

CLASS 11 MATHEMATICS — FORMULA SHEET

Chapter 11 : Introduction to Three Dimensional Geometry (NCERT)

11.1 Coordinate Axes & Planes

Concept	Detail
Three axes	x-axis, y-axis, z-axis — mutually perpendicular, meeting at origin O
Coordinates of a point	$P(x, y, z)$
Coordinate planes	XY-plane ($z=0$), YZ-plane ($x=0$), ZX-plane ($y=0$)
Octants	The three planes divide space into 8 octants
Point on x-axis	$(x, 0, 0)$; on y-axis $(0, y, 0)$; on z-axis $(0, 0, z)$
Point in XY-plane	$(x, y, 0)$; YZ-plane $(0, y, z)$; ZX-plane $(x, 0, z)$

11.2 Signs of Coordinates in Octants

Octant	x	y	z
I	+	+	+
II	-	+	+
III	-	-	+
IV	+	-	+
V	+	+	-
VI	-	+	-
VII	-	-	-
VIII	+	-	-

11.3 Distance Formula

Concept	Formula
Distance between two points	$PQ = \sqrt{[(x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2]}$
Distance from origin	$OP = \sqrt{(x^2 + y^2 + z^2)}$
Collinearity of 3 points	Sum of two distances = third distance (A, B, C collinear)

11.4 Section Formula

Concept	Formula
Internal division (ratio $m:n$)	$P = [(mx_2+nx_1)/(m+n), (my_2+ny_1)/(m+n), (mz_2+nz_1)/(m+n)]$
External division (ratio $m:n$)	$P = [(mx_2-nx_1)/(m-n), (my_2-ny_1)/(m-n), (mz_2-nz_1)/(m-n)]$
Midpoint	$M = [(x_1+x_2)/2, (y_1+y_2)/2, (z_1+z_2)/2]$
Centroid of triangle	$G = [(x_1+x_2+x_3)/3, (y_1+y_2+y_3)/3, (z_1+z_2+z_3)/3]$
Ratio in which point divides	Find k from one coordinate: $x = (kx_2+x_1)/(k+1)$

11.5 Key Facts & Special Cases

Concept	Detail
Distance is always positive	Square root gives the non-negative value
Equidistant point	Set $PA = PB$ and solve (locus is a plane)
Point dividing a line	Use section formula; negative ratio means external
Coordinate plane distances	Distance from XY-plane = $ z $; YZ-plane = $ x $; ZX-plane = $ y $
Distance from axes	From x-axis = $\sqrt{y^2+z^2}$; from y-axis = $\sqrt{x^2+z^2}$; from z-axis = $\sqrt{x^2+y^2}$

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3D distance	Just add the z-term: $\sqrt{(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2}$. Same as 2D plus one dimension.
Octant I	All three coordinates positive (+, +, +) — like the first quadrant extended.
Plane membership	$z = 0 \rightarrow$ on XY-plane ; $x = 0 \rightarrow$ YZ-plane ; $y = 0 \rightarrow$ ZX-plane.
Axis membership	Two coordinates zero $\rightarrow$ on an axis (e.g. $(x,0,0)$ is on x-axis).
Midpoint	Average each coordinate — works the same in 3D as in 2D.
Distance from a plane	Drop the matching coordinate: from XY-plane it's just $ z $.
Distance from an axis	Combine the OTHER two coordinates: from z-axis it's $\sqrt{x^2+y^2}$.
External division	Use minus signs in the section formula ($m-n$ in denominator).