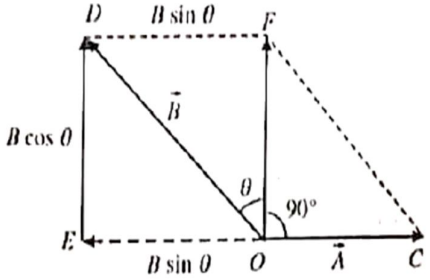
LEVEL - 1

Question - 1 The greatest and least resultant of two forces acting at a point is 10 N and 6 N, respectively. If each force is increased by 3 N, find the resultant of new forces when acting at a point at an angle of 90° with each other.

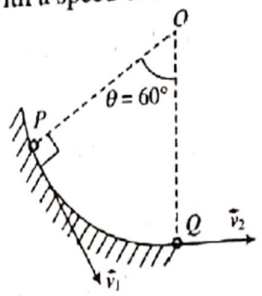
Question - 2 The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to the vector $\vec{A}$ and its magnitude is equal to half of the magnitude of the vector $\vec{B}$. Find out the angle between $\vec{A}$ and $\vec{B}$.



Question - 3 Two forces of unequal magnitude simultaneously act on a particle making an angle $\theta(=120°)$ with each other. If one of them is reversed, the acceleration of the particle is becomes $\sqrt{3}$ times. Calculate the ratio of the magnitude of the forces.

Question - 4 The resultant of $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If $\vec{Q}$ is doubled, $\vec{R}$ is doubled; when $\vec{Q}$ is reversed, $\vec{R}$ is again doubled. Find $P : Q : R$.

Question-5 A particle slides with a speed of 3m s^{-1} at P. When it reaches Q, it acquires a speed of 4 ms^{-1} after describing an angle of 60° at O as shown in Fig 3.22. Find the change in the velocity of the particle between P and Q. Assume that the path followed by the particle is circular from P to Q.



Question - 6 Find the unit vector of $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$.

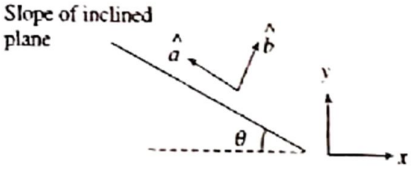
Question - 7 Find the unit vector of $(\vec{A} + \vec{B})$ where $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = 3\hat{i} - 2\hat{j} - 2\hat{k}$.

Question - 8 Given $\vec{A} = 0.3\hat{i} + 0.4\hat{j} + c\hat{k}$. Calculate the value of c if A is a unit vector.

Question - 9 A car is moving in direction $\vec{r} = -4\hat{i} + 3\hat{j}$ with a speed of 10 m s^{-1}. Write the velocity vector of car in unit vector notation.

Question - 10 A car is moving with a speed of 10 m s^{-1}. If the east direction taken as x-axis and the north direction as y-axis. Write the velocity vector of car in unit vector notation. If it is moving (a) in the direction of N-E, (b) in the direction of N-W (c) in the direction of S-W, and (d) in the direction of S-E

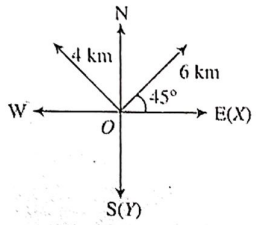
Question - 11 An inclined plane is inclined at θ with horizontal as shown in Fig. Write a unit vector in the direction parallel $(\hat{a})$ and perpendicular $(\hat{b})$ to inclined plane in standard xy coordinate system.



Question - 12 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 vector is $\sqrt{2}$ times that of either of the two having equal magnitude. Find the angles between the vectors.

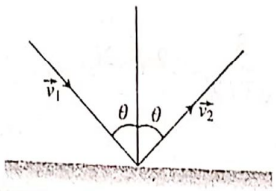
LEVEL – 2

1. A car travels 6 km towards north at an angle of 45° to the east and then travels distance of 4 km towards north at an angle of 135° to the east Fig. How far is the point from the starting point? What angle does the straight line joining its initial and final position makes with the east?



2. There are two force vectors, one of 5 N and other of 12 N. At what angle should the two vectors be added to get the resultant vector of 17 N, 7 N, and 13 N respectively?
3. Given that $\vec{A} + \vec{B} + \vec{C} = 0$. Out of three vectors, the two are equal in magnitude and the magnitude of third vector is $\sqrt{2}$ times that of either of the two having equal magnitude. Then find the angles between vectors
4. 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 $\vec{A} + \vec{B}$

5. A truck travelling due north at 20 m s^{-1} turns west and travels at the same speed. Find the change in its velocity.
6. If the sum of two unit vectors is a unit vector, then find
7. 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?
8. Two forces F_1 = 1 N and F_2 = 2 N act along the lines $x = 0$ and $y = 0$, respectively. Then find the resultant of forces.
9. 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 $\vec{A} - 2\vec{B} + 3\vec{C}$.
10. A vector $\vec{a}$ is turned without a change in its length through a small angle $d\theta$. Find the value of $|\Delta\vec{a}|$ and Δa.
11. An object of m kg with speed of v m s^{-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.



12. 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
13. Vector $\vec{A}$ makes equal angles with x-, y-, and z-axes. Find the value of its components (in terms of magnitude of $\vec{A}$)
14. 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.
15. At what angle should the two force vectors $2F$ and $\sqrt{2}F$ act so that the resultant force is $\sqrt{10}F$?
16. Two forces, while acting on a particle in opposite directions, have the resultant of 10 N. If they act at right angles to each other, the resultant is found to be 50 N. Find the two forces.
17. Two forces each equal to $F/2$ act at right angle. Their effect may be neutralized by a third force acting along their bisector in the opposite direction. What is the magnitude of that third force?
18. The resultant of two forces has magnitude 20 N. One of the forces is of magnitude $20\sqrt{3}$ N and makes an angle of 30° with the resultant. Then what is the magnitude of the other force?
19. The resultant of $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If $\vec{Q}$ is doubled, $\vec{R}$ is doubled, when $\vec{Q}$ is reversed, $\vec{R}$ is again doubled, find P : Q : R.

ANSWER KEY

LEVEL – 1

1. $\sqrt{146}\,N$
2. 150^0
3. $x = 1$ or $\frac{F_1}{F_2} = 1$
4. $P:Q:R = \sqrt{2} : \sqrt{3} : \sqrt{2}$
5. $\sqrt{3^2 + 4^2 - 2.3.4\cos 60^0}$
6. $\frac{2\hat{i}+3\hat{j}+2\hat{k}}{\sqrt{17}}$
7. $\frac{5\hat{i}-3\hat{j}+\hat{k}}{\sqrt{35}}$
8. 0.87
9. $(-8\hat{i} + 6\hat{j})ms^{-1}$
10. (a) $5(\hat{i} + \hat{j})ms^{-1}$
(b) $5(-\hat{i} + \hat{j})ms^{-1}$
(c) $-5(\hat{i} + \hat{j})ms^{-1}$
(d) $5(\hat{i} - \hat{j})ms^{-1}$
11. (a) $\hat{a} = \cos\theta\hat{i} + \sin\theta\,\hat{j}$
(b) $\hat{b} = \sin\theta\,\hat{i} + \cos\theta\,\hat{j}$
12. 135^0

LEVEL – 2

1. $\frac{5\sqrt{2}}{\sqrt{2}}$
2. 90^0
3. 135^0
4. $tan^{-1}\left(\frac{1}{2}\right)$
5. 45^0
6. $\sqrt{3}$
7. 13
8. $2\hat{i} + \hat{j}$
9. $20\hat{i} - 5\hat{j} - 4\hat{k}$
10. 0
11. $2m\,v\cos\theta$
12. $15\hat{i} + 20\hat{j}$
13. $\cos\alpha = \frac{1}{\sqrt{3}}$
14. $-4\hat{i} - 2\hat{j} + 5\hat{k}$
15. 45^0
16. 30 N
17. $F/\sqrt{2}$
18. $P = 20N$
19. $Q = \sqrt{\frac{3}{2}}R$