

VECTORS

1. a) \hat{i} & \hat{j} are unit vectors along x and y axis. Find the magnitude and direction of $\hat{i}+\hat{j}$ and $\hat{i}-\hat{j}$
 b) Find the components of vector $A = A\hat{i}+3\hat{j}$ along the vector $\hat{i}+\hat{j}$ and $\hat{i}-\hat{j}$.
2. At what angle the forces $\vec{A}+\vec{B}$ and $\vec{A}-\vec{B}$ act so that their resultant is $(3A^2 + B^2)^{1/2}$ assume that \vec{A} and \vec{B} are collinear vectors.
3. A vector \vec{X} when added to two vectors $\vec{A}=3\hat{i}-5\hat{j}+7\hat{k}$ and $\vec{B}=2\hat{i}+4\hat{j}-3\hat{k}$ gives a unit vector along y axis as their resultant. Find the vector \vec{X}
4. a) Can 2 vectors of different magnitude be combined to give zero resultant? Can 3 vectors do?
 b) Under what condition/s the magnitude of the sum of 2 vectors is equal to the magnitude of difference between them?
5. The vector sum of two vectors \vec{P} and \vec{Q} is \vec{R} . If vector \vec{Q} is reversed, the resultant becomes \vec{S} . Then prove that $R^2 + S^2 = 2(P^2 + Q^2)$.
6. If unit vectors A and B are inclined at an angle θ , then show that $(A - B) = 2 \sin(\theta/2)$.
7. Find the unit vector perpendicular to each of these vectors $2\hat{i}+4\hat{j}-n\hat{k}$ and $3\hat{i}-4\hat{j}-2\hat{k}$ are orthogonal.
8. If $\vec{A}=3\hat{i}+4\hat{j}$ & $\vec{B}=7\hat{i}+24\hat{j}$, find a vector having the same magnitude as \vec{B} and parallel to \vec{A} .
9. Find the unit vector perpendicular to each of these vectors $\vec{P}=3\hat{i}+\hat{j}+2\hat{k}$ and $\vec{Q}=2\hat{i}-2\hat{j}+4\hat{k}$
10. A person moves 30 m north, then 20 m east and then $30\sqrt{2}$ m south west. Find his displacement from the original positions.
11. Three vectors \vec{A} , \vec{B} and \vec{C} are such that $\vec{A}=\vec{B}+\vec{C}$ and their magnitudes are 5, 4 and 3 respectively. Find the angle between \vec{A} and \vec{C} .
12. A man can swim with a speed of 4 km/h in still water. How long does he takes to cross a river 1 km wide, if the river flow steadily at 3 km/h and he makes his strokes normal to the river current? How far down the river does he go, when he reaches the other bank?
13. A boatman can row with speed of 10 km/h in still water. If the river flows steadily 5 km/h, in which direction should the boatman row in order to reach a point on the other bank directly opposite to the point from where he started? The width of the river is 2 km.
14. On a certain day rain was falling vertically with a speed of 30 m/s. If wind starts blowing with a speed of 10 m/s in the direction from north to south, find the direction in which a boy should hold his umbrella in order to protect himself from the rain?