CBSE Class 11 Maths Notes Chapter 12: Introduction to Three Dimensional Geometry is very important topic for the exam. The concept of three-dimensional space, where points are located using three coordinates: (x,y,z)(x,y,z). Through detailed explanations and examples, students learn about the Cartesian coordinate system in three dimensions and how to visualize points, lines, and planes in 3D space.

The CBSE Class 11 Maths Notes Chapter 12 gives students an instant overview of all the subjects and formulas taught in the chapter, which helps them complete the Dimensional Geometry-based problems with greater confidence.

CBSE Class 11 Maths Notes Chapter 12 PDF

You can access the CBSE Class 11 Maths Notes for Chapter 12 on Introduction to Three Dimensional Geometry through the provided PDF link. This chapter teaches about working with objects and shapes in three-dimensional space. It covers topics like coordinates, distance, and direction. Understanding three-dimensional geometry is important for fields like engineering, architecture, and computer graphics. By using these notes, students can learn more about working with objects in three-dimensional space and improve their problem-solving skills.

CBSE Class 11 Maths Notes Chapter 12 PDF

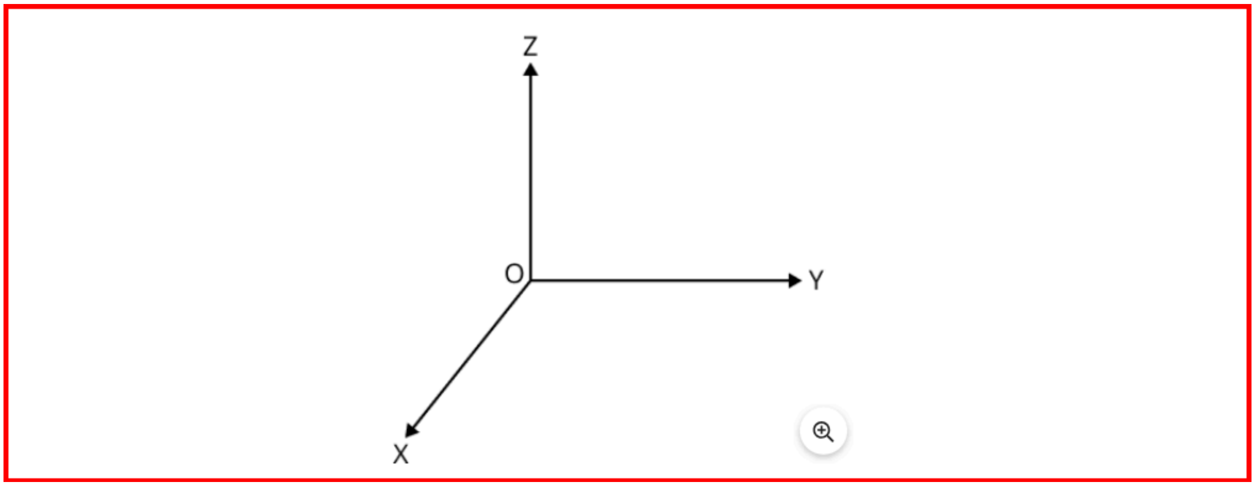
CBSE Class 11 Maths Notes Chapter 12 Introduction to Three Dimensional Geometry

Solutions for CBSE Class 11 Maths Notes Chapter 12 on Introduction to Three-Dimensional Geometry are available below. By using these solutions, students can deepen their understanding of three-dimensional concepts and improve their problem-solving skills. These notes serve as a valuable resource for mastering the principles of three-dimensional geometry.

Coordinate Axes

Coordinate axes are imaginary lines that serve as reference lines in a coordinate system. In a three-dimensional coordinate system, there are three mutually perpendicular coordinate axes: the x-axis, the y-axis, and the z-axis. These axes intersect at a common point called the origin, often denoted as O. Three mutually perpendicular lines, denoted as OX, OY, and OZ, collectively form the coordinate axes.

Coordinate Planes

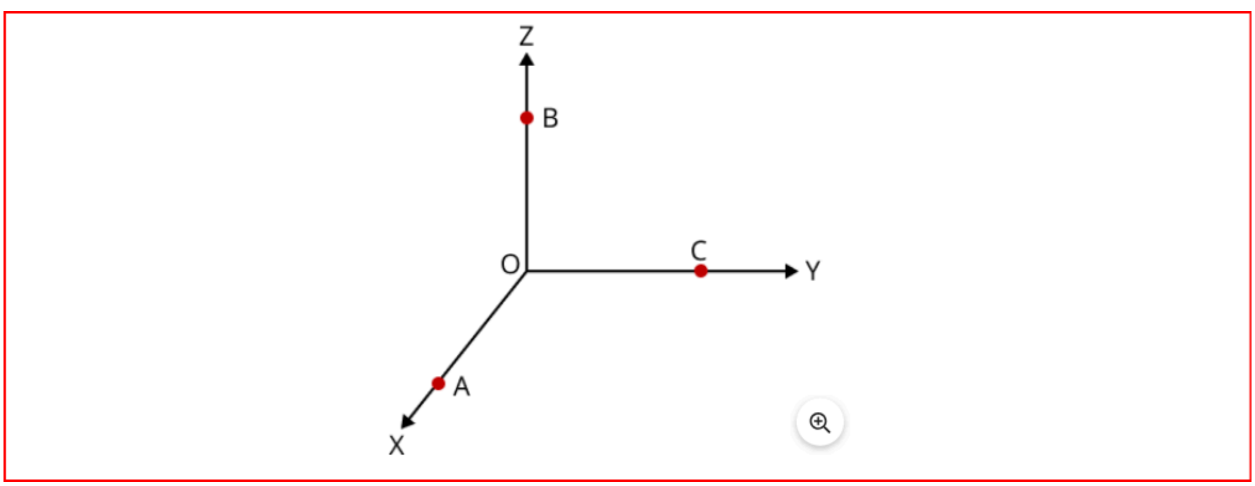


- The planes created by the coordinate axes are termed as coordinate planes.
- The XY plane is formed by the x and y axes.
- The YZ plane is formed by the y and z axes.
- The XZ plane is formed by the x and z axes.

Coordinates of a Point in Space

- The coordinates of the origin, labeled as point O, are (0,0,0).
- For any point A on the x-axis, its coordinates are (x,0,0).
- For any point B on the z-axis, its coordinates are (0,0,z).
- For any point C on the y-axis, its coordinates are (0,y,0).
- Points on the XY plane have coordinates (x,y,0), on the YZ plane have coordinates (0,y,z), and on the XZ plane have coordinates (x,0,z).

Octants



- A 3-dimensional coordinate system is divided into 8 sections known as octants.
- The sign convention for octants follows:
- Octant I: All coordinates are positive.
- Octant II: x-coordinate is negative, while y and z coordinates are positive.
- Octant III: x and y coordinates are negative, while z coordinate is positive.
- Octant IV: x-coordinate is positive, while y and z coordinates are negative.
- Octant V: x and z coordinates are positive, while y coordinate is negative.
- Octant VI: y-coordinate is positive, while x and z coordinates are negative.
- Octant VII: x, y, and z coordinates are negative.
- Octant VIII: y-coordinate is positive, while x and z coordinates are negative.

Understanding The Basics of Three Dimensional Geometry

According to experts, the introduction of three-dimensional geometry in mathematics aims to aid students in comprehending various types of figures and shapes. For instance, objects such as beds, chairs, tables, and kitchen utensils are all examples of three-dimensional geometric shapes. By studying this topic, students can better understand the spatial characteristics and properties of such objects, enhancing their grasp of geometry in practical contexts.

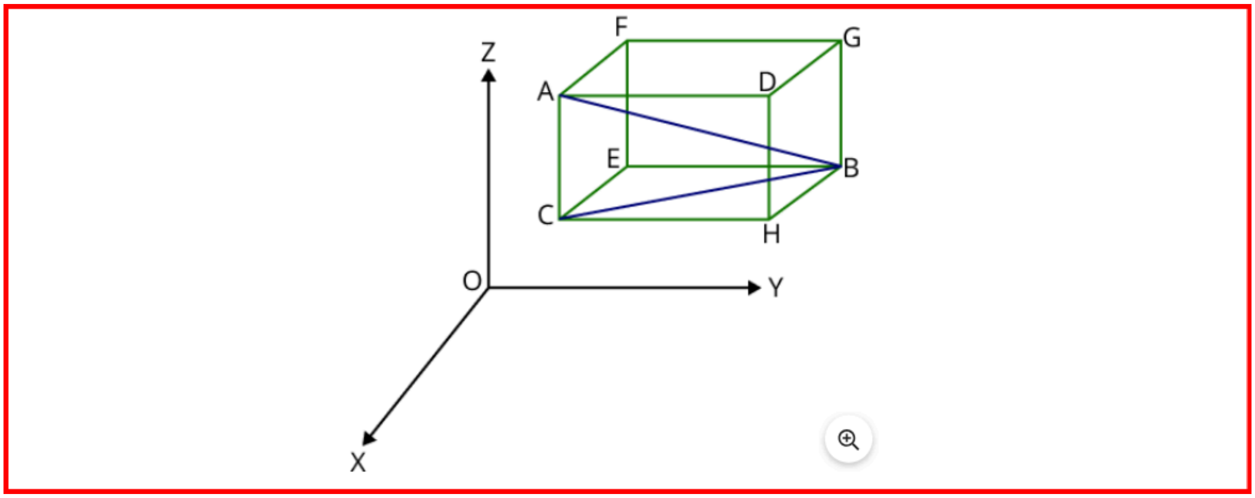
The Coordinate System in Three Dimensional Geometry

The coordinate system in three-dimensional geometry is a fundamental concept that helps us locate points in space. Unlike the familiar two-dimensional Cartesian coordinate system, which consists of two perpendicular axes (x and y), the three-dimensional coordinate system adds a third axis (usually labeled z) perpendicular to the x-y plane.

Each point in three-dimensional space can be uniquely identified by its coordinates, typically represented as (x, y, z), where x represents the horizontal position, y represents the vertical position, and z represents the position along the third dimension.

Distance between Two Points

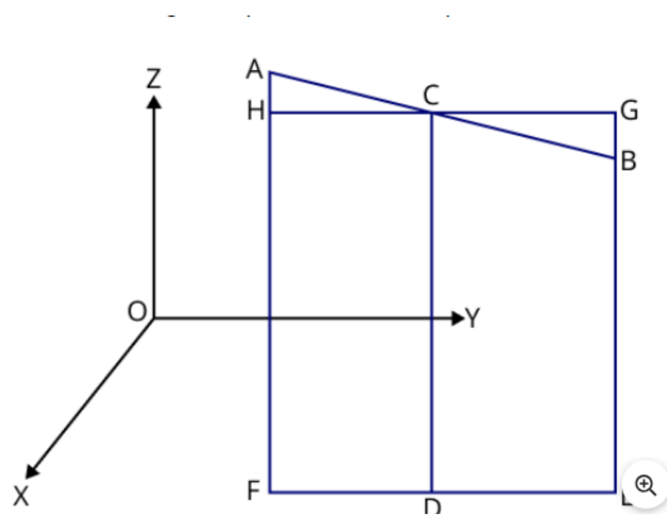
i) Considering two points A(x1, y1, z1) and B(x2, y2, z2), forming a right-angled triangle ΔACB, we apply the Pythagoras theorem. This yields $AB^2 = AC^2 + BC^2$. Similarly, for the triangle ΔBCH, $BC^2 = CH^2 + BH^2$. Combining these equations, we find $AB^2 = AC^2 + CH^2 + BH^2$. Substituting the coordinates of BH = x2 - x1, CH = y2 - y1, and AC = z2 - z1, we arrive at $AB = \sqrt{(x2 - x1)^2 + (y2 - y1)^2 + (z2 - z1)^2}$, representing the distance between two points in three-dimensional space.



ii) The distance of any point (x1, y1, z1) from the origin is given by √(x1^2 + y1^2 + z1^2).

iii) According to the rule, the sum of two collinear points equals the third collinear point, applicable only when dealing with three collinear points A, B, and C. For instance, AB + BC = AC. The application of the distance formula helps determine collinearity among points.

Section Formula



i) The Section Formula enables us to determine the internal division ratio of a line segment by a point.

ii) If point C divides the line segment AB internally, the ratio m:n in which AB is divided internally can be found using the section formula.

iii) Consider two points A(x1, y1, z1) and B(x2, y2, z2), with C(x, y, z) dividing the line segment AB internally in the ratio m:n.

iv) Perpendiculars are drawn from A, B, and C on the XY plane, such that $AH || CD || BE$. Additionally, line HG is drawn through point C, parallel to FE.

v) Quadrilaterals CDFH and DEGC are parallelograms based on the figure.

vi) ΔACH and ΔBCG are right-angled triangles with vertically opposite angles, thus similar. Hence, $mn = AC/BC = AH/BG = AF - HF/GE - BE = AF - CD/CD - BE$.

vii) Writing the corresponding coordinates, we derive $mn = (z - z_1)/(z_2 - z) = (mz_2 - mz)/(nz - nz_1) = z(m + n)/(mz_2 + nz_1)$.

viii) Similarly, for other coordinates, $x = (mx_2 + nx_1)/(m + n)$ and $y = (my_2 + ny_1)/(m + n)$.

ix) Therefore, the required coordinates of the point dividing internally are $(mx_2 + nx_1)/(m + n)$, $(my_2 + ny_1)/(m + n)$, $(mz_2 + nz_1)/(m + n)$.

x) For a midpoint, where $m = 1$ and $n = 1$, the coordinates of the point will be $((x_2 + x_1)/2, (y_2 + y_1)/2, (z_2 + z_1)/2)$.

Rectangular Coordinate System

The rectangular coordinate system, also known as the Cartesian coordinate system, is a fundamental tool in mathematics for representing points and shapes in two-dimensional and three-dimensional space. Comprising three perpendicular lines passing through a common point, it includes the x-axis, y-axis, and z-axis, converging at the observer or center, denoted by O.

This system facilitates measuring the distance covered by 3D objects. For instance, if an object's position coordinates are (3, -4, 5), it signifies movements of 3 units along the positive x-axis, 4 units along the negative y-axis, and 5 units along the positive z-axis.

Another crucial concept discussed is calculating distance from the origin, achievable via the Pythagorean theorem. For a point P (x, y, z), its distance from the origin (0, 0, 0) is given by $\sqrt{x^2 + y^2 + z^2}$.

The distance between two points P (x_1, y_1, z_1) and Q (x_2, y_2, z_2) is determined by the formula $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2}$.

Dividing a line segment between two points P (x_1, y_1, z_1) and Q (x_2, y_2, z_2) involves calculating the coordinates of the division point R using the ratio (m:n), expressed as $R = ((mx_2 + nx_1) / (m + n), (my_2 + ny_1) / (m + n), (mz_2 + nz_1) / (m + n))$.

Projection in 3D space is explored, with the projection PQ of a line segment equal to $AB \cos \theta$, where θ represents the angle between AB and PQ or CD.

Direction Ratios Of A Line And Direction Cosine

In three-dimensional geometry, when a line passes through the origin, it forms angles α, β, and γ with the x, y, and z-axes, respectively. The cosines of these angles represent the direction cosine of the line.

The direction ratios of a line are any three numbers proportional to its direction cosines. For a line with direction cosines l, m, and n, the direction ratios are $a = \lambda l$, $b = \lambda m$, and $c = \lambda n$, where λ is a non-zero real number.

Expressed as ratios, the direction cosines are represented as $L/a = m/b = n/c = k$, and their values can be calculated as $L = \pm a / \sqrt{(a^2 + b^2 + c^2)}$, $m = \pm b / \sqrt{(a^2 + b^2 + c^2)}$, and $n = c / \sqrt{(a^2 + b^2 + c^2)}$.

When a line in space doesn't pass through the origin, a parallel line is drawn from the origin to determine its direction cosines. These cosines remain the same for parallel lines originating from the origin.

Furthermore, the relation between the direction cosines of a line RS is given by $L^2 + m^2 + n^2 = 1$, indicating that the squares of direction cosines sum up to 1.

The direction cosines of a line passing through two points P (x1, y1, z1) and Q (x2, y2, z2) can be calculated as $(x2 - x1) / PQ$, $(y2 - y1) / PQ$, and $(z2 - z1) / PQ$, where PQ represents the distance between the two points given by $PQ = \sqrt{((x2-x1)^2 + (y2-y1)^2 + (z2-z1)^2)}$.

Benefits of CBSE Class 11 Maths Notes Chapter 12 Introduction to Three Dimensional Geometry

Conceptual Clarity: These notes provide clear explanations of fundamental concepts related to three-dimensional geometry, helping students develop a strong foundation in the subject.

Comprehensive Coverage: The notes cover all essential topics of the chapter, including the coordinate system, distance formula, section formula, direction cosines, and ratios, ensuring comprehensive understanding.

Problem-Solving Skills: By practicing problems provided in the notes, students can enhance their problem-solving skills and gain confidence in tackling questions related to three-dimensional geometry.

Visual Representation: Visual aids such as diagrams and illustrations are often included in the notes to help students visualize geometric concepts, making learning more engaging and effective.

Supplementary Resource: These notes can be used as a supplementary resource alongside textbooks and classroom lectures, providing additional explanations and examples to reinforce learning.