

# BAAP OF ALL FORMULA LISTS

FOR IIT JEE

VECTORS

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| SL# | FORMULA   |
|-----|---|
| 1   | <b>Unit Vectors,</b> $\vec{i} = (1, 0, 0), \vec{j} = (0, 1, 0), \vec{k} = (0, 0, 1), \left  \vec{i} \right  \left  \vec{j} \right  = \left  \vec{k} \right  = 1,$ |
| 2   | $\vec{r} = \overrightarrow{AB} = (x_1 - x_0)\vec{i} + (y_1 - y_0)\vec{j} + (z_1 - z_0)\vec{k}$  |
| 3   | $\left  \vec{r} \right  = \left  \overrightarrow{AB} \right  = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2 + (z_1 - z_0)^2}$  |
| 4   | <b>If</b> $\overrightarrow{AB} = \vec{r},$ <b>then</b> $\overrightarrow{BA} = -\vec{r}.$  |
| 5   | $X = \left  \vec{r} \right  \cos \alpha, Y = \left  \vec{r} \right  \cos \beta, Z = \left  \vec{r} \right  \cos \gamma$   |
| 6   | <b>If</b> $\vec{r}(X, Y, Z) = \vec{r}_1(X_1, Y_1, Z_1),$ <b>then</b> $X = X_1, Y = Y_1, Z = Z_1$  |
| 7   | $\vec{w} = \vec{u} + \vec{v}$   |
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| 8   | $\vec{w} = \vec{u}_1 + \vec{u}_2 + \vec{u}_3 + \dots + \vec{u}_m$   |
| 9   | <b>Cummutative Law</b> $\vec{u} + \vec{v} = \vec{v} + \vec{u}$  |
| 10  | <b>Associative Law</b> $(\vec{u} + \vec{v}) + \vec{w} = \vec{u}(\vec{v} + \vec{w})$   |
| 11  | $\vec{u} + \vec{v} = (X_1 + X_2, Y_1 + Y_2, Z_1 + Z_2)$   |
| 12  | $\vec{w} = \vec{u} - \vec{v}$ if $\vec{c} + \vec{w} = \vec{u}$  |
| 13  | $\vec{u} - \vec{v} = \vec{u} + (= \vec{c})$   |
| 14  | $\vec{u} - \vec{u} = \vec{0} = (0, 0, 0)$   |
| 15  |   |

$$|\vec{0}| = 0$$

16  $\vec{u} - \vec{v} = (X_1 - X_2, Y_1 - Y_2, Z_1 - Z_2)$

17  $\vec{w} = \lambda \vec{u}$

18  $|\vec{w}| = |\lambda| \cdot |\vec{u}|$

19  $\lambda \vec{u} = (\lambda X, \lambda Y, \lambda Z)$

20  $(\lambda + \mu) \vec{u} = \lambda \vec{u} + \mu \vec{u}$

21  $\lambda(\mu \vec{u}) = \mu(\lambda \vec{u}) = (\lambda\mu) \vec{u}$

22  $\lambda(\vec{u} + \vec{v}) = \lambda \vec{u} + \lambda \vec{v}$

**Scalar Product of Vectors**

23  $\vec{u}$  and  $\vec{v}$   $\vec{u} \cdot \vec{v} = |\vec{u}| \cdot |\vec{v}| \cdot \cos \theta,$

where  $\theta$  is the angle between vectors  $\vec{u}$  and  $\vec{v}$ .

**Scalar Product in Coordinate Form**

24 If  $\vec{u} = (X_1, Y_1, Z_1)$  and  $\vec{v} = (X_2, Y_2, Z_2)$  then  $\vec{u} \cdot \vec{v} = X_1X_2 + Y_1Y_2 + Z_1Z_2.$

**Angle Between Two vectors**

25 If  $\vec{u} = (X_1, Y_1, Z_1), \vec{v} = (X_2, Y_2, Z_2),$  then



$$\cos \theta = \frac{X_1X_2 + Y_1Y_2 + Z_1Z_2}{\sqrt{X_1^2 + Y_1^2 + Z_1^2} \sqrt{X_2^2 + Y_2^2 + Z_2^2}}$$




26 **Commutative Property**  $\vec{u} \cdot \vec{v} = \vec{v} \cdot \vec{u}$

27 **Associative Property**  $(\lambda \vec{u}) \cdot (\mu \vec{v}) = \lambda\mu \vec{u} \cdot \vec{v}$

28 **Distributive Property**  $\vec{u} \cdot (\vec{v} + \vec{w}) = \vec{u} \cdot \vec{v} + \vec{u} \cdot \vec{w}$

29  $\vec{u} \cdot \vec{v} = 0$  if  $\vec{u}, \vec{v}$  are orthogonal  $(\theta = \frac{\pi}{2})$

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| 30  | $\vec{u} \cdot \vec{v} > 0$ if $0 < \theta < \frac{\pi}{2}$   |
| 31  | $\vec{u} \cdot \vec{v} < 0$ if $\frac{\pi}{2} < \theta < \pi$   |
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| 32  | $\vec{u} \cdot \vec{v} \leq  \vec{u}  \cdot  \vec{v} $  |
| 33  | $\vec{u} \cdot \vec{v} =  \vec{u}  \cdot  \vec{v} $ if $\vec{u}, \vec{v}$ are parallel ( $\theta = 0$ )   |
| 34  | <p>If <math>\vec{u} = (X_1, Y_1, Z_1)</math>,</p> <p>then <math>\vec{u} \cdot \vec{u} = u^2 =  \vec{u} ^2 = X_1^2 + Y_1^2 + Z_1^2</math></p>  |
| 35  | $\vec{i} \cdot \vec{i} = \vec{j} \cdot \vec{j} = \vec{k} \cdot \vec{k} = 1$   |
| 36  | $\vec{i} \cdot \vec{j} = \vec{j} \cdot \vec{k} = \vec{k} \cdot \vec{i} = 0$   |
| 37  | <p><b>Vector Product of Vectors</b></p> <p><math>\vec{u}</math> and <math>\vec{v} \times \vec{v} = \vec{w}</math>,</p> <p>where, <math> \vec{w}  =  \vec{u}  \cdot  \vec{v}  \cdot \sin \theta</math>,</p> <p>where <math>0 \leq \theta \leq \frac{\pi}{2}</math>, <math>\vec{w} \perp \vec{u}</math> and <math>\vec{w} \perp \vec{v}</math>;</p> <p><b>Vectors <math>\vec{u}, \vec{v}, \vec{w}</math> form a right handed screw.</b></p> |
| 38  | $\vec{w} = \vec{u} \times \vec{v} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ X_1 & Y_1 & Z_1 \\ X_2 & Y_2 & Z_2 \end{vmatrix}$  |
| 39  | $\vec{w} = \vec{u} \times \vec{v} = \left( \begin{vmatrix} Y_1 & Z_1 \\ Y_2 & Z_2 \end{vmatrix}, - \begin{vmatrix} X_1 & Z_1 \\ X_2 & Z_2 \end{vmatrix}, \begin{vmatrix} X_1 & Y_1 \\ X_2 & Y_2 \end{vmatrix} \right)$  |
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| 40  | $S =  \vec{u} \times \vec{v}  =  \vec{u}  \cdot  \vec{v}  \cdot \sin \theta$  |
| 41  | <b>Angle Between Two Vectors</b> $\sin \theta = \frac{ \vec{u} \times \vec{v} }{ \vec{u}  \cdot  \vec{v} }$   |
| 42  | <b>Noncommutative Property</b> $\vec{u} \times \vec{v} = -(\vec{v} \times \vec{u})$   |

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| 43  | <b>Associative Property</b> $(\lambda \vec{u}) \times (\mu \vec{v}) = \lambda \vec{u} \times \vec{v}$   |
| 44  | <b>Distributive Property</b> $\vec{u} \times (\vec{v} + \vec{w}) = \vec{u} \times \vec{v} + \vec{u} \times \vec{w}$   |
| 45  | $\vec{u} \times \vec{v} = \vec{0}$ if $\vec{u}$ and $\vec{v}$ are parallel ( $\theta = 0$ )   |
| 46  | $\vec{i} \times \vec{j} = \vec{k}$ , $\vec{j} \times \vec{k} = \vec{i}$ , $\vec{k} \times \vec{i} = \vec{j}$  |
| 47  | $\vec{i} \times \vec{i} = \vec{j} \times \vec{j} = \vec{k} \times \vec{k} = \vec{0}$  |
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| 48  | <b>Scalar Triple Product</b> $[\vec{u} \vec{v} \vec{w}] = \vec{u} \cdot (\vec{v} \times \vec{w}) = \vec{v} \cdot (\vec{w} \times \vec{u}) = \vec{w} \cdot (\vec{u} \times \vec{v})$   |
| 49  | $[\vec{u} \vec{v} \vec{w}] = [\vec{w} \vec{u} \vec{v}] = [\vec{v} \vec{w} \vec{u}] = -[\vec{v} \vec{u} \vec{w}] = -[\vec{w} \vec{v} \vec{u}] = -[\vec{u} \vec{w} \vec{v}]$  |
| 50  | $k\vec{u} \cdot (\vec{v} \times \vec{w}) = k[\vec{u} \vec{v} \vec{w}]$  |
| 51  | <b>Scalar Triple Product in Coordinate Form</b> $\vec{u} \cdot (\vec{v} \times \vec{w}) = \begin{vmatrix} X_1 & Y_1 & Z_1 \\ X_2 & Y_2 & Z_2 \\ X_3 & Y_3 & Z_3 \end{vmatrix}$ , where $\vec{u} = (X_1, Y_1, Z_1)$ , $\vec{v} = (X_2, Y_2, Z_2)$ , $\vec{w} = (X_3, Y_3, Z_3)$                                      |
| 52  | <b>Volume of Parallelepiped</b> $V =  \vec{u} \cdot (\vec{v} \times \vec{w}) $  |
| 53  | <b>Volume of Pyramid</b> $V = \frac{1}{6}  \vec{u} \cdot (\vec{v} \times \vec{w}) $   |
| 54  | If $\vec{u} \cdot (\vec{v} \times \vec{w}) = 0$ , then the vectors $\vec{u}$ , $\vec{v}$ and $\vec{w}$ are linearly dependent so $\vec{w} = \lambda \vec{u} + \mu \vec{v}$ for some scalars $\lambda$ and $\mu$   |
| 55  | If $\vec{u} \cdot (\vec{v} \times \vec{w}) \neq 0$ , then the vectors $\vec{u}$ , $\vec{v}$ , and $\vec{w}$ are linearly independent.   |
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| 56  | <b>Vector Triple Product</b> $\vec{u} \times (\vec{v} \times \vec{w}) = (\vec{u} \cdot \vec{w})\vec{v} - (\vec{u} \cdot \vec{v})\vec{w}$  |
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