

Mechanics

1. ✓ State Triangle law of vector addition. Obtain the expression for the resultant of two vectors \vec{P} and \vec{Q} inclined at an angle θ .
2. a) ✓ State parallelogram law of vector addition.
b) ✓ Derive the expression for the magnitude and direction of the resultant of two vectors inclined at an angle θ .
c) ✓ What are the conditions for maximum and minimum value of resultant?
3. a) ✓ At what angle two forces of magnitude $(P + Q)$ and $(P - Q)$ act, so that their resultant is $\sqrt{3P^2 + Q^2}$.
b) ✓ The Magnitudes of two vectors are equal and the angle between them is θ . Show that their resultant divides angle θ equally.
4. ✓* Two forces \vec{F}_1 and \vec{F}_2 act upon a body in such a manner that the resultant force \vec{R} has magnitude equal to that of \vec{F}_1 and makes angle of 90° with \vec{F}_1 . Let $F_1 = R = 10\text{N}$. Find the magnitude of the second force and its direction.
5. ✓ A spelunker is surveying a cave. She follows a passage 180m straight west then 210m in a direction 45° east of south, and then 280m at 30° east of north. After a fourth unmeasured displacement she finds herself back where she started. Find the magnitude and direction of the fourth displacement.
6. ✓ The sum and difference of two vectors are equal in magnitude i.e. $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ prove that vectors \vec{A} and \vec{B} are perpendicular to each other.
7. ✓ A particle moves from position $(3\hat{i} + 2\hat{j} - 6\hat{k})$ to a position $(14\hat{i} + 13\hat{j} - 9\hat{k})$ constant force $(4\hat{i} + 2\hat{j} - 3\hat{k})$ newton acts on it. Calculate the work done in meter unites.
8. ✓ If unit vectors \hat{A} and \hat{B} are inclined at an angle θ , then prove that $|\hat{A} - \hat{B}| = 2 \sin \frac{\theta}{2}$.
9. Determine the area of the parallelogram whose adjacent sides are $2\hat{i} + \hat{j} + 3\hat{k}$ and $\hat{i} - \hat{j}$.
10. ✓ Can any of the two rectangular components of a given vector have a magnitude greater than the vector itself?
11. What is the angle between \vec{A} and \vec{B} if \vec{A} and \vec{B} denote the adjacent sides of a parallelogram drawn from point and the area of the parallelogram is $\frac{1}{2} AB$?
12. a) What is the direction of $\hat{k} \times \hat{j}$? p b ?
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b) For the vectors if $\vec{A} + \vec{B} = \vec{C}$ and $A^2 + B^2 = C^2$, prove that vectors \vec{A} and \vec{B} are perpendicular to each other.
c) Can resultant magnitude of two vectors be smaller than the magnitude of either vector?