

# **ADHIKAANSH ACADEMY (IITJEE NEET IX X XI XII)**

**RUN BY:**

**DEEPAK SAINI SIR**

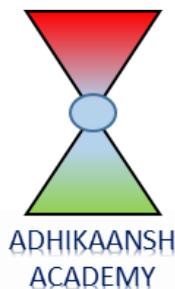
**B.TECH, M.TECH (N.S.I.T. DELHI UNIVERSITY)**

**Ex. Faculty of**

**Resonance Kota, Career Point Kota**

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# **MATHS NOTES (CLASS 12<sup>TH</sup>)**



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*So why  
to wait...*



**DIRECTOR**  
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NSIT DELHI UNIVERSITY

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# Key Notes

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## Chapter-10

### Vector Algebra

- Position vector of a point P (x, y, z) is given as  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$  and its magnitude by  $\sqrt{x^2 + y^2 + z^2}$
- The scalar components of a vector are its direction ratios, and represent its projections along the respective axes.
- The magnitude (r), direction ratios (a, b, c) and direction cosines (l, m, n) of any vector are related as:  $l = \frac{a}{r}, m = \frac{b}{r}, n = \frac{c}{r}$
- The vector sum of the three sides of a triangle taken in order is  $\vec{0}$
- The vector sum of two conical vectors is given by the diagonal of the parallelogram whose adjacent sides are the given vectors.
- The multiplication of a given vector by a scalar  $\lambda$ , changes the magnitude of the vector by the multiple  $|\lambda|$ , and keeps the direction same (or makes it opposite) according as the value of  $\lambda$  is positive (or negative).
- For a given vector  $\vec{a}$ , the vector  $\hat{a} = \frac{\vec{a}}{|\vec{a}|}$  gives the unit vector in the direction of  $\vec{a}$
- The position vector of a point R dividing a line segment joining the points P and Q whose position vectors are  $\vec{a}$  and  $\vec{b}$  respectively, in the ratio  $m : n$ 
  - (i) internally, is given by  $\frac{n\vec{a} + m\vec{b}}{m+n}$
  - (ii) externally, is given by  $\frac{n\vec{a} - m\vec{b}}{m-n}$
- The scalar product of two given vectors  $\vec{a}$  and  $\vec{b}$  having angle  $\theta$  between them is defined as  $\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$

## Key Notes

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Also, when  $\vec{a} \cdot \vec{b}$  is given, the angle  $\theta$  between the vectors  $\vec{a}$  and  $\vec{b}$  may be determined by

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

- If  $\theta$  is the angle between two vector  $\vec{a}$  and  $\vec{b}$ , then their cross product is given as

$\vec{a} \times \vec{b} = |\vec{a}| |\vec{b}| \sin\theta \hat{n}$  where  $\hat{n}$  is a unit vector perpendicular to the plane containing  $\vec{a}$  and  $\vec{b}$ .

Such that  $\vec{a}$ ,  $\vec{b}$ ,  $\hat{n}$  form right handed system of coordinate axes.

- If we have two vectors  $\vec{a}$  and  $\vec{b}$  given in component form as  $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$  and  $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$  and  $\lambda$  any scalar, then,  $\vec{a} + \vec{b} = (a_1 + b_1)\hat{i} + (a_2 + b_2)\hat{j} + (a_3 + b_3)\hat{k}$

$$\lambda\vec{a} = (\lambda a_1)\hat{i} + (\lambda a_2)\hat{j} + (\lambda a_3)\hat{k};$$

$$\vec{a} \cdot \vec{b} = a_1b_1 + a_2b_2 + a_3b_3$$

$$\text{and } \vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}$$

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