

3D Geometry

Introduction to Three Dimensional Geometry

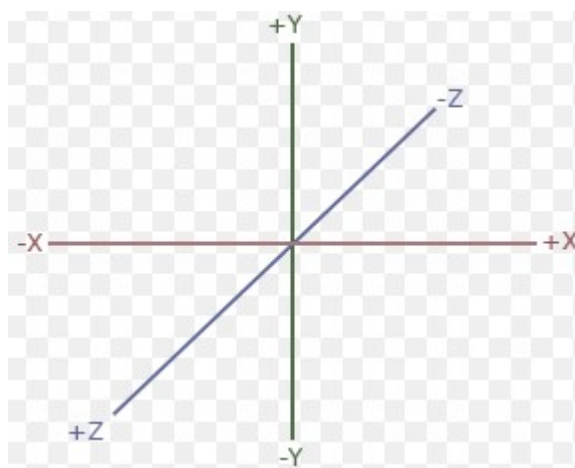
3D geometry involves the mathematics of shapes in **3D space** and involving **3 coordinates** which are **x-coordinate, y-coordinate and z-coordinate**. In a 3d space, three parameters are required to find the exact location of a point. For JEE, three-dimensional geometry plays a major role as a lot of questions are included in the exam. Here, the basic concepts of geometry involving 3-dimensional coordinates are covered which will help to understand different operations on a point in 3d plane.

Coordinate System in 3D Geometry

In **3 dimensional geometry**, a coordinate system refers to the process of identifying the position or location of a point in the coordinate plane. To understand more about coordinate planes and system, refer to the **coordinate geometry** lesson which covers all the basic concepts, theorems, and formulas related to coordinate or analytic geometry.

Rectangular coordinate system

Three lines perpendicular to each other pass through a common point. That common point is called the origin, the 3 lines the axes. They are x-axis, y-axis, z-axis respectively. O is the observer with respect to his position of any other point is measured. The position or **coordinates of any point in 3D space** is measured by how much he has moved along x, y and z-axis respectively. So if a point has a position (3, -4, 5) means he has moved 3 unit along positive x-axis, 4 unit along negative y-axis, 5 unit along positive z-axis.



Rectangular coordinate system – 3D Geometry

Why study three-dimensional geometry?

Motivation:

- The non-traditional activities that include three-dimensional geometry topics can motivate students who see geometry as a set of abstract rules and definitions.
- Three-dimensional geometry lends itself easily to discovery learning which also stimulates and maintains motivation.

History:

- Three-dimensional geometry can also provide a historical context for the history-oriented student. For example, presenting a historical perspective on the Platonic and Archimedean solids can motivate certain students.

Everyday Interactions:

- Three-dimensional geometry enhances students' intuitive geometry usually generated from interactions with their environments.

Reinforcement:

- Three-dimensional geometry can expand, enhance, and reinforce students' knowledge of Euclidean geometry that is traditionally taught in high school.

Refinement:

- Three-dimensional geometry can aid in the development or refinement of students' spatial sense, perception, and visualization.
- Three-dimensional geometry enhances spatial abilities. Spatial ability can affect how much of a student's focus is given to the entire act of learning. If a student lacks a component crucial to spatial sense then he/she may not be able to devote his/her entire attention to the learning of other geometric ideas and concepts. Seven components of spatial sense identified as having "greatest relevance to academic development" (Del Grande, p. 127) are: eye-motor coordination, figure-ground perception, perceptual constancy, position-in-space perception, perception of spatial relationships, visual discrimination, and visual memory.

Foundations:

- Early experience with three-dimensional geometry provides a solid foundation for higher level mathematics, including calculus, group theory, and topology. It can also lay a foundation for other disciplines such as computer science and chemistry.

Confidence:

- Working with physical models in three-dimensional geometry can increase student mathematical confidence with abstract concepts.

Another way to study traditional ideas of mathematics:

- Three-dimensional geometry can be studied in a non-abstract fashion that still maintains the rigor associated with traditional geometry.