Maths Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 29

Three Dimensional Geometry

Direction cosines and ratios

$$l = \cos\alpha,\ m = \cos\beta,\ n = \cos\gamma; \qquad l^2 + m^2 + n^2 = 1$$

FROM DIRECTION RATIOS

$$l = \frac{a}{\sqrt{a^2 + b^2 + c^2}}, \ \ldots$$

ANGLE BETWEEN LINES

$$\cos\theta = \frac{a_1a_2 + b_1b_2 + c_1c_2}{\sqrt{a_1^2 + b_1^2 + c_1^2}\sqrt{a_2^2 + b_2^2 + c_2^2}}$$

Lines in space

EQUATION

$$\vec{r} = \vec{a} + \lambda\vec{b}; \qquad \frac{x - x_1}{a} = \frac{y - y_1}{b} = \frac{z - z_1}{c}$$

SHORTEST DISTANCE (SKEW LINES)

$$d = \frac{\left|(\vec{a}_2 - \vec{a}_1)\cdot(\vec{b}_1 \times \vec{b}_2)\right|}{|\vec{b}_1 \times \vec{b}_2|}$$

PARALLEL LINES

$$d = \frac{|(\vec{a}_2 - \vec{a}_1) \times \vec{b}|}{|\vec{b}|}$$

COPLANAR LINES

$$(\vec{a}_2 - \vec{a}_1)\cdot(\vec{b}_1 \times \vec{b}_2) = 0$$

Planes

EQUATIONS

$$ax + by + cz + d = 0; \qquad \vec{r} \cdot \hat{n} = p; \qquad \frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$$

THROUGH THREE POINTS

$$\begin{vmatrix} x - x_1 & y - y_1 & z - z_1 \\ x_2 - x_1 & y_2 - y_1 & z_2 - z_1 \\ x_3 - x_1 & y_3 - y_1 & z_3 - z_1 \end{vmatrix} = 0$$

POINT TO PLANE

$$d = \frac{|ax_1 + by_1 + cz_1 + d|}{\sqrt{a^2 + b^2 + c^2}}$$

PARALLEL PLANES

$$d = \frac{|d_1 - d_2|}{\sqrt{a^2 + b^2 + c^2}}$$

FAMILY

$$P_1 + \lambda P_2 = 0 \text{ passes through the line } P_1 = P_2 = 0$$

Line and plane

ANGLE

$$\sin\theta = \frac{|\vec{b} \cdot \vec{n}|}{|\vec{b}||\vec{n}|}$$

FOOT AND IMAGE OF A POINT

$$\frac{x - x_1}{a} = \frac{y - y_1}{b} = \frac{z - z_1}{c} = -\frac{ax_1 + by_1 + cz_1 + d}{a^2 + b^2 + c^2} \text{ (foot)}; \qquad \times 2 \text{ for the image}$$

LINE LIES IN PLANE

$$\vec{b} \cdot \vec{n} = 0 \text{ and a point of the line satisfies the plane}$$

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