PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

VECTORS

Vectors Vector Addition And Components Of A Vector

1. Which one of the following statements is true?

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

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

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

D. A scalar quantity has the same value for observes with different orientation of the axes

Answer: D

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2. 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 vector having different magnitudes cannot have their resultant Zero.

D. Vectors obey triangle law of addition.

Answer: B

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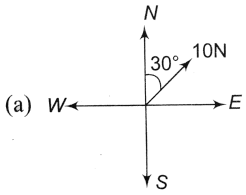
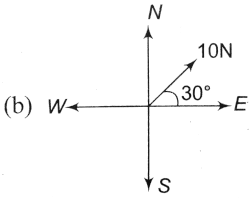
4. Which of the following figure represents the force of $10N$ in a direction of 30° east north?

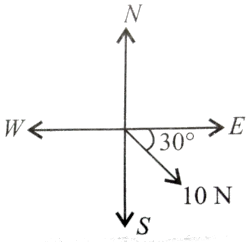
A.



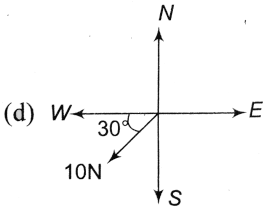
B.



C.



D.



Answer: A

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5. If $\vec{A}$ is a vector of magnitudes $5units$ due east. What is the magnitude and direction of a vector $-5\vec{A}$?

A. 5 units due east

B. 25 units due west

C. 5 units due west

D. 25 units due east

Answer: B

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

D. Angle between A and B

Answer: B

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7. How many minimum numbers of non zero vectors in different planes can be added to give zero resultant.

A. 2

B. 3

C. 4

D. 5

Answer: B

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8. If $\vec{P} = \vec{Q}$ then which of the following is NOT correct?

A. $\hat{P} = \hat{Q}$

B. $\left|\vec{P}\right| = \left|\vec{Q}\right|$

C. $P\hat{Q} = Q\hat{P}$

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

Answer: D

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9. Three concurrent force of the same magnitude are in equilibrium. What is the angle between the forces? Also name the triangle formed by the forces as sides.

A. 60° equilateral triangle

B. 120°, equilateral triangle

C. 30°, an isosceles triangle

D. 120°, an obtuse angled triangle

Answer: B

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

A. Zero

B. $1000N$

C. $500N$

D. $250N$

Answer: A

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11. Five equal forces of $10N$ each are applied at one point and all are lying one plane. If the angles between them are equal, the resultant force will be

A. Zero

B. $10N$

C. $20N$

D. $10\sqrt{2}N$

Answer: A

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12. In the following options you are given the magnitudes of three forces in newton acting simultaneously on a body. Fint the set for which the resultant force on the body can be zero

A. 10,8,2

B. 15,30,14

C. 40,19,17

D. 10,20,35

Answer: A

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13. Given that $\vec{A} + \vec{B} + \vec{C} = \vec{0}$. Out of three vectors, two are equal in magnitude and the magnitude of the third vectors is $\sqrt{2}$

times that of either of the two having equal magnitude. Find the angles between the vectors.

A. $30^\circ, 60^\circ, 90^\circ$

B. $45^\circ, 45^\circ, 90^\circ$

C. $45^\circ, 60^\circ, 90^\circ$

D. $90^\circ, 135^\circ, 135^\circ$

Answer: D

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14. A person moves 30 m north, then 20 m east and finally $30\sqrt{2}m$ south-west. This displacement from the original position is :

A. Zero

B. $28m$ towards south

C. $10m$ towards west

D. $15m$ towards east

Answer: A

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15. A boy walks uniformly along the sides of a rectangular park of size $400m \times 300m$, starting from one corner to the other corner diagonally opposite. Which of the following statements is incorrect?

A. He has travelled a distance of $700m$

B. His displcement is $700m$

C. His displcement is $500m$

D. His velocity is not uniform throughout the walk

Answer: B

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16. When three forces of $50N, 30N$ and $15N$ act on body, then the boy is

A. At rest

B. Moving with a uniform velocity

C. In equilibrium

D. Moving with an acceleration

Answer: D

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

A. $\frac{\pi}{2}$

B. $\cos^{-1}(0.6)$

C. $\tan^{-1}\left(\frac{7}{5}\right)$

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

Answer: A

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18. One of the rectangular components of velocity of $80Kmh^{-1}$ is $40Kmh^{-1}$. What is the other components?

A. $40Kmh^{-1}$

B. $69.28Kmh^{-1}$

C. $89.44Kmh^{-1}$

D. $120Kmh^{-1}$

Answer: B

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19. A force is inclined at 60° to the horizontal. If its rectangular component in the horizontal direction is $50N$, then magnitude of the vertical components of force is approximately

A. $25N$

B. $84N$

C. $87N$

D. $90N$

Answer: C

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20. A force of $5N$ acts on a particle along a direction making an angle of 60° with vertical. Its vertical component is

A. $10N$

B. $3N$

C. $4N$

D. $2.5N$

Answer: D

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21. y component of velocity is 20 and x component of velocity is 10. The direction of motion of the body with the horizontal at this instant is

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

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

C. 45°

D. 0°

Answer: A

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22. A vector $\vec{a}$ is turned without a change in its length through a small angle $d\theta$. Find the value of $\left|\Delta \vec{a}\right|$ and Δa.

A. $0, adth\eta$

B. $adth\eta, 0$

C. $0, 0$

D. None of these

Answer: B

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23. 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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Resultant Of Vectors

1. If $\left|\vec{A}+\vec{B}\right|=\left|\vec{A}\right|=\left|\vec{B}\right|$ then the angle between $\vec{A}$ and $\vec{B}$ is

A. 90°

B. 120°

C. 0°

D. 60°

Answer: C

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2. The maximum and minimum magnitude of the resultant of two given vectors are 17 units and 7 unit respectively. If these two vectors are at right angles to each other, the magnitude of their resultant is

A. 14

B. 16

C. 18

D. 13

Answer: D

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

A. $F_1 + F_2$

B. $F_1 - F_2$

C. $\sqrt{F_1^2 + F_2^2}$

D. $F_1^2 + F_2^2$

Answer: C

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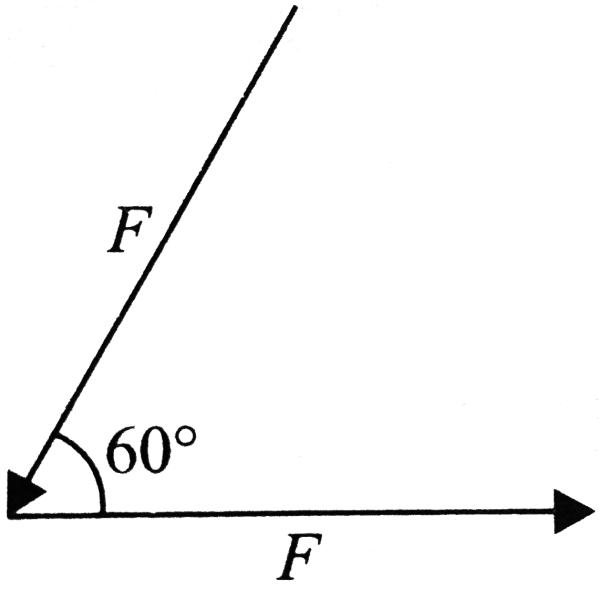
4. Two forces, each equal to F, act, as shown in figure. Their resultant is



A. $F/2$

B. $F/4$

C. F

D. $2F$

Answer: C

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5. What is the angle between $\vec{P}$ and the resultant of $\left(\vec{P}+\vec{Q}\right)$ and $\left(\vec{P}-\vec{Q}\right)$

A. Zero

B. $\tan^{-1}(P/Q)$

C. $\tan^{-1}(Q/P)$

D. $\tan^{-1}(P-Q)/(P+Q)$

Answer: A

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6. A force of $6kg$ another of $8kg$ can be applied together to produce the effect of a single force of

A. $1kg$

B. $9kg$

C. $15kg$

D. $22kg$

Answer: B

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7. The ratio of maximum and minimum magnitudes of the resultant of two vectors $\vec{a}$ and $\vec{b}$ is 3:1. Now, $\left|\vec{a}\right|$ is equal to

A. $P = 2Q$

B. $P = Q$

C. $PQ = 1$

D. None of these

Answer: A

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8. There are two forces vector,one of 5N and other of 12N. At what angle should the two vector be added to get the resultant vector of 17N, 7N,and 13N respectively?

A. $0^\circ, 180^\circ$ and 90°

B. $0^\circ, 90^\circ$ and 180°

C. $0^\circ, 90^\circ$ and 90°

D. $180^\circ, 0^\circ$ and 90°

Answer: A

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9. A particle is simultaneously acted by two forces equal to $4N$ and $3N$. The net force on the particle is

A. $7N$

B. $5N$

C. $1N$

D. Between $1N$ and 7 N`

Answer: D

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

A. $2N$ and $2N$

B. $1N$ and $1N$

C. $1N$ and $3N$

D. $1N$ and $4N$

Answer: D

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11. Two vectors $\vec{A}$ and $\vec{B}$ lie in plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors i.e., $\vec{A}+\vec{B}+\vec{C}$

A. Can be zero

B. cannnot be zero

C. Lies in the plane containing $\vec{A}+\vec{B}$

D. Lies in the plane containing $\vec{C}$

Answer: B

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12. 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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13. When two vectors of magnitudes P and Q are inclined at an angle θ, the magnitudes of their resultant is 2P. When the inclination is changed to $180^\circ - \theta$, the magnitude of the resultant is halved. Find the ratio of P and Q.

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

B. $1:\sqrt{3}$

C. $1:\sqrt{2}$

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

Answer: A

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14. Two forces of magnitudes P and Q are inclined at an angle (θ). The magnitude of their resultant is 3Q. When the inclination is

changed to $(180^\circ - \theta)$, the magnitude of the resultant force becomes Q. Find the ratio of the forces.

A. $\frac{4}{1}$

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

C. $\frac{1}{4}$

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

Answer: B

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15. The resultant of $\vec{A} + \vec{B} is \vec{R}_1$. On reversing the vector $\vec{B}$, the resultant becomes $\vec{R}_2$. What is the value of $R_1^2 + R_2^2$?

A. $A^2 + B^2$

B. $A^2 - B^2$

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

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

Answer: C

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

A. 30°

B. 45°

C. 60°

D. 90°

Answer: D

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17. The sum of two forces at a point is 16N. if their resultant is normal to the smaller force and has a magnitude of 8N, then two forces are

A. $6N$ and $10N$

B. $8N$ and $8N$

C. $4N$ and $2N$

D. $2N$ and $14N$

Answer: A

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18. If vector P, Q and R have magnitude 5,12,and 13 units and $\overrightarrow{P} + \overrightarrow{Q} = \overrightarrow{R}$, the angle between Q and R is

A. $\frac{\cos^{-1}5}{12}$

B. $\frac{\cos^{-1}5}{13}$

C. $\frac{\cos^{-1}(12)}{13}$

D. $\frac{\cos^{-1}7}{13}$

Answer: C

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19. The resultant of two vector A and B is at right angles to A and its magnitude is half of B. Find the angle between A and B.

A. 120°

B. 150°

C. 135°

D. None of these

Answer: B

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20. The resultant $\vec{P}$ and $\vec{Q}$ is perpendicular to $\vec{P}$. What is the angle between $\vec{P}$ and $\vec{Q}$?

A. $\cos^{-1}(P/Q)$

B. $\cos^{-1}(-P/Q)$

C. $\sin^{-1}(P/Q)$

D. $\sin^{-1}(-P/Q)$

Answer: B

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21. If the sum of two unit vectors is a unit vector,then find the magnitude of their differences.

A. $\sqrt{2}$

B. $sqer(3)$

C. $1/sqer(2)$

D. $\sqrt{5}$

Answer: B

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22. The resultant of two forces 3P and 2P is R. If the first force is doubled then resultant is also doubled.The angle between the two forces is

A. 30°

B. 60°

C. 90°

D. 120°

Answer: D

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

A. 12,5

B. 14,4

C. 5,13

D. 10,8

Answer: C

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24. Three forces P, Q and R are acting on a particel in the plane, the angle between P and Q and that between Q and R are 150° and 120° respectively. Then for equilibrium, forces P, Q and R are in the ratio

A. $1:2:3$

B. $1:2:\sqrt{3}$

C. $3:2:1$

D. $\sqrt{3}:2:1$

Answer: D

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Expressing Vectors In Unit Vector Notation

1. The magnitude of a given vector with end points $(4, -4, 0)$ and $(-2, -2, 0)$ must be

A. 6

B. $5\sqrt{2}$

C. 4

D. $2\sqrt{10}$

Answer: D

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2. The expression $\left(\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}\right)$ is a

A. Unit vector

B. Null vector

C. Vector of magnitude sqrt(2)`

D. Scalar

Answer: A

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3. $\overrightarrow{P}+\overrightarrow{Q}$ is a unit vector along x-axis. If $\overrightarrow{P}=\hat{i}-\hat{j}+\hat{k}$, then what is $\overrightarrow{Q}$?

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

B. $\hat{j}-\hat{k}$

C. $\hat{i}+\hat{j}+\hat{k}$

D. $\hat{j}+\hat{k}$

Answer: B

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4. The vector projection of a vector $3\hat{i}+4\hat{k}$ on y-axis is

A. 5

B. 4

C. 3

D. Zero

Answer: D

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5. The unit vector along $\hat{i} + \hat{j}$ is

A. $\hat{k}$

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

C. $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$

D. $\frac{\hat{i} + \hat{j}}{2}$

Answer: C

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6. The projection of a vector $\vec{r} = 3\hat{i} + \hat{j} + 2\hat{k}$ on the $x - y$ plane has magnitude

A. 2

B. $\sqrt{14}$

C. $\sqrt{10}$

D. $\sqrt{5}$

Answer: C

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7. The angle made by the vecotr $\overrightarrow{A} = \hat{i} + \hat{j}$ with x-axis is

A. 90°

B. 45°

C. 22.5°

D. 30°

Answer: B

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8. If a unit vector is represented by $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$ the value of c is

A. 1

B. $\sqrt{0.11}$

C. $\sqrt{0.01}$

D. $\sqrt{0.39}$

Answer: B

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9. With respect to a rectangular Cartesian coordinate system, three vectors are expressed as

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

Where, $\hat{i}, \hat{j}, \hat{k}$ are unit Vector, along the X, Y and Z-axis respectively.

The unit vectors $\hat{r}$ along the direction of sum of these vector is

A. $\vec{r} = \frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

B. $\vec{r} = \frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

C. $\vec{r} = \frac{1}{3}\left(\hat{i} - \hat{j} + \hat{k}\right)$

D. $\vec{r} = \frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

Answer: A

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10. If $\vec{A} = 4\hat{i} - 3\hat{j}$ and $\vec{B} = 6\hat{i} + 8\hat{j}$,then find the magnitude and direction of $\vec{A} + \vec{B}$.

A. $5, \tan^{-1}(3/4)$

B. $5\sqrt{5}, \tan^{-1}(1/2)$

C. $10, \tan^{-1}(5)$

D. $25, \tan^{-1}(3/4)$

Answer: B

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11. A truck travelling due to north at $20ms^{-1}$ turns west and travels at the same speed. Find the change in its velocity.

A. $40m/sS - W$

B. $20\sqrt{2}m/sN - W$

C. $40m/sS - W$

D. $20\sqrt{2}m/sS - W$

Answer: D

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12. Determine a vector which when added to the resultant of $\overrightarrow{A} = 2\hat{i} + 5\hat{j} - \hat{k}$ and $\overrightarrow{B} = 3\hat{i} - 4\hat{j} - \hat{k}$ gives unit Vector along negative y direction.

A. $-5\hat{i} - 2\hat{j} + 2\hat{k}$

B. $-5\hat{i} - \hat{j} + \hat{k}$

C. $5\hat{i} - \hat{j} + 2\hat{k}$

D. $-5\hat{i} - \hat{j} + 2\hat{k}$

Answer: A

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13. If a particle moves from point $P(2, 3, 5)$ to point $Q(3, 4, 5)$. Its displacement vector be

A. $\hat{i} + \hat{j} + 10\hat{k}$

B. $\hat{i} + \hat{j} + 5\hat{k}$

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

D. $2\hat{i} + 4\hat{j} + 6\hat{k}$

Answer: C

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14. Let $\vec{A} = 2\hat{i} + \hat{j}, B = 3\hat{j} - \hat{k}$ and $\vec{C} = 6\hat{i} - 2\hat{k}$. Find the value of $\vec{A} - 2\vec{B} + 3\vec{C}$.

A. $20\hat{i} + 5\hat{j} + 4\hat{k}$

B. $20\hat{i} - 5\hat{j} - 4\hat{k}$

C. $4\hat{i} + 5\hat{j} + 20\hat{k}$

D. $5\hat{i} + 4\hat{j} + 10\hat{k}$

Answer: B

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15. Two forces $F_1 = 1N$ and $F_2 = 2N$ act along the lines x=0 and y=0, respectively. Then find the resultant of forces.

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

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

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

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

Answer: D

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16. Following forces start acting on a particle at rest at the origin of the co-ordinate system simultaneously $\vec{F}_1 = -4\hat{i} - 5\hat{j} + 5\hat{k}, \vec{F}_2 = 5\hat{i} + 8\hat{j} + 6\hat{k}, \vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{F}_4 = 2\hat{i} - 3\hat{k}$ then the particle will move

A. in x-y plane

B. In y-z plane

C. In x-z plane

D. Along x-axis

Answer: B

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17. A body is at rest under the action of three forces, two of which are $\vec{F}_1 = 4\hat{i}, \vec{F}_2 = 6\hat{j}$, the third force is

A. $4\hat{i}+6\hat{j}$

B. $4\hat{i}-6\hat{j}$

C. $-4\hat{i}+6\hat{j}$

D. $-4\hat{i}-6\hat{j}$

Answer: D

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18. Find the vector that must be added to the vector $\hat{i}-3\hat{j}+2\hat{k}$ and $3\hat{i}+6\hat{j}-7\hat{k}$ so that the resultant vector is a unit vector along the y-axis.

A. $4\hat{i}+2\hat{j}+5\hat{k}$

B. $-4\hat{i}-2\hat{k}+5\hat{k}$

C. $3\hat{i}+4\hat{j}+5\hat{k}$

D. Null vector

Answer: B

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19. If $A = 3\hat{i} + 4\hat{j}$ and $B = 7\hat{i} + 24\hat{j}$,find the vector having the same magnitude as B and parallel to A.

A. $5\hat{i} + 20\hat{j}$

B. $15\hat{i} + 10\hat{j}$

C. $20\hat{i} + 15\hat{j}$

D. $15\hat{i} + 20\hat{j}$

Answer: D

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20. The unit vector parallel to the resultant of the vectors $\vec{A} = 4\hat{i} + 3\hat{j} + 6\hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} - 8\hat{k}$ is

A. $\frac{1}{7}\left(3\hat{i} + 6\hat{j} - 2\hat{k}\right)$

B. $\frac{1}{7}\left(3\hat{i} + 6\hat{j} + 2\hat{k}\right)$

C. $\frac{1}{49}\left(3\hat{i} + 6\hat{j} - 2\hat{k}\right)$

D. $\frac{1}{49}\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right)$

Answer: A

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21. Unit vector parallel to the resultant of vectors $\vec{A} = 4\hat{i} - 3\hat{j}$ and $\vec{B} = 8\hat{i} + 8\hat{j}$ will be

A. $\frac{24\hat{i} + 5\hat{j}}{13}$

B. $\frac{12\hat{i}+5\hat{j}}{13}$

C. $\frac{6\hat{i}+5\hat{j}}{13}$

D. None of these

Answer: B

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22. The three vector $\overrightarrow{A}=3\hat{i}-2\hat{j}+\hat{k}, \overrightarrow{B}=\hat{i}-3\hat{j}+5\hat{k}$ and $\overrightarrow{C}=2\hat{i}+\hat{j}-4\hat{k}$ from

A. An equilateral triangel

B. An isosceles triangle

C. A right angle triangle

D. No triangle

Answer: C

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Dot Product

1. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces

A. Are equal to each other in magnitude

B. Are not equal to each other in magnitude

C. Cannot be predicted

D. Are equal to each other

Answer: A

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2. When $\vec{A} . \vec{B} = -|A||B|$, then

A. $\vec{A}$ and $\vec{B}$ are perpendicular to each other

B. $\vec{A}$ and $\vec{B}$ act in the same direction

C. $\vec{A}$ and $\vec{B}$ act in the opposite direction

D. $\vec{A}$ and $\vec{B}$ can act in any direction

Answer: C

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3. Find the angle between the Vector $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$.

A. 30°

B. 60°

C. 120°

D. 90°

Answer: D

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4. The angle between two vectors given by $6\hat{i} + 6\hat{j} - 3\hat{k}$ and $7\hat{i} + 4\hat{j} + 4\hat{k}$ is

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

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

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

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

Answer: D

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5. The angle between two vectors $-2\hat{i}+3\hat{j}+\hat{k}$ and $2\hat{i}+2\hat{j}-4\hat{k}$ is

A. obtuse

B. right angle

C. acute

D. can't say

Answer: A

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6. The angle between two vectors $\overrightarrow{A}=3\hat{i}+4\hat{j}+5\hat{k}$ and $\overrightarrow{B}=3\hat{i}+4\hat{j}+5\hat{k}$ is

A. 60°

B. Zero

C. 90°

D. None of these

Answer: B

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7. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{j} - 4\hat{i} + \alpha\hat{k}$. Then the value of α is

A. -1

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

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

D. 1

Answer: C

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8. Given: $\vec{A} = A\cos\theta\hat{i} + A\sin\theta\hat{j}$. A vector $\vec{B}$, which is perpendicular to $\vec{A}$,is given by

A. $\hat{i}B\cos\theta + \hat{j}B\sin\theta$

B. $\hat{i}B\sin\theta + \hat{j}B\cos\theta$

C. $\hat{i}B\sin\theta + \hat{j}B\cos\theta$

D. $\hat{i}B\cos\theta - \hat{j}B\sin\theta$

Answer: C

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9. If $\vec{A}$ and $\vec{B}$ are perpendicular Vectors and vector $\vec{A} = 5\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{B} = 2\hat{i} + 2\hat{j} - a\hat{k}$. The value of a is

A. -2

B. 8

C. 7

D. -8

Answer: D

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10. The angles with a vector $\hat{i}+\hat{j}+\sqrt{2\hat{k}}$ makes with X,Y and Z axes respectively are

A. $60^\circ, 60^\circ, 60^\circ$

B. $45^\circ, 45^\circ, 45^\circ$

C. $60^\circ, 60^\circ, 45^\circ$

D. $45^\circ, 45^\circ, 60^\circ$

Answer: C

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11. If a vector $\vec{P}$ making angles α, β, γ respectively with the X,Y, and Z axes respectively. Then $\sin^2\theta + \sin^2\beta + \sin^2\gamma =$

A. 0

B. 1

C. 2

D. 3

Answer: C

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12. If two vectors $2\hat{i}+3\hat{j}-\hat{k}$ and $-4\hat{i}-6\hat{j}-\lambda\hat{k}$ are parallel to each other, then find the value of λ

A. 0

B. -2

C. 3

D. 4

Answer: B

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13. The angle between two vectors $\overrightarrow{A}=3\hat{i}+4\hat{j}+5\hat{k}$ and $\overrightarrow{B}=3\hat{i}+4\hat{j}+5\hat{k}$ is

A. 90°

B. 0°

C. 60°

D. 45°

Answer: A

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14. If for two vectors $\vec{A}$ and $\vec{B}$, sum $\left(\vec{A}+\vec{B}\right)$ is perpendicular to the difference $\left(\vec{A}-\vec{B}\right)$. Find the ratio of their magnitude.

A. 1

B. 2

C. 3

D. None of these

Answer: A

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15. The angle between the Vector $\left(\hat{i}+\hat{j}\right)$ and $\left(\hat{j}+\hat{k}\right)$ is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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16. If $\overrightarrow{P}.\overrightarrow{Q}=PQ$, then angle between $\overrightarrow{P}$ and $\overrightarrow{Q}$ is

A. 0°

B. 30°

C. 45°

D. 60°

Answer: A

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17. The vector $\overrightarrow{P} = a\hat{i} + a\hat{j} + 3\hat{k}$ and $\overrightarrow{Q} = a\hat{i} - 2\hat{j} - \hat{k}$ are perpendicular to each other. The positive value of a is

A. 3

B. 4

C. 9

D. 13

Answer: A

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

A. $4\hat{i} + 3\hat{j}$

B. $6\hat{i}$

C. $7\hat{k}$

D. $3\hat{i} - 4\hat{j}$

Answer: C

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19. At what angle must the two forces $(x+y)$ and $(x-y)$ act so that the resultant may be $\sqrt{\left(x^2+y^2\right)}$:-

A. $\cos^{-1}\left(-\frac{x^2+y^2}{2x^2-y^2}\right)$

B. $\cos^{-1}\left(-\frac{2\left(x^2-y^2\right)}{x^2+y^2}\right)$

C. $\cos^{-1}\left(\frac{x^2+y^2}{x^2-y^2}\right)$

D. $\cos^{-1}\left(-\frac{x^2-y^2}{x^2+y^2}\right)$

Answer: A

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20. The component of vector $A=2\hat{i}+3\hat{j}$ along the vector $\hat{i}+\hat{j}$ is

A. $\frac{5}{\sqrt{2}}$

B. $10\sqrt{2}$

C. $5\sqrt{2}$

D. 5

Answer: A

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21. If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} + 4\hat{k}$, then find the projection of $\vec{A}$ on $\vec{B}$.

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

B. $\frac{3}{\sqrt{26}}$

C. $\sqrt{\frac{3}{26}}$

D. $\sqrt{\frac{3}{13}}$

Answer: B

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22. 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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Cross Product

1. Vector $\vec{A}$ makes equal angles with x-,y-,and z-axis. Find the value of its components (in terms of magnitude of $\vec{A}$)

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

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

C. $\sqrt{3}A$

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

Answer: A

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2. If $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ then the direction of cosins of the vector $\vec{A}$ are

A. $\frac{2}{\sqrt{45}}, \frac{4}{\sqrt{45}}$ and $\frac{-5}{\sqrt{45}}$

B. $\frac{1}{\sqrt{45}}, \frac{2}{\sqrt{45}}$ and $\frac{3}{\sqrt{45}}$

C. $\frac{4}{\sqrt{45}}, 0$ and $\frac{4}{\sqrt{45}}$

D. $\frac{3}{\sqrt{45}}, \frac{2}{\sqrt{45}}$ and $\frac{5}{\sqrt{45}}$

Answer: A

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3. The area of the parallelogram represented by the vectors $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = \hat{i} + 4\hat{j}$ is

A. 14 units

B. 7.5 unit

C. 10 unit

D. 5 unit

Answer: D

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4. Find the torque of the force $\vec{F} = \left(2\hat{i} - 3\hat{j} + 4\hat{k}\right)$ N acting at the point $\vec{r} = \left(3\hat{i} - 2\hat{j} + 3\hat{k}\right)$m about the origion.

A. $6\hat{i} - 6\hat{j} + 12\hat{k}$

B. $17\hat{i} - 6\hat{j} - 13\hat{k}$

C. $-6\hat{i} + 6\hat{j} - 12\hat{k}$

D. $-17\hat{i} + 6\hat{j} + 13\hat{k}$

Answer: B

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5. If for two vectors $\vec{A}$ and $\vec{B}$, $\vec{A} \times \vec{B} = 0$, the vectors

A. Are perpendicular to each other

B. Are parallel to each other

C. Act at an angle of 60°

D. Act at an angle of 30°

Answer: B

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6. The angle between Vectors $\left(\vec{A} \times \vec{B}\right)$ and $\left(\vec{B} \times \vec{A}\right)$ is

A. Zero

B. π

C. $\pi/4$

D. $\pi/2$

Answer: B

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7. What is the anlge between $\vec{P} \times \vec{Q}$ and $\vec{Q} \times \vec{P}$ is

A. 0

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

C. $\frac{\pi}{4}$

D. π

Answer: B

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8. What is the unit vector perpendicular to the following Vector $2\hat{i}+2\hat{j}-\hat{k}$ and $6\hat{i}-3\hat{j}+2\hat{k}$?

A. $\frac{\hat{i}+10\hat{j}-18\hat{k}}{5\sqrt{17}}$

B. $\frac{\hat{i}-10\hat{j}+18\hat{k}}{5\sqrt{17}}$

C. $\frac{\hat{i}-10\hat{j}-18\hat{k}}{5\sqrt{17}}$

D. $\frac{\hat{i}+10\hat{j}+18\hat{k}}{5\sqrt{17}}$

Answer: C

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9. The area of the parallelogram whose sides are represented by the vector $\hat{j}+3\hat{k}$ and $\hat{i}+2\hat{j}-\hat{k}$ is

A. $\sqrt{16}sq.\ unit$

B. $\sqrt{59} sq.\ unit$

C. $\sqrt{49} sq.\ unit$

D. $\sqrt{52} sq.\ unit$

Answer: B

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10. The position of the particle is given by $\vec{r} = \left(\vec{i} + 2\vec{j} - \vec{k}\right)$ momentum $\vec{P} = \left(3\vec{i} + 4\vec{j} - 2\vec{k}\right)$. The angular momentum is perpendicular to

A. x-axis

B. y-axis

C. z-axis

D. Line at equal angles to all the three axes

Answer: A

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11. If A=5 units,B=6 units and $\left|\vec{A} \times \vec{B}\right| = 15 units$, then what is the angle between $\vec{A}$ and $\vec{B}$?

A. 30°

B. 60°

C. 90°

D. 120°

Answer: A

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12. The area of the parallelogram whose diagonals are $\vec{P} = 2\hat{i} + 3\hat{j}$ and $\vec{Q} = \hat{i} + 4\hat{j}$is

A. 5 square units

B. 10 square units

C. 20 square units

D. 2.5 square units

Answer: D

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

A. $\vec{B}$

B. $\overrightarrow{C}$

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

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

Answer: C

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14. If a vector $\overrightarrow{A}$ is parallel to another vector $\overrightarrow{B}$ then the resultant of the vector $\overrightarrow{A} \times \overrightarrow{B}$ will be equal to

A. A

B. $\overrightarrow{A}$

C. Zero vector

D. Zero

Answer: C

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15. If $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} - 2\hat{j} + 4\hat{k}$, then find the value of $\left|\vec{A} \times \vec{B}\right|$

A. $8\sqrt{2}$

B. $8\sqrt{3}$

C. $8\sqrt{5}$

D. $5\sqrt{8}$

Answer: B

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16. Which of the following is the unit vector perpendicular to $\vec{A}$ and $\vec{B}$?

A. $\frac{\hat{A} \times \hat{B}}{AB \sin \theta}$

B. $\frac{\hat{A} \times \hat{B}}{AB \cos \theta}$

C. $\frac{\vec{A} \times \vec{B}}{AB \sin \theta}$

D. $\frac{\vec{A} \times \vec{B}}{AB \cos \theta}$

Answer: C

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17. The angle between the vector $\vec{A}$ and $\vec{B}$ is θ. Find the value of triple product $\vec{A} . \left(\vec{B} \times \vec{A} \right)$.

A. $A^2 B$

B. Zero

C. $A^2 B \sin \theta$

D. $A^2 B \cos \theta$

Answer: B

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18. The angle between vectors $\left(\vec{A} \times \vec{B}\right)$ and $\left(\vec{B} \times \vec{A}\right)$ is

A. $\pi / 2$

B. $\pi / 3$

C. π

D. $\pi / 4$

Answer: C

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19. The angle between Vectors $\left(\vec{A} \times \vec{B}\right)$ and $\left(\vec{B} \times \vec{A}\right)$ is

A. Zero

B. π

C. $\pi/4$

D. $\pi/2$

Answer: B

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20. Two vector $\overrightarrow{A}$ and $\overrightarrow{B}$ have equal magnitudes. Then the vector $\overrightarrow{A}+\overrightarrow{B}$ is perpendicular :

A. $A \times B$

B. $A - B$

C. $3A - 3B$

D. All of these

Answer: A

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21. The value of $\left(\vec{A}+\vec{B}\right)\times\left(\vec{A}-\vec{B}\right)$ is

A. 0

B. A^2-B^2

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

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

Answer: D

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22. Two adjacent sides of a parallelogram are respectively by the two vectors $\hat{i} + 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$. What is the area of parallelogram?

A. 8

B. $8\sqrt{3}$

C. $3\sqrt{8}$

D. 192

Answer: B

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23. The vector from origion to the point A and B are $\vec{A} = 3\hat{i} - 6\hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} + \hat{j} - 2\hat{k}$,respectively. Find the area of the triangle OAB.

A. $\frac{5}{2}\sqrt{17} sq.\ unit$

B. $\frac{2}{5}\sqrt{17} sq.\ unit$

C. $\frac{3}{5}\sqrt{17} sq.\ unit$

D. $\frac{5}{3}\sqrt{17} sq.\ unit$

Answer: A

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24. What is the unit vector perpendicular to the following Vector $2\hat{i} + 2\hat{j} - \hat{k}$ and $6\hat{i} - 3\hat{j} + 2\hat{k}$?

A. $\frac{\hat{i} + 10\hat{j} - 18\hat{k}}{5\sqrt{17}}$

B. $\frac{\hat{i} - 10\hat{j} + 18\hat{k}}{5\sqrt{17}}$

C. $\frac{\hat{i} - 10\hat{j} - 18\hat{k}}{5\sqrt{17}}$

D. $\frac{\hat{i} + 10\hat{j} + 18\hat{k}}{5\sqrt{17}}$

Answer: C

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25. If $\left|\vec{A} \times \vec{B}\right| = \sqrt{3}\vec{A} \cdot \vec{B}$, then the value of $\left|\vec{A} + \vec{B}\right|$ is

A. $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$

B. $A + B$

C. $\left(A^2 + B^2 + \sqrt{3}AB\right)^{1/2}$

D. $\left(A^2 + B^2 + AB\right)^{1/2}$

Answer: D

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Problems Based On Mixed Concepts

1. A unit vector in the dirction 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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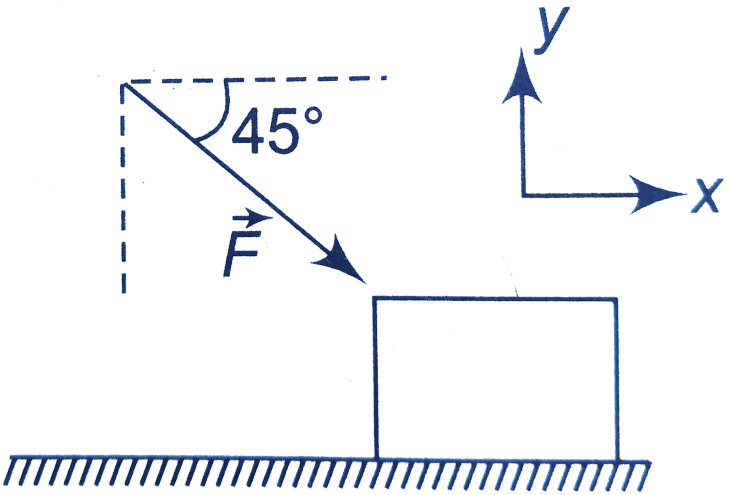
2. A person pushes a box kept on a horizontal surface with force of $100N$.In unit vector natation force can be expressed as:



A. $100\left(\hat{i}+\hat{j}\right)$

B. $100\left(\hat{i}-\hat{j}\right)$

C. $50\sqrt{2}\left(\hat{i}-\hat{j}\right)$

D. $50\sqrt{2}\left(\hat{i}+\hat{j}\right)$

Answer: C

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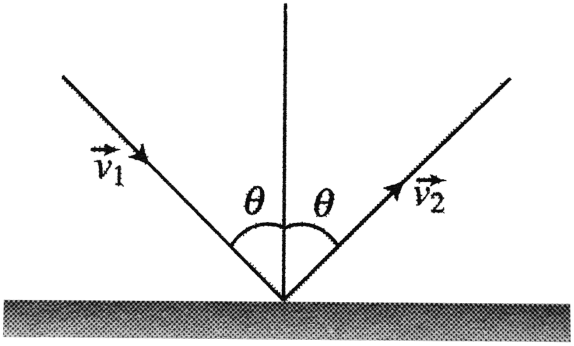
3. An object of m kg with speed of v ms^{-1} strikes a wall at an angle θ and rebounds at the same speed and same angle. Find the magnitude of change in the momentum of object.



A. $2mv\cos\theta$

B. $2mv\sin\theta$

C. 0

D. $2mv$

Answer: A

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

A. 30°

B. 45°

C. 60°

D. 90°

Answer: B

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

A. $\overrightarrow{b}$

B. $\overrightarrow{c}$

C. $\overrightarrow{b} . \overrightarrow{c}$

D. $\overrightarrow{b} \times \overrightarrow{c}$

Answer: D

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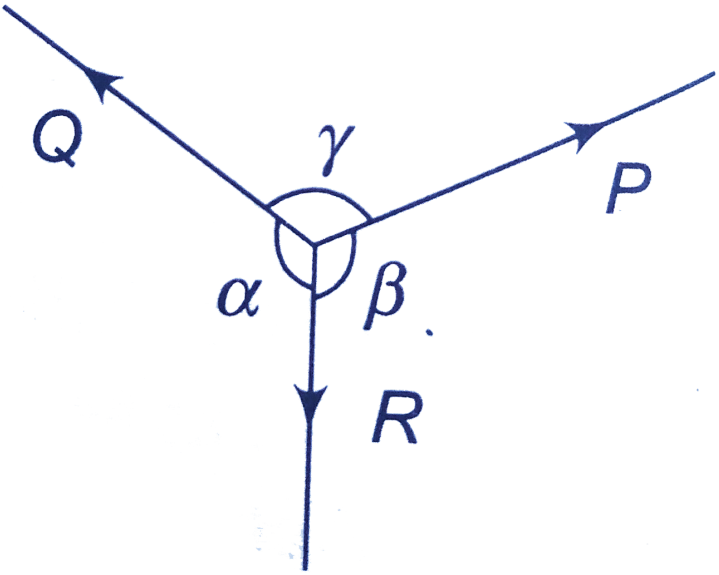
6. A body is in equilibrium under the action of three coplanar forces P, Q and R as shown in figure. Select the correct

statement.



A. $\frac{P}{\sin\alpha} = \frac{Q}{\sin\beta} = \frac{R}{\sin\gamma}$

B. $\frac{P}{\cos\alpha} = \frac{Q}{\cos\beta} = \frac{R}{\cos\gamma}$

C. $\frac{P}{\tan\alpha} = \frac{Q}{\tan\beta} = \frac{R}{\tan\gamma}$

D. $\frac{P}{\sin\beta} = \frac{Q}{\sin\gamma} = \frac{R}{\sin\alpha}$

Answer: A

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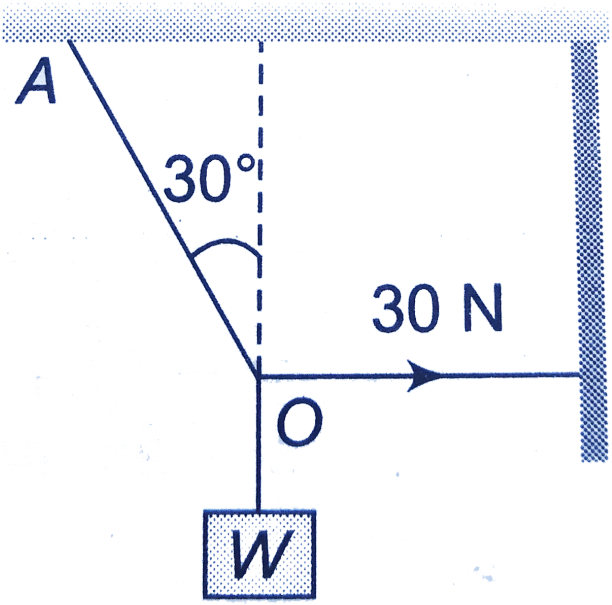
7. As shown in figure the tension in the horizontal cord is $30N$. The weight W and tension in the string OA in Newton are



A. $30\sqrt{3}, 30$

B. $30\sqrt{3}, 60$

C. $60\sqrt{3}, 30$

D. None of these

Answer: B

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8. A particle is moving eastwards with a velocity of $5ms_{-1}$. In $10\,\text{sec}\,onds$ the velocity changes to $5ms^{-1}$ northwards. The average acceleration in this time is

A. Zero

B. $\frac{1}{\sqrt{2}}m/s^2N - W$

C. $\frac{1}{\sqrt{2}}m/s^2N - E$

D. $\frac{1}{\sqrt{2}}m/s^2S - W$

Answer: B

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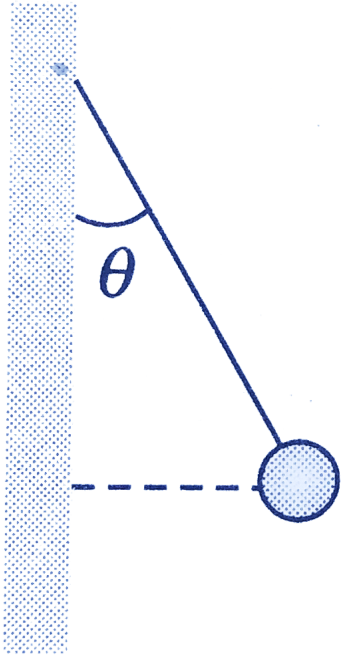
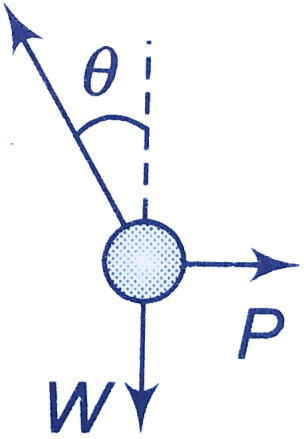
9. A metal sphere is hung by a string fixed to a wall. The sphere is pushed away from the wall by a stick. The forces acting on the sphere are shown in the second diagram. Which of the following statements is wrong?





A. $P = W \tan\theta$

B. $\overrightarrow{T} + \overrightarrow{P} + \overrightarrow{W} = 0$

C. $T^2 = P^2 + W^2$

D. $T = P + W$

Answer: D

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10. Consider east as positive x-axis, north as positive y-axis and vertically upward direction as z-axis. A helicopter first rises up to an altitide of $100m$ than flies straight in north $500m$ and then suddenly takes a turn towards east and travels $1000m$ east. What is position vector of helicopter ? (Take starting point as origin)

A. $1000\hat{i} - 500\hat{j} + 100\hat{k}$

B. $1000\hat{i} + 500\hat{j} - 100\hat{k}$

C. $1000\hat{i} + 500\hat{j} + 100\hat{k}$

D. $-1000\hat{i} + 500\hat{j} + 100\hat{k}$

Answer: C

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11. In a methane $(CH_4$ molecule each hydrogen atom is at a corner of a regular tetrahedron with the carbon atom at the centre. In coordinates where one of the $C-H$ bond in the $\hat{i}-\hat{j}-\hat{k}$, an adjacent $C-H$ bond in the $\hat{i}-\hat{j}-\hat{k}$ direction. Then angle between these two bonds.

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

B. $\cos^{-1}\left(\frac{2}{3}\right)$

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

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

Answer: C

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12. If the resultant of two forces of magnitudes p and $2p$ is perpendicular to p, then the angle between the forces is

A. $\frac{2\pi}{3}$

B. $\frac{3\pi}{4}$

C. $\frac{4\pi}{5}$

D. $\frac{5\pi}{6}$

Answer: A

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13. Consider east as positive x-axis, north as positive y-axis. A girl walks $10m$ east first time than $10m$ in a direction 30° west of north for the second time and then third time in unknown

direction and magnitude so as to return to her initial position. What is her third displacement in unit vector notation.?

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

B. $5\hat{i}-5\sqrt{3}\hat{j}$

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

D. She cannot return

Answer: A

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14. A car moving on a straight road due north with a uniform speed of $50kmh^{-1}$ when it returns left through 90°. If the speed remains unchanged after turning process is

A. Zero

B. $50\sqrt{2}kmh^{-1}S-Wdirection$

C. $50\sqrt{2}kmh^{-1}N-Wdirection$

D. $50kmh^{-1}duewest$

Answer: B

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15. What is the angle between $\left(\vec{P}+\vec{Q}\right)$ and $\left(\vec{P}\times\vec{Q}\right)$?

A. 90°

B. 0° only

C. any angle between 0° and 180°

D. 180° only

Answer: C

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16. In x-y plane, a force $10N$ acts at an angle 30° to the positive direction of x-axis. The force can be written as

A. $5\hat{i} + 5\hat{j}$

B. $5\sqrt{3}\hat{i} + 5\hat{j}N$

C. $5\hat{i} + 5\sqrt{3}\hat{j}N$

D. None of these

Answer: B

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17. A sail boat sails $2km$ due east, $5km$ 37° south of east, and finally an unknown displacement. If the final displacement of the

boat from the starting point is $6km$ due east,determine the third displacement.

A. $3km$ North

B. $4km$, South

C. $5km$, East

D. $3km$,West

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

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. The position vectors of two balls are given by

$\vec{r}_1 = 2(m)i + 7(m)j$

$\vec{r}_2 = -2(m)i + 4(m)j$

What will be the distance between the two balls?

A. $4m$

B. $4.5m$

C. $5m$

D. $3m$

Answer: C

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20. A particle whose speed is $50ms^{-1}$ moves along the line from $A(2, 1)$ to $B(9, 25)$. Find its velocity vector in the from of $a\hat{i} + b\hat{j}$.

A. $\left(7\hat{i} + 24\hat{j}\right)m/s$

B. $2\left(7\hat{i} + 24\hat{j}\right)m/s$

C. $4\left(7\hat{i} + 24\hat{j}\right)m/s$

D. $5\left(7\hat{i} + 24\hat{j}\right)m/s$

Answer: B

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21. A particle travels with speed $50ms^{-1}$ from the point $(3, -7)$ in a direction $7\hat{i} - 24(j)$. Find its position vector after $3s$.

A. $\left(45\hat{i} - 125\hat{j}\right)m$

B. $\left(45\hat{i} - 151\hat{j}\right)m$

C. $\left(45\hat{i} - 125\hat{j}\right)m$

D. $\left(35\hat{i} - 115\hat{j}\right)m$

Answer: B

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

A. $6\sqrt{3}unit$

B. $6\sqrt{2}unit$

C. $7\sqrt{3}unit$

D. $7\sqrt{2}unit$

Answer: D

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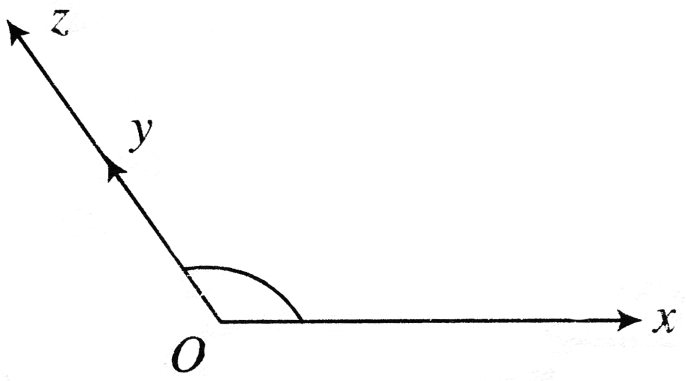
23. Forces X,Y and Z have magnitudes $10N$, $5\left(\sqrt{3}-1\right)N$ and $5\left(\sqrt{3}+1\right)N$, respectively. The forces Y and Z act in the same direction as shown in figure. The resultant of X and Y and the resultant of X and Z have the same magnitudes. Find θ, the angle

between X and Y.



A. 150°

B. 135°

C. 120°

D. 105°

Answer: A

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24. A car going due North at $10\sqrt{2}ms^{-1}$ turns right through an angle of 90° without changing speed. The change in velocity of car is

A. $20ms^{-1}$ in South -East direction

B. $20\sqrt{20}ms^{-1}$ in South -East direction

C. $20ms^{-1}$ in North-West dircrection

D. $20ms^{-1}$ in North-West direction

Answer: A

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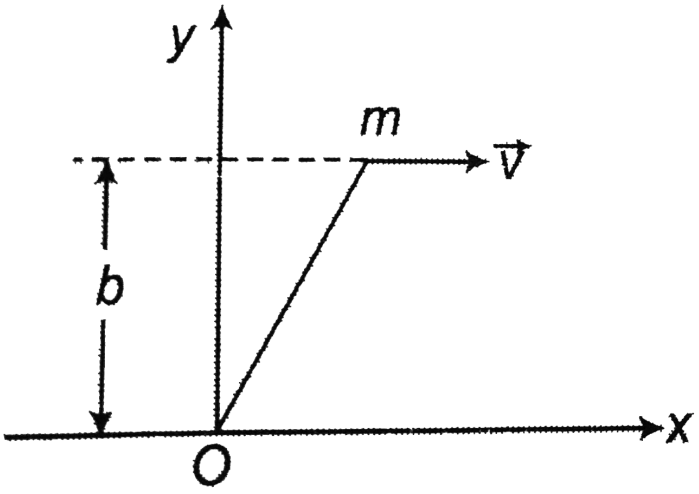
25. If the particle of mass m is moving with constant velocity v parallel to x-axis in x-y plane as shown in figure. Find its angular

momentum with respect to origin at any time t.



A. $mvb\hat{k}$

B. $-mvb\hat{k}$

C. $mvb\hat{i}$

D. $mv\hat{i}$

Answer: B

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26. If $\vec{A} \times \vec{B} = \vec{C}$, then which of the following statements is wrong?

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

B. $\vec{C} \perp \vec{B}$

C. $\vec{C} \perp \left(\vec{A} + \vec{B}\right)$

D. $\vec{C} \perp \left(\vec{A} \times \vec{B}\right)$

Answer: D

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27. The linear velocity of a rotating body is given by $\vec{v} = \vec{\omega} \times \vec{r}$, where $\vec{\omega}$ is the angular velocity and $\vec{r}$ is the radius vector. The angular velocity of a body is $\vec{\omega} = \hat{i} - 2\hat{j} + 2\hat{k}$ and the radius vector $\vec{r} = 4\hat{j} - 3\hat{k}$, then $\left|\vec{v}\right|$ is

A. $\sqrt{29}units$

B. $\sqrt{31}unit$

C. $\sqrt{37}unit$

D. $\sqrt{41}unit$

Answer: A

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28. If $\vec{A} \times \vec{B} = \vec{C} + \vec{D}$, then select the correct alternative.

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

B. $\vec{A}$ is perpendicualr to $\vec{C}$.

C. Components 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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29. $\left|\vec{A} \times \vec{B}\right|^2 + \left|\vec{A} . \vec{B}\right|^2 =$

A. Zero

B. $A^2 B^2$

C. AB

D. $\sqrt{AB}$

Answer: B

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

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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31. If $\vec{A}$ and $\vec{B}$ are two vectors, which of the following is not correct?

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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32. The angle between the vector $\vec{A}$ and $\vec{B}$ is θ. Find the value of triple product $\vec{A} \cdot \left(\vec{B} \times \vec{A}\right)$.

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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Assertion Reasoning

1. Assertion: Two vectors are said to be like vectors if they have same direction but different magnitude.

Reason: Vector quantities do not have specific direction.

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 aseertion and reason are false.

Answer: C

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

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

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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3. Assertion: A null Veactor is a vector whose magnitude is zero and directon is arbitrary.

Reason: A null vector does not exist

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 aseertion and reason are false.

Answer: C

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4. 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.

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 aseertion and reason are false.

Answer: A

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5. Assertion: Vector addition is commutative.

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

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 aseertion and reason are false.

Answer: B

Watch Video Solution

6. Assertion: The some of two Vectors can be zero.

Reason: The vector cancel each other, when they are equal and opposite.

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 aseertion and reason are false.

Answer: A

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7. Assertion: Minimum number of non-equal Vectors in a plane required to give zero resultant is three.

Reason: If $\vec{A} + \vec{B} + \vec{C} = \vec{0}$, then they must lie in one plane

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 aseertion and reason are false.

Answer: B

Watch Video Solution

8. Assertion: The minimum number of non-coplanar Vectors whose sum can be zero, is four

Reason: The resultant of two vectors of unequal magnitude can be zero.

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 aseertion and reason are false.

Answer: C

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9. Assertion: $\vec{A} \times \vec{B}$ is perpendicualr to both $\vec{A} - \vec{B}$ as well as $\vec{A} - \vec{B}$

Reason: $\vec{A} \times \vec{B}$ as well as $\vec{A} - \vec{B}$ lie in the plane containing $\vec{A}$ and $\vec{B}$, but $\vec{A} \times \vec{B}$ lies perpendicular to the plane containing $\vec{A}$ and $\vec{B}$.

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 aseertion and reason are false.

Answer: A

Watch Video Solution

10. Assertion: Angle between $\hat{i}+\hat{j}$ and $\hat{i}$ is 45°.

Reason: $\hat{i}+\hat{j}$ is equally inclined to both $\hat{i}$ and $\hat{j}$ and the angle between $\hat{i}$ and $\hat{j}$ is 90°.

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 aseertion and reason are false.

Answer: A

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11. Assertion: If $\left|\vec{A}+\vec{B}\right|=\left|\vec{A}-\vec{B}\right|$, then angle between $\vec{A}$ and $\vec{B}$ is 90°

Reason: $\vec{A}+\vec{B}=\vec{B}+\vec{A}$

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 aseertion and reason are false.

Answer: B

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12. Assertion: The scalar product of two vectors can be zero

Reason: If two vectors are perpendicular to each other their scalar product will be zero.

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 aseertion and reason are false.

Answer: A

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13. Assertion: If $\vec{A} . \vec{B} = \vec{B} . \vec{C}$, then $\vec{A}$ may not always be equal to $\vec{C}$.

Reason: The dot product of two vectors involves consine of the angle between the two vectors.

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 aseertion and reason are false.

Answer: A

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14. Assertion: If θ be the angle between $\vec{A}$ and $\vec{B}$, then

$$\tan\theta = \frac{\vec{A} \times \vec{B}}{\vec{A} \cdot \vec{B}}$$

Reason: $\vec{A} \times \vec{B}$ is perpendicualr to $\vec{A} \cdot \vec{B}$.

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 aseertion and reason are false.

Answer: D

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15. Assertion: Vector product of two vectors is an axial vector.

Reason: If $\overrightarrow{v} =$ instantaneous Velocity, $\overrightarrow{r} =$ radius vector and $\overrightarrow{\omega} =$ angular velocity, then $\overrightarrow{\omega} = \overrightarrow{v} \times \overrightarrow{r}$.

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 aseertion and reason are false.

Answer: C

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16. Assertion: $\vec{\tau} = \vec{r} \times \vec{F}$ and $\vec{\tau} \neq \vec{F} \times \vec{r}$

Reason: Cross product of vectors is commutative.

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 aseertion and reason are false.

Answer: C

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17. Assertion: If dot product and cross product of $\vec{A}$ and $\vec{B}$ are zero, it implies that one of the vector $\vec{A}$ and $\vec{B}$ must be a null

vector.

Reason: Null vector is a vector with zero magnitude.

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 aseertion and reason are false.

Answer: B

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Neet Questions

1. The angle between the two Vectors $\overrightarrow{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $\overrightarrow{B} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ will be

A. Zero

B. 45°

C. 90°

D. 180°

Answer: C

Watch Video Solution

2. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces

A. Cannot be predicted

B. are equal to the each other

C. are equal to each other in magnitude

D. are not equal to each other in magnitude

Answer: C

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3. If $\left|\vec{A} \times \vec{B}\right| = \sqrt{3}\vec{A} . \vec{B}$, then the value of $\left|\vec{A} + \vec{B}\right|$ is

A. $\left(A^2 + B^2 + AB\right)^{1/2}$

B. $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$

C. $A + B$

D. $\left(A^2 + B^2 + \sqrt{3}AB\right)^{1/2}$

Answer: A

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4. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{j}-4\hat{i}+\alpha\hat{k}$. Then the value of α is

A. -1

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

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

D. 1

Answer: C

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

A. 60°

B. 45°

C. 30°

D. 90°

Answer: A

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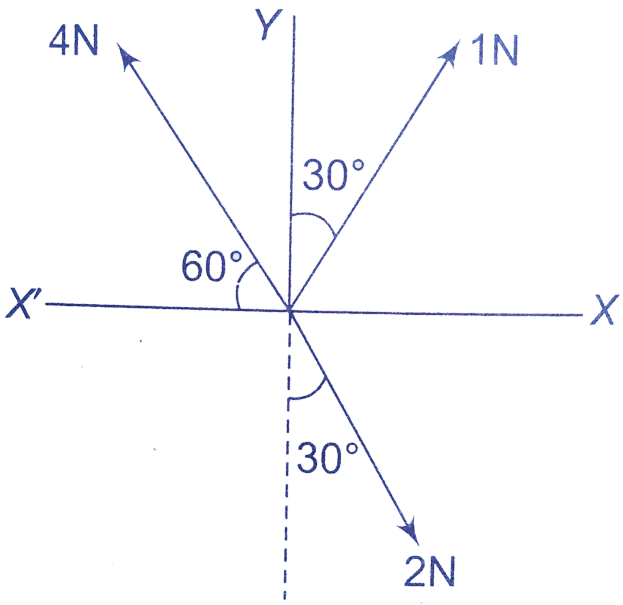
6. Three forces are acting on a particle as shown in the figure. To have the resultant force only along the Y-direction, the magnitude

of the minimum additional force needed is



A. $0.5N$

B. $1.5N$

C. $\frac{\sqrt{3}}{4}N$

D. $\sqrt{3}N$

Answer: A

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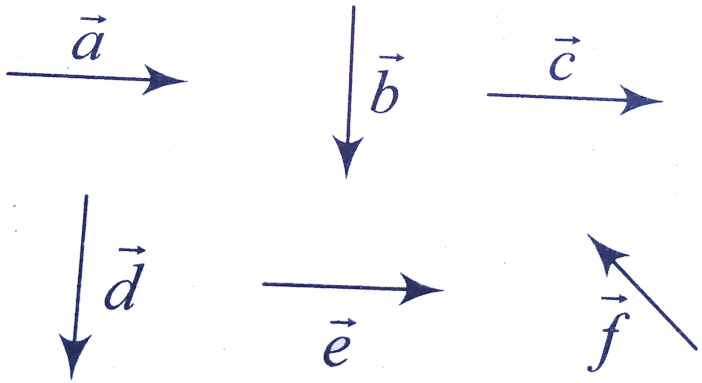
7. Six vector $\vec{a}$ through $\vec{f}$ have the magnitudes and direction indicated in the figure. Which of the following statements is true?



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

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

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

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

Answer: C

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

A. 9 units

B. $9\sqrt{2}units$

C. $5\sqrt{2}units$

D. 5 unit

Answer: C

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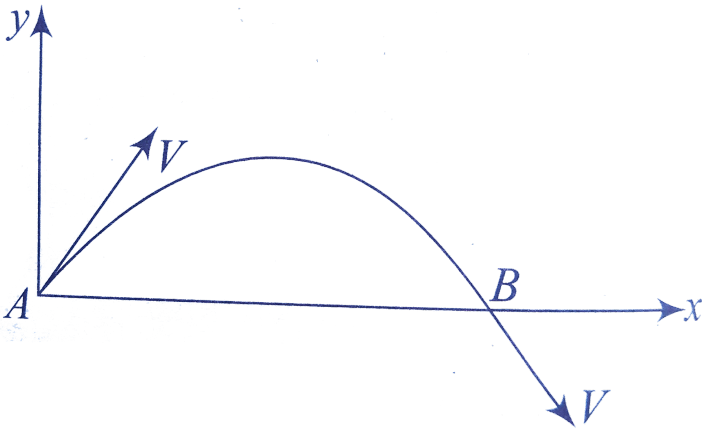
9. The velocity of a projectile at the initial point A is $\left(2\hat{i}+3\hat{j}\right)m/s$.Its velocity (in m//s) at point B is



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

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

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

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

Answer: C

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10. If Vectors $\vec{A} = \cos\omega\hat{i} + \sin\omega\hat{j}$ and $\vec{B} = (\cos)\frac{\omega t}{2}\hat{i} + (\sin)\frac{\omega t}{2}\hat{j}$ are functions of time. Then the value of t at which they are orthogonal to each other is

A. $t = 0$

B. $t = \frac{\pi}{4\omega}$

C. $t = \frac{\pi}{2\omega}$

D. $t = \frac{\pi}{\omega}$

Answer: D

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11. The position vector of a particle $\vec{R}$ as a funtion of time is given by:

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

Where R is in meters, t is in seconds and $\hat{i}$ and $\hat{j}$ denote until vectors along x-and y- directions, respectively Which one of the following statements is wrong for the motion of particle ?

A. Path of the particle is a circle of radius $4meter$

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

C. Magnitude of acceleration vector is $\frac{V_2}{R}$ where $v$is the velocity of particle.

D. Magnitude of the Velocity of particle is $8meter/\sec ond$

Answer: D

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12. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vector, the angle between these Vector is

A. 180°

B. 0°

C. 90°

D. 45°

Answer: C

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Chapter Test

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

A. 0

B. π

C. $\pi/2$

D. $\pi/4$

Answer: C

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2. The angle between the two vector $\vec{A} = 5\hat{i} + 5\hat{j}$ and $\vec{B} = 5\hat{i} - 5\hat{j}$ will be

A. Zero

B. 45°

C. 90°

D. 180°

Answer: C

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3. Angle between the vectors $\left(\hat{i}+\hat{j}\right)$ and $\left(\hat{j}-\hat{k}\right)$ is

A. 90°

B. 0°

C. 180°

D. 60°

Answer: D

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4. If the resultant of n forces of different magnitudes acting at a point is zero, then the minimum value of n is

A. 1

B. 2

C. 3

D. 4

Answer: C

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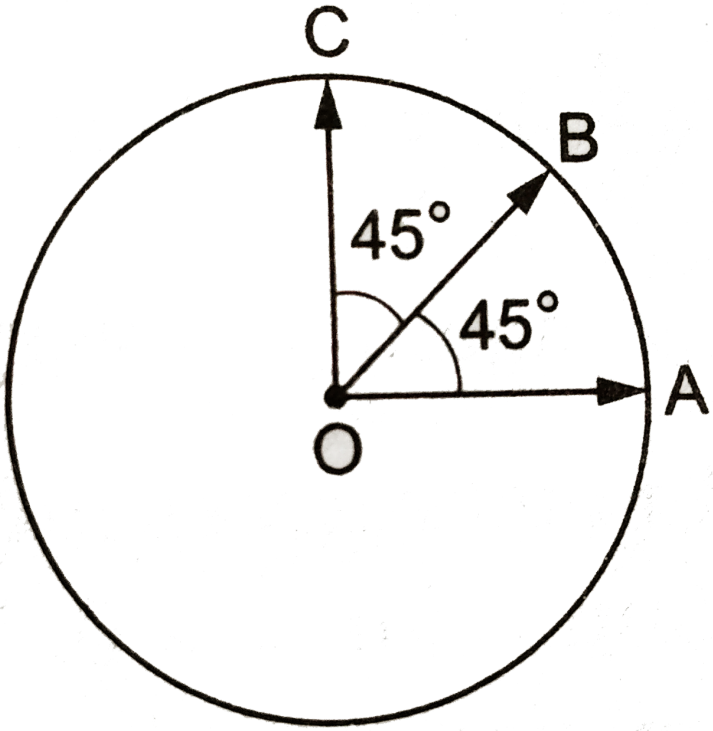
5. Find the resultant of the three vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ shown in figure. Radius of the circle is R.



A. $2R$

B. $R(1+\sqrt{2})$

C. $R\sqrt{2}$

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

Answer: B

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6. A person goes $10km$ north and $20km$ east. What will be displacement from initial point ?

A. $22.36Km$

B. $2km$

C. $5km$

D. $20km$

Answer: A

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7. Let $\vec{C} = \vec{A} + \vec{B}$ then

A. $\left|\vec{C}\right|$ is always greater then $\left|\vec{A}\right|$

B. It is possible to have $\left|\overrightarrow{C}\right| < \left|\overrightarrow{A}\right|$ and $\left|\overrightarrow{C} < \left|\overrightarrow{B}\right|\right.$

C. C is always equal to $A + B$

D. C is never equal to $A + B$

Answer: B

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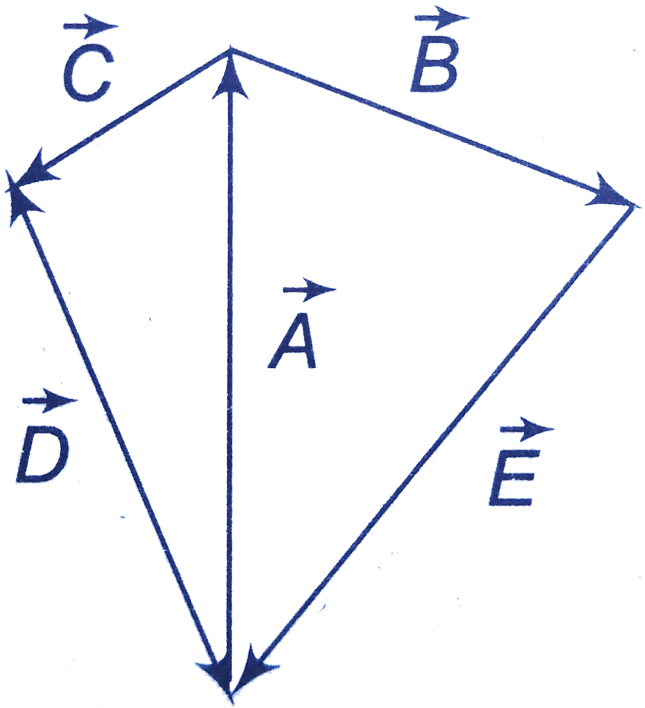
8. In figure, $\vec{E}$ equals



A. $\vec{A}$ and $\vec{B}$ are perpendicular to each other

B. $\vec{B}$

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

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

Answer: D

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9. A scooter going due east at $10ms^{-1}$ turns right through an angle of 90°. If the speed of the scooter remain unchanged in taking turn, the change is the velocity the scooter is

A. $20.0ms^{-1}$ south-east direction

B. Zero

C. $10.0ms^{-1}$ in south direction

D. $14.14ms^{-1}$ in south-west direction

Answer: D

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10. Given that $\vec{A} + \vec{B} = \vec{C}$ and that $\vec{C}$ is perpendicular to $\vec{A}$ Further if $\left|\vec{A}\right| = \left|\vec{C}\right|$, then what is the angle between $\vec{A}$ and $\vec{B}$

A. $\frac{\pi}{4}$ radian

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

C. $\frac{3\pi}{4}$ radian

D. π radian

Answer: C

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

A. r is along positive Y-axis

B. r is along positve X-axis

C. r makes an angle of 45° with the X-axis

D. r is along negative Y-axis.

Answer: B

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12. A particle moves so that its position vector varies with time as $\overrightarrow{r} = A\cos\omega t\hat{i} + A\sin\omega thai(j)$. The initial velocity of the particel the particle is

A. $A\omega\hat{i}$

B. $A\omega\hat{j}$

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

D. $A\omega\left(\hat{i}-\hat{j}\right)$

Answer: B

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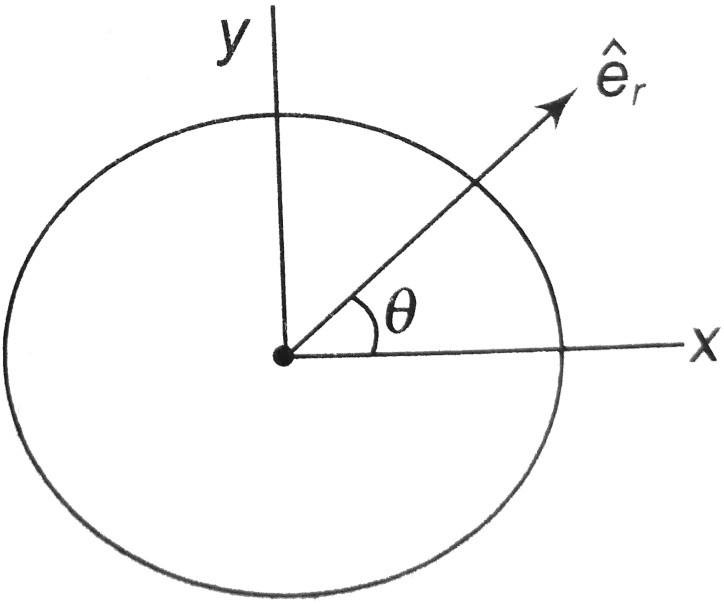
13. $\hat{e}_r$ is unit Vector along radius of a circle shown in figure $\hat{e}_r$ can be represented as `



A. $\cos\theta\hat{i} + \sin\theta\hat{j}$

B. $\sin\theta\hat{i} + \cos\theta\hat{j}$

C. $\cos\theta\hat{i} - \sin\theta\hat{j}$

D. $-\cos\theta\hat{i}+\sin\theta\hat{i}$

Answer: A

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14. A vector of magnitude $10N$ acting in X-Y-plane has componets $8N$ and $6N$ along positive X-axis and positive Y-axis, repectively.The coordinate system is rotated about Z-axis through angle 90° in anti-clockwise direction. Find x-components and y-component in new coordinate system.

A. $F_x=8N, F_y=6N$

B. $F_x=6N, F_y=8N$

C. $F_x=6N, F_y=-8N$

D. $F_x=0N, F_y=10N$

Answer: C

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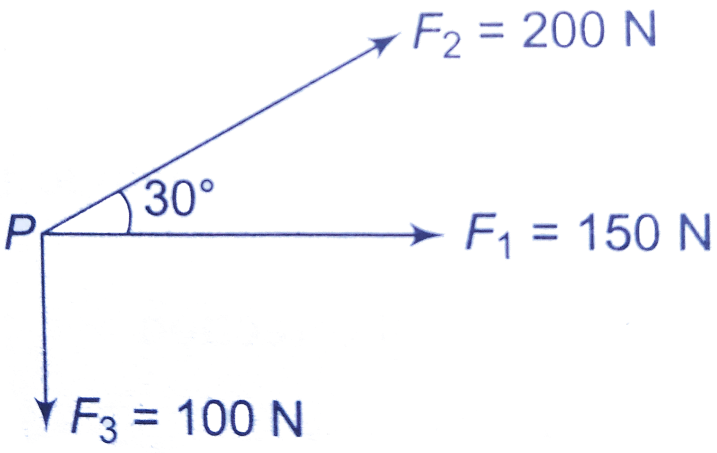
15. A particle P is acted by three coplanar forces as shown in the figure



Find the force needed to prevent the particle P from moving. (taking, sqrt(3)=1.7)`

A. $320N$ in the direction of F_1

B. $200N$ in opposite direction of F_2

C. $320N$ in opposite direction of F_1

D. $320N$ at an angle 53° with direction of F_3

Answer: C

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16. A person moves $30m$ north, then $30m$, then $20m$ towards east and finally $30\sqrt{2}m$ in south-west direction. The displacement of the person from the origin will be

A. $10m$ along north

B. $10m$ long south

C. $10m$along west

D. Zero

Answer: C

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17. A particle moves from position $3\hat{i} + 2\hat{j} - 6\hat{k}$ to $14\hat{i} + 13\hat{j} + 9\hat{k}$ due to a uniform force of $4\hat{i} + \hat{j} + 3\hat{k}N$. If the displacement is in meters, then find the work done by the force.

A. $100J$

B. $200J$

C. $300J$

D. $250J$

Answer: A

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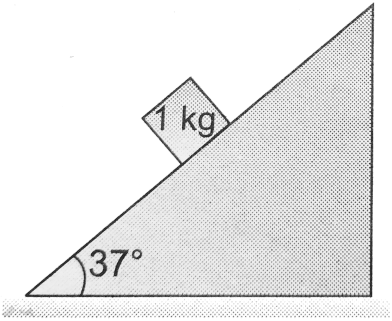
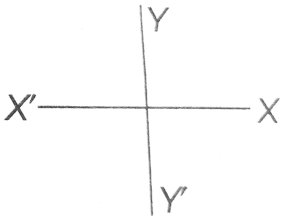
18. Normal reaction N is a force exerted by the surface on the block perpendicular to the surface to contact. A block of mass $1kg$ is placed on inclined plane of inclintation 37° as shown in the figure

Find the component of normal reaction $N = 8N$ on the block x-axis and y-axis





A. $-4.8N, 6.4N$

B. $6.4N, 4.8N$

C. $10N, 0$

D. $4.8N, 6.4N$

Answer: A

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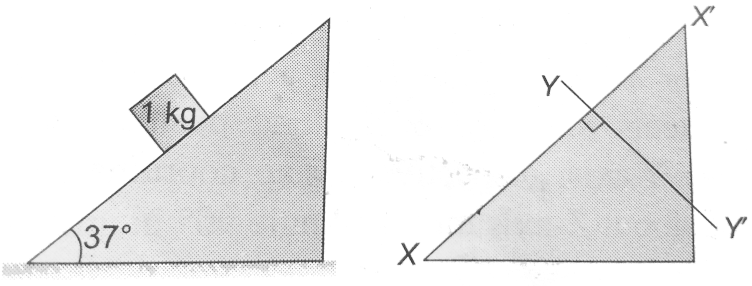
19. Weight mg of a block is a force acting downward toward centre of the earth. A block of mass $1kg$ is placed on an inclined plane as shown in figure. Find the x-component and y-component of weight of the block are



A. $6N, \ -8N$

B. $6N, 8N$

C. $8N, 6N$

D. $8N, \ -6N$

Answer: A

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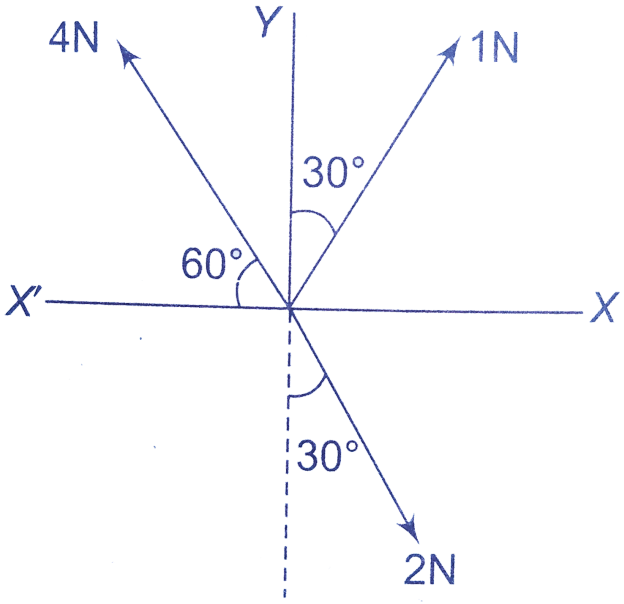
20. Three forces are acting on a particle as shown in the figure. To have the resultant force only along the Y-direction, the magnitude of the maximum additional force needed is



A. $0.866N$

B. $1.732N$

C. $0.5N$

D. $4N$

Answer: C

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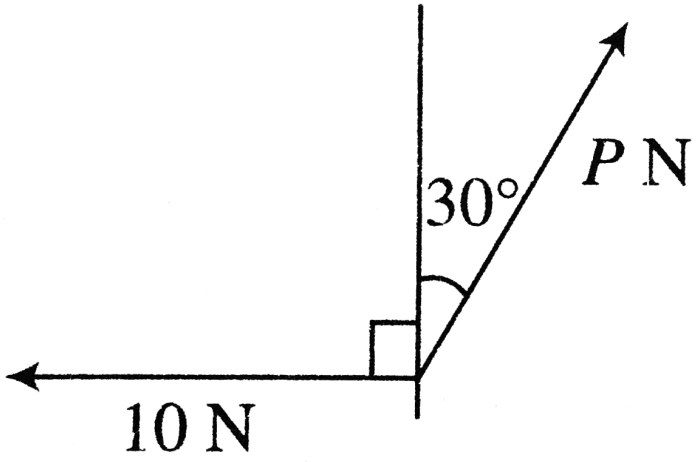
21. Two horizontal forces of magnitudes of $10N$ and PN act on a particle. The force of magnitude $10N$ acts due west and the force of magnitude PN acts on a bearing of 30° east of north as shown in figure. The resultant of these two force acts due north. Find the

magnitude of the resultant.



A. $10\sqrt{2}N$

B. $15\sqrt{3}N$

C. $12\sqrt{5}N$

D. $10\sqrt{3}N$

Answer: D

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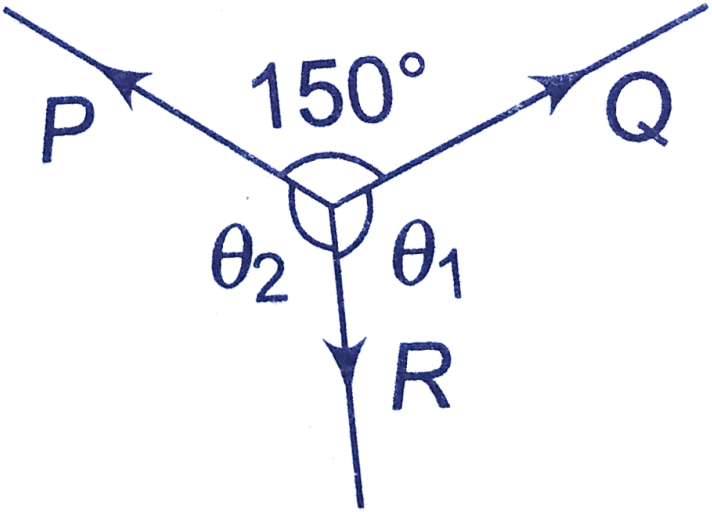
22. P, Q and R are three coplanar forces acting at a point and are in equilibrium. Given $P = 1.9318kg - wt, \sin\theta_1 = 0.9659$, the value of R is $(\in kg - wt)$



A. 0.9659

B. 2

C. 1

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

Answer: C

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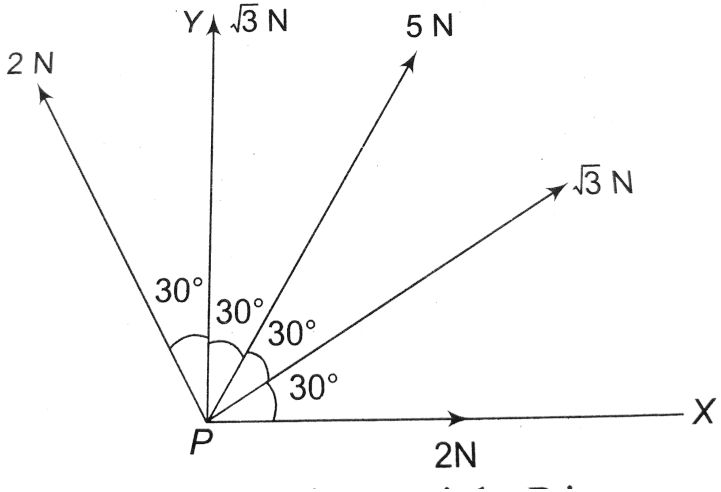
23. Five forces $2N, \sqrt{3}N, 5N, \sqrt{3}$ and $2N$ respectively act at a particel P as shown in figure.



The resultant force on the particle P is

A. $10N$ making angle 60° with X-axis

B. $10N$ making angle 60° with Y-axis

C. $20N$ along Y-axis

D. None of these

Answer: A

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24. Consider two Vectors $\vec{F}_1 = 2\hat{i} + 5\hat{k}$ and $\vec{F}_2 = 3\hat{j} + 4\hat{k}$. The magnitude of the scalar product of these Vector is

A. 20

B. 23

C. $5\sqrt{33}$

D. 26

Answer: A

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25. A particle moves with a velocity $6\hat{i} - 4\hat{j} + 3\hat{k}m/s$ under the influence of a constant force $\overrightarrow{F} = 20\hat{i} + 15\hat{j} - 5\hat{k}N$.

The instantaneous power applied to the particle is

A. $35J/s$

B. $45J/s$

C. $25J/s$

D. $195J/s$

Answer: B

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26. The length of second's hand in watch is $1cm$. The change in Velocity of its tip in 15 seconds is

A. Zero

B. $\frac{\pi}{30\sqrt{2}} cm/\sec$

C. $\frac{\pi}{30} cm/\sec$

D. $\frac{\pi\sqrt{2}}{30} cm/\sec$

Answer: D

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

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

A. 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 aseertion and reason are false.

Answer: B

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28. Assertion: Multiplying any vector by an scalar is meaningful operatons.

Reason: In uniform motion spedd remains constant.

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 aseertion and reason are false.

Answer: B

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29. 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.

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 aseertion and reason are false.

Answer: B

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