Vector Algebra Class 12 Formula Sheet

CBSE Class 12 Maths · NCERT · for boards, NEET and JEE revision

ChapterNotes

1. Scalars and Vectors

Scalar	Vector
Has only magnitude	Has both magnitude and direction
Examples: mass, temperature, speed	Examples: force, velocity, displacement
Denoted by ordinary letters	Denoted by letters with arrow (→) on top

2. Types of Vectors

Type	Definition	Example
Zero Vector ($\vec{0}$)	Magnitude = 0, arbitrary direction	Force on a stationary object at rest
Unit Vector ($\hat{a}$)	Magnitude = 1	$\hat{i}$, $\hat{j}$, $\hat{k}$ along x, y, z axes
Co-initial	Same starting point	Vectors from origin
Collinear	Parallel (same or opposite direction)	$\vec{a} = \lambda\vec{b}$
Equal	Same magnitude and direction	Free vectors that overlap
Negative	Same magnitude, opposite direction	$-\vec{a}$

3. Position Vector

If a point P has coordinates (x, y, z), then its position vector is:

$\vec{OP} = x\hat{i} + y\hat{j} + z\hat{k}$

Magnitude: $|\vec{OP}| = \sqrt{x^2 + y^2 + z^2}$

4. Addition of Vectors

If $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$, then:

$\vec{a} + \vec{b} = (a_1+b_1)\hat{i} + (a_2+b_2)\hat{j} + (a_3+b_3)\hat{k}$

5. Section Formula

The position vector of point dividing the line joining A($\vec{a}$) and B($\vec{b}$):

Internally in ratio m:n → $\vec{r} = \frac{m\vec{b} + n\vec{a}}{m+n}$

Externally in ratio m:n → $\vec{r} = \frac{m\vec{b} - n\vec{a}}{m-n}$

Midpoint: $\vec{r} = \frac{\vec{a} + \vec{b}}{2}$

6. Scalar (Dot) Product

$\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos\theta$

In component form: $\vec{a} \cdot \vec{b} = a_1b_1 + a_2b_2 + a_3b_3$

$\cos\theta = \frac{\vec{a} \cdot \vec{b}}{|\vec{a}||\vec{b}|}$

7. Cross (Vector) Product

$\vec{a} \times \vec{b} = |\vec{a}||\vec{b}| \sin\theta \cdot \hat{n}$

where $\hat{n}$ is the unit vector perpendicular to both $\vec{a}$ and $\vec{b}$ (right-hand rule).

In component form:

$\vec{a} \times \vec{b} = (a_2b_3 - a_3b_2)\hat{i} - (a_1b_3 - a_3b_1)\hat{j} + (a_1b_2 - a_2b_1)\hat{k}$

$|\vec{a} \times \vec{b}|$ = **Area of parallelogram** with adjacent sides $\vec{a}$ and $\vec{b}$

$\frac{1}{2}|\vec{a} \times \vec{b}|$ = **Area of triangle**

Quick revision

- Vectors have magnitude AND direction; scalars have only magnitude
- Unit vector: $\hat{a} = \vec{a}/|\vec{a}|$ (divide by magnitude)
- Section formula: $(m\vec{b} + n\vec{a})/(m+n)$ for internal division
- Dot product → scalar, gives angle: $\cos\theta = (\vec{a}\cdot\vec{b})/(|\vec{a}||\vec{b}|)$
- Cross product → vector, gives area: $|\vec{a}\times\vec{b}|$ = area of parallelogram
- Perpendicular ⟹ dot product = 0
- Parallel ⟹ cross product = $\vec{0}$
- Projection of $\vec{a}$ on $\vec{b} = (\vec{a}\cdot\vec{b})/|\vec{b}|$
- Area of triangle = $\frac{1}{2}|\vec{a} \times \vec{b}|$

Full chapter notes with solved examples and practice questions: https://chapternotes.in/cbse/class-12-maths/vector-algebra-class-12-notes/