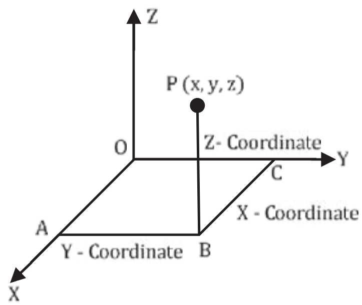
COORDINATES OF A POINT IN SPACE

To determine the precise position of a point within three-dimensional space, the use of a rectangular coordinate system is essential. Upon establishing a fixed coordinate system in 3D, the coordinates for any point P within that system can be represented as an ordered triple (x, y, z). Conversely, if we already possess the coordinates (x, y, z), we can readily determine the point P's location within the 3D space.

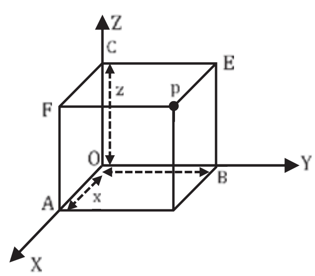
Three Dimensional Coordinate System

Consider a point P within the depicted space. By extending a perpendicular PB onto the XY plane and further dropping perpendiculars BA and BC from point B onto the x-axis and y-axis, respectively, we can define the lengths of these perpendiculars as x, y, and z. These values, x, y, and z, are recognized as the coordinates of point P in three-dimensional space. It's important to emphasize that when expressing the coordinates of a point, we consistently list them in a specific order, commencing with the coordinate along the x-axis, followed by the coordinate along the y-axis, and concluding with the coordinate along the z-axis. Consequently, for each point existing in space, there is a structured 3-tuple comprising real numbers that serves as its representation.



In the provided diagram, the coordinates of point P are represented as (x, y, z). The origin O is designated as (0, 0, 0). Furthermore, the coordinates of point A are (x, 0, 0) since A is situated entirely along the x-axis. Likewise, for any point situated on the y-axis, their coordinates are (0, y, 0), and for points located on the z-axis, the coordinates are (0, 0, z). Additionally, when considering points within the three planes XY, YZ, and ZX, their coordinates can be defined as (x, y, 0), (0, y, z), and (x, 0, z), respectively.

In situations where we are tasked with locating a specific point, meaning its coordinates are provided, we need to establish three planes that are parallel to the XY, YZ, and ZX planes. These planes intersect the three axes at points A, B, and C, as depicted in the diagram. By defining OA = x, OB = y, and OC = z, we can represent the coordinates of the point as (x, y, z).



The intersection of planes ADPF, BDPE, and CEPF occurs at a point denoted as P, which corresponds to the ordered triplet (x, y, z).

The origin O is located at (0, 0, 0). Any point on the x-axis has coordinates in the form (x, 0, 0). While a point in the YZ-plane is represented as (0, y, z). In the YZ-plane, the x-coordinate is zero, in the XZ-plane, the y-coordinate is zero, and in the XY-plane, the z-coordinate is zero. The equations for these planes are $x = 0$, $y = 0$, and $z = 0$, respectively.

Additionally, for a point on the x-axis, both y and z coordinates are zero, leading to the equations $y = 0$ and $z = 0$ for the x-axis. Similarly, for the y-axis, the equations are $x = 0$ and $z = 0$, and for the z-axis, the equations are $x = 0$ and $y = 0$.