Vectors

1. If $\vec{R} = \vec{P} + \vec{Q}$ and the magnitudes of $\vec{R}$, $\vec{P}$ and $\vec{Q}$are 5, 4 and 3 respectively, the angle between $\vec{Q}$and $\vec{R}$is:
   (a) $cos^{-1}\left(\frac{3}{5}\right)$ (b) $cos^{-1}\left(\frac{4}{5}\right)$ (c) $sin^{-1}\left(\frac{3}{5}\right)$ (d $tan^{-1}\left(\frac{3}{4}\right)$
2. Two forces A and B have a resultant perpendicular to A. The angle between the forces is:
   (a) $cos^{-1}\left(-\frac{A}{B}\right)$ (b) $cos^{-1}\left(\frac{B}{A}\right)$ (c) $sin^{-1}\left(\frac{A}{B}\right)$ (d) $tan^{-1}\left(-\frac{A}{B}\right)$
3. The sum of two forces acting at a point is 16 N. If the resultant force is 8 N and its direction is perpendicular to the smaller force, then the forces are:
   (a) 4 N and 12 N **(b)** 6 N and 10 N (c) 8 N and 8 N (d) 2 N and 14 N
4. Two equal forces are acting at a point with an angle of 60° between them. If the resultant force is equal to $20\sqrt{3}$ N , the magnitude of each force is:
   (a) 40 N **(b)** 20 N (c) 10 N (d) 15 N
5. A man can swim with a speed of 4 km/h in still water. How long does he take to cross a river 1 km wide if the river flows steadily at 3 km/h and he makes his strokes normal to the river current?
   (a) 5 min (b) 10 min **(c)** 15 min (d) 20 min
6. A boatman can row with a speed of 10 km/h in still water. River flows at 6 km/h. If he crosses the river from one bank to the other along the shortest possible path, time taken to cross that river of width 1 km is:
   (a) 1/8 h (b) 1/4 h (c) 1/2 h (d) 1 h
7. Given $\vec{A} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{B} = -\hat{\imath} - \hat{\jmath} - \hat{k}$. $\overrightarrow{(A} - \vec{B})$ will make angle with $\vec{B}$ as:
   (a) 0° **(b)** 180° (c) 90° (d) 60°
8. 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 vector$\vec{B}$. Then the angle between $\vec{A}$ and $\vec{B}$ is:
   (a) 30° (b) 45° (c) 120° **(d)** 150°
9. Two forces in the ratio 1:2 act simultaneously on a particle. The resultant of these forces is three times the first force. The angle between them is:
   (a) 0° (b) 60° (c) 90° (d) 45°
10. 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) $2(A^2 + B^2)$ (b) $A^2 — B^2$ (b) $2(A^2 — B^2)$ (d) $A^2 + B^2$
11. Two vectors each of magnitude A are inclined to each other such that their resultant is equal to $\sqrt{3}$A. Then the magnitude of their difference is:
    (a) A (b) $\sqrt{3}$A (c) 2A (d) A/2
12. The maximum and minimum magnitude of the resultant of two given vectors are 17 units and 7 units respectively. If these two vectors are at right angles to each other, the magnitude of their resultant is:
    (a) 10 (b) 12 **(c)** 13 (d) 16
13. With respect to a rectangular Cartesian co-ordinate system three vectors are expressed as$\vec{A} = \hat{\imath} + \hat{\jmath} + \hat{k}$, $\vec{B} = 2\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and$\vec{C} = \hat{\imath} - \hat{\jmath} + 4\hat{k}$. The unit vector along the direction of the sum of these vectors is:
    (a) $\frac{1}{\sqrt{18}}(4\hat{\imath} + \hat{\jmath} + \hat{k})$ (b) $\frac{1}{\sqrt{21}}(4\hat{\imath} + 2\hat{\jmath} + \hat{k})$ (c) $\frac{1}{3}(2\hat{\imath} + \hat{\jmath} + 2\hat{k})$ **(d)** $\frac{1}{\sqrt{21}}(4\hat{\imath} + \hat{\jmath} + 2\hat{k})$

14. Given $\vec{A} = \hat{3}\iota + 2\hat{\jmath}$ and $\vec{B} = \hat{\imath} + \hat{\jmath}$. The component of vector $\vec{A}$ along vector $\vec{B}$ is:
    (a) $\frac{1}{\sqrt{2}}$ (b) $\frac{3}{\sqrt{2}}$ **(c)** $\frac{5}{\sqrt{2}}$ (d) $\frac{7}{\sqrt{2}}$
15. A vector $\vec{A}$ is along the positive y-axis and its vector product with another vector $\vec{B}$ is zero, then vector $\vec{B}$ could be:
    (a) $\hat{\imath} + \hat{k}$ (b) $4\hat{\imath}$ (c) $\hat{\jmath} + \hat{k}$ **(d)** $2\hat{\jmath}$
16. What is the area of the triangle formed by sides $\vec{A} = 2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and$\vec{B} = \hat{\imath} - \hat{k}$?
    (a) $\sqrt{13.5}$ unit (b) 12.5 unit (c) 13.5 unit (d) $\sqrt{24.5}$ unit
17. When vector $p\hat{\imath} + q\hat{\jmath}$ is perpendicular to vector $(\hat{\imath} + \hat{\jmath})$, then p and q are:
    (a) 1, 2 (b) 3, 1 **(c)** -1, 1 (d) 1, 1
18. If the vectors $\vec{A} = 2\hat{\imath} + 6\hat{\jmath}$ and$\vec{B} = 5\hat{\imath} - p\hat{\jmath}$ are parallel to each other, the magnitude of $\vec{B}$ is:
    (a) $5\sqrt{10}$ (b) 15 (c) 25 (d) $10\sqrt{5}$
19. The diagonals of a parallelogram are represented by vectors$\vec{A} = 5\hat{\imath} - 4\hat{\jmath} + 3\hat{k}$ and$\vec{B} = 3\hat{\imath} + 2\hat{\jmath} - \hat{k}$. Then the area of the parallelogram is:
    (a) $\sqrt{45}$ units **(b)** $\sqrt{171}$ units (c) $\sqrt{271}$ units (d) 72 units
20. For any two vectors $\vec{A}$ and $\vec{B}$, if $\vec{A}\bullet\vec{B}$ = I$\vec{A}$ x $\vec{B}$I, the magnitude of $\vec{C}$ = $\vec{A}$ + $\vec{B}$ is:
    (a) $\sqrt{A^2+B^2+2AB}$ (b) $\sqrt{A^2+B^2}$ (c) $\sqrt{A^2+B^2-2AB}$ **(d)** $\sqrt{A^2+B^2+\sqrt{2}AB}$