

# 6. ADDITION OF VECTORS



(1 x 2) + (1 x 4) = 6 Marks

~~IMP FORMULAS, KEY CONCEPTS~~

- 1) **Position vector of a point:** If  $P(x, y, z)$  is a point in space then the PV of P w.r.t O in the component form is  $\overrightarrow{OP} = \vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ . Its length is  $|\overrightarrow{OP}| = |\vec{r}| = \sqrt{x^2 + y^2 + z^2}$
- 2) **Direction Cosines:** If  $\alpha, \beta, \gamma$  are the angles made by the vector  $\overrightarrow{OP} = \vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$  then the direction cosines of the vector  $\vec{r}$  are  $l = \cos \alpha = \frac{x}{|\vec{r}|}$ ,  $m = \cos \beta = \frac{y}{|\vec{r}|}$ ,  $n = \cos \gamma = \frac{z}{|\vec{r}|}$

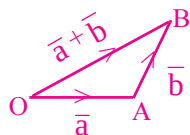
- 3) The unit vector in the direction of the non-zero vector  $\vec{a}$  is  $\hat{a} = \frac{\vec{a}}{|\vec{a}|}$

- 4.1) **Section formula:** The PV of C collinear with A, B dividing the line segment joining

$$A(\vec{a}), B(\vec{b}) \text{ in the ratio } m : n \text{ is } \overrightarrow{OC} = \frac{m\vec{b} + n\vec{a}}{m + n}$$

- 4.2) The P.V of the mid point of line segment joining  $A(\vec{a}), B(\vec{b})$  is  $\frac{\vec{a} + \vec{b}}{2}$

- 5) **Triangle Law:** In  $\triangle OAB$ ,  $\overrightarrow{OA} + \overrightarrow{AB} = \overrightarrow{OB} \Rightarrow \overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$



- 6.1) If  $\vec{a} = t\vec{b}$ ,  $t \in \mathbb{R}$  then  $\vec{a}, \vec{b}$  are collinear vectors.

- 6.2) The points  $A(\vec{a}), B(\vec{b}), C(\vec{c})$  are collinear  $\Leftrightarrow$  the vectors  $\overrightarrow{AB}, \overrightarrow{AC}$ , are collinear.

- 7.1) The points  $A(\vec{a}), B(\vec{b}), C(\vec{c}), D(\vec{d})$  are coplanar  $\Leftrightarrow$  the vectors  $\overrightarrow{AB}, \overrightarrow{AC}, \overrightarrow{AD}$  are coplanar.

- 7.2) If  $\vec{a} = a_1\vec{i} + a_2\vec{j} + a_3\vec{k}$ ,  $\vec{b} = b_1\vec{i} + b_2\vec{j} + b_3\vec{k}$ ,  $\vec{c} = c_1\vec{i} + c_2\vec{j} + c_3\vec{k}$  are coplanar then  $\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix} = 0$

- 8.1) The vector equation of the line passing through the point  $A(\vec{a})$  and parallel to the vector  $\vec{b}$  is  $\vec{r} = \vec{a} + t\vec{b}$ ,  $t \in \mathbb{R}$ .

- 8.2) The vector equation of the line passing through the points  $A(\vec{a}), B(\vec{b})$  is  $\vec{r} = (1-t)\vec{a} + t\vec{b}$ ;  $t \in \mathbb{R}$

- 9.1) The vector equation of the plane passing through the points  $A(\vec{a}), B(\vec{b}), C(\vec{c})$  is

$$\vec{r} = (1-s-t)\vec{a} + t\vec{b} + s\vec{c}; \quad t, s \in \mathbb{R}$$

- 9.2) The vector equation of the plane passing through the points  $A(\vec{a}), B(\vec{b})$  and parallel to the vector  $\vec{c}$  is  $\vec{r} = (1-t)\vec{a} + t\vec{b} + s\vec{c}$ ;  $t, s \in \mathbb{R}$

- 9.3) The vector equation of the plane passing through the point  $A(\vec{a})$  and parallel to the vectors  $\vec{b}, \vec{c}$  is  $\vec{r} = \vec{a} + t\vec{b} + s\vec{c}$ ;  $t, s \in \mathbb{R}$

BULLET MASTER'S  
**MATH BEATS!**

Vector  $\Rightarrow$  రామబాణం

**Vectors**  $\Rightarrow \vec{a}, \vec{b}, \vec{c}, \vec{r}, \dots, \vec{i}, \vec{j}, \vec{k}, \dots, \overline{OA}, \overline{OB}, \overline{OC}, \overline{OR}, \dots, \overline{AB}, \overline{PQ}, \dots, \vec{s}, \vec{v}, \vec{a}, \vec{F}$  (in Physics), ....

**Vectors**  $\Rightarrow$  Should satisfy Triangle Law of Addition of Vectors.

**Light Rays** and **Electric Current** have both Magnitude and Direction

but they don't obey Triangle Law. So, they are not Vectors but are Tensors.