0.25min

Answer: C

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12. An aircraft is flying at a height of 3400 m above the ground. If the angle subtended at a ground observation point by the aircraft positions 10 s apart is 30° , what is the speed of the aircraft ?

A. 10 .8 m s^{-1}

B. 1963 m s^{-1}

C. 108 m s^{-1}

D. 196.3 m s^{-1}

Answer: D

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13. A fighter plane flying horizontally at an altitude of $1.5km$ with speed $720kmh^{-1}$ passes directly over head an anticraft gun.

At what angle from the vertical should the gun be fired from the shell with muzzle speed $600ms^{-1}$ to hit plane.

At what minimum altitude should the pilot fly the plane to avoid being hit ? (Take g= 10 ms^{-2}).

A. $\sin^{-1}\left(\frac{1}{3}\right)$, 16km

B. $\sin^{-1}\left(\frac{2}{3}\right)$,16 km

C. $\cos^{-1}\left(\frac{1}{3}\right)$ 16m

D. $\cos^{-1}\left(\frac{2}{3}\right)$,16m

Answer: A

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14. From a building two balls A and B are thrown such that A is thrown upwards and B downwards (both vertically with the same speed). If v_A and v_B are

their respective velocities on reaching the ground , then

A. $v_B > v_A$

B. $v_A = v_B$

C. $v_A = v_B$

D. their velocities depend on their masses.

Answer: B

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Higher Order Thinking Skills

1. A stone is projected from level ground with speed u and ann at angle θ with horizontal. Somehow the acceleration due to gravity (g) becomes double (that is 2g) immediately after the stone reaches the maximum height and remains same thereafter. Assume direction of acceleration due to gravity always vertically downwards.

Q. The horizontal range of particle is

A. $\frac{3}{4}\frac{u^2 \sin 2\theta}{g}$

B. $\frac{u^2 \sin 2\theta}{2g}\left(1+\frac{1}{\sqrt{2}}\right)$

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

D. $\frac{u^2 \sin 2\theta}{2g}\left(2+\frac{1}{\sqrt{2}}\right)$

Answer: B

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2. In the question number 1, the angle ϕ which the velocity vector of stone makes with horizontal just before hitting the ground is given by

A. $\tan\phi = 2\tan\theta$

B. $\tan\phi = 2\cot\theta$

C. $\tan\phi = \sqrt{2}\tan\theta$

D. $\tan\phi = \sqrt{2}\cot\theta$

Answer: C

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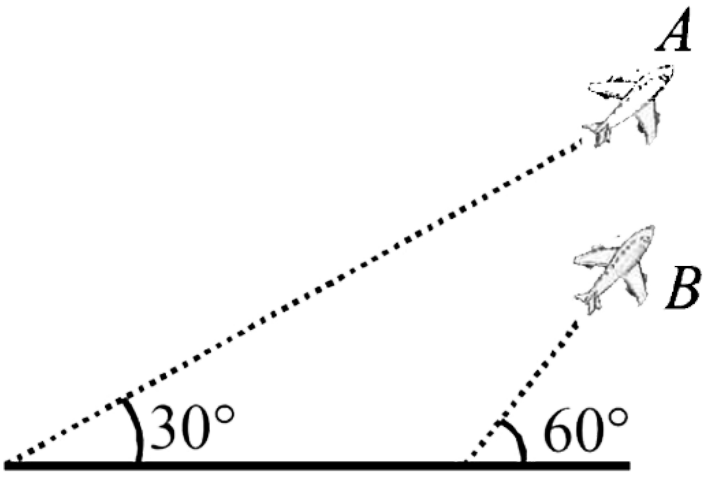
3. Airplanes A and B are flying with constant velocity in the same vertical plane at angles 30° and 60° with respect to the horizontal respectively as shown in figure . The speed of A is $100\sqrt{3}m/s$. At time $t = 0s$, an observer in A finds B at a distance of $500m$. The observer sees B moving with a constant velocity perpendicular to the line of motion of A . If at $t = t_0$, A just escapes being hit by B, t_0 , A just escapes being

hit by B, t_0 in seconds is



A. 3s

B. 5s

C. 2s

D. 1s

Answer: B

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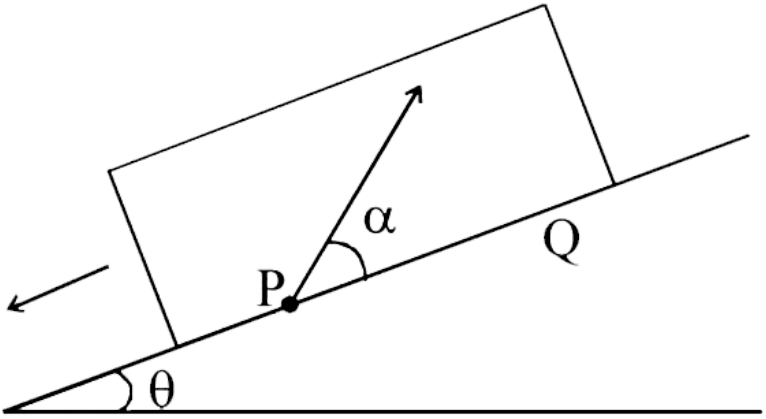
4. A large , heavy box is sliding without friction down a smooth plane of inclination θ . From a point P on the bottom of the box , a particle is projected inside the box . The initial speed of the particle with respect to the box is u , and the direction of projection makes an angle α with the bottom as shown in Figure .

(a) Find the distance along the bottom of the box between the point of projection p and the point Q where the particle lands . (Assume that the particle does not hit any other surface of the box . Neglect air resistance .)

(b) If the horizontal displacement of the particle as seen by an observer on the ground is zero , find the

speed of the box with respect to the ground at the instant when particle was projected .



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

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

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

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

Answer: A

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5. in the question number 4, if the horizontal displacement of the particle as seen by an observer on the ground is zero, the speed of the box with respect to the ground at the instant when particle was projected is

A. $u\cos\alpha$

B. $\frac{u\sin\alpha}{\cos\theta}$

C. $\frac{u\cos(\alpha+\theta)}{\cos\theta}$

D. $\frac{u\sin\theta\sin\alpha}{\cos\theta}$

Answer: C

View Text Solution

6. A train is moving along a straight line with a constant acceleration 'a' . A boy standing in the train throws a ball forward with a speed of $10m/s$, at an angle of $60(\circ)$ to the horizontal. The boy has to move forward by $1.15m$ inside the train to catch the ball back at the initial height . the acceleration of the train , in m/s^2 , is

A. 3 m s^{-2}

B. 5 m s^{-2}

C. 8 m s^{-2}

D. 6 m s^{-2}

Answer: B

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7. A body falling freely from a given height H hits an inlclined plane in its path at a height h. As a result of this impact the direction of the velocity of the body becomes horizontal. For what value of h/H, the body will take the maximum time to reach the ground.

A. $\frac{1}{3}$

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

C. $\frac{2}{5}$

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

Answer: B

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8. A body is projected with the velocity u_1 from the point A as shown in Figure. At the same time another body is projectd vertically upwards with the velocity u_2 from the point B. What shold be the value of $\frac{u_1}{u_2}$

for both the bodies to collide.

A. 2

B. $1/2$

C. $\sqrt{3/2}$

D. 1

Answer: B

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Ncert Exemplar

1. The angle between $\vec{A} = \hat{i} + \hat{j}$ and $\vec{B} = \hat{i} - \hat{j}$ is

A. 45°

B. 90°

C. -45°

D. 180°

Answer: B

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2. Which one of the following statements is true?

A. A scalar quantity is the one that is conserved in a process.

B. A scalar quantity is the one that can never take negative values.

C. A scalar quantity is the one that does not vary from one point to antother in space.

D. A scalar quantity has the same value for observers with different orientations of the axes.

Answer: D

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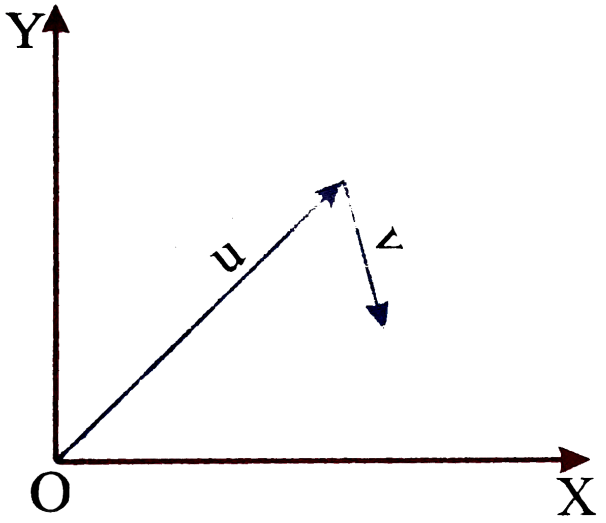
3. Figure shows the orientation of two vectors u and v in the XY plane.

if $\overrightarrow{u} = a\hat{i} + b\hat{j}$ and $\overrightarrow{v} = p\hat{i} + q\hat{j}$

which of the following is correct?



A. a and p are positive while b and q are negative.

B. a,p and b are positive while q is negative.

C. a,q and b are positive while p is negative.

D. a, b, p and q are all positive.

Answer: B

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4. The component of a vector r along X-axis will have maximum value if

A. $\vec{r}$ is along positive y-axis

B. $\vec{r}$ is along positive x-axis

C. $\vec{r}$ makes an angle of 45° with the x-axis

D. $\overrightarrow{r}$ is along negative y-axis

Answer: B

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5. The range of a projectile fired at an angle of 15° is 50 m. If it is fired with the same speed at an angle of 45° its range will be

A. 60 m

B. 71 m

C. 100 m

D. 141 m

Answer: C

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6. Consider the quantities, pressure, power, energy, impulse, gravitational potential , electrical charge, temperature , area. Out of these, the only vector quantities are

A. Impulse, pressure and area

B. Impulse and area

C. Area of gravitational potential

D. Impulse and pressure

Answer: B

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7. In a two dimensional motion,instantaneous speed v_0 is a positive constant.Then which of the following are necessarily true?

A. The average velocity is not zero at any time.

B. Average acceleration must always vanish.

C. Displacements is equal time intervals are equal.

D. Equal path lengths are traversed in equal intervals.

Answer: D

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8. In a two dimensional motion, instantaneous speed v_0 is a positive constant. Then which of the following are neccessarily true?

A. The acceleration of the particle is zero.

B. The acceleration of the particle is bounded.

C. The acceleration of the particle is necessarily in the plane of motion.

D. The particle must be undergoing a uniform circular motion.

Answer: C

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9. Three vectors A, B and C add upto zero. Find which is false.

A. $\left(\vec{A} \times \vec{B}\right) \times \vec{C}$ is not zero unless $\vec{B}, \vec{C}$ are parallel.

B. $\left(\vec{A} \times \vec{B}\right) \cdot \vec{C}$ is not zero unless $\vec{B}, \vec{C}$ are parallel.

C. If $\vec{A}, \vec{B}, \vec{C}$ define a plane, $\left(\vec{A} \times \vec{B}\right) \times \vec{C}$ is in that plane.

D.

$$\left(\vec{A} \times \vec{B}\right) \cdot \vec{C} = \left|\vec{A}\right|\left|\vec{B}\right|\left|\vec{C}\right| \rightarrow C^2 = A^2 + B^2.$$

Answer: C

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10. It is found that $|A + B| = |A|$,This necessarily implies.

A. $\vec{B} = 0$

B. $\vec{A}, \vec{B}$ are antiparallel

C. $\vec{A}$, $\vec{B}$ are perpendicular

D. $\vec{A} \cdot \vec{B} \leq 0$

Answer: B

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Assertion And Reason

1. Assertion: Two vectors are said to be equal if , and only if, they have the same magnitude and the same dirction.

Reason: Addition and subtraction of scalars make sense only for quantities with same units.

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2. Assertion: Vector addition is commutative.

Reason: Two vectors may be added graphically using head- to-tail method or parallelogram method.

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3. Assertion: The difference of two vectors A and B can be treated as the sum of two vectors.

Subtraction of vectors can be defined in terms of addition of vectors.

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4. Assertion: For motion in two or three diemensions, velocity and acceleration vecotrs must have any angle between $0^\circ \text{ and } 90^\circ$ between them.

Reason: For such motion velocity and acceleration of an object is always in the opposite direction.

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5. Asserion: Magnitude of the resultant of two vectors may be less than the magnitude of either vector.

Reason: The resultant of two vectors is obtained by means of law of parallelogram of Vectors.

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6. Assertion : An object has given two velocities $\vec{v}_1$ and $\vec{v}_2$ has a resultant velocity $\vec{v} = \vec{v}_1 + \vec{v}_2$.

Reason : $\vec{v}_1$ and $\vec{v}_2$ should be velocities with reference to some common reference frame.

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7. Assertion : A vector $\vec{A}$ can be resolved into component along with given vectors $\vec{a}$ and $\vec{b}$ lying in the same plane.

Reason : $\vec{A} = \lambda\vec{a} + \mu\vec{b}$ where λ and μ are real numbers.

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8. Assertion: If $\hat{i}$ and $\hat{j}$ are unit Vectors along x-axis and y-axis respectively, the magnitude of Vector $\hat{i}+\hat{j}$ will be $\sqrt{2}$

Reason: Unit vectors are used to indicate a direction only.

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9. Assertion: Rain is falling vertically with a certain speed. A boy holding an umbrella rides a bicycle in east to west direction and does not get wet.

Reason: The boy is holding his umbrella (at some angles) with the vertical towards the west.

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10. Assertion : The instantaneous velocity is given by the limiting value of the average velocity as the time interval approaches zero.

Reason : The direction of the average velocity is same as that of displacement.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer: B

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11. Assertion: The trajectory of an object moving under the same accleration due to gravity can be straight line or a parabola depending on the initial conditions.

Reason: The shape of the trajectory of the motion of an object is determined by the acceleration alone.

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12. Assertion: A projectile that traverses a parabolic path show deviation from its idealised trajectory in the presence of air resistance.

Reason: Air resistance affect the motion of the projectile.

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13. Assertion : A projectile should have two component velocities in two mutually perpendicular directions .

Reason : A body is said to be projectile if it has motion in two dimensions.

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14. Assertion: Centripetal acceleration is always direction towards the centre of rotation of an object undergoing uniform circular motion

Reason: Centripetal acceleration is a constant vector

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15. Assertion: A uniform circular motion is an acceleration motion.

Reason: Direction of acceleration is parallel to velocity vector.

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