

## Introduction to Three Dimensional Geometry — Assignment 1

Class 11 Maths · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.  
 (2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.  
 (3) Universal values:  $g = 10 \text{ m/s}^2$  unless stated. Give answers with correct SI units.

### Coordinate Axes and Planes in Space

#### MCQ Questions (choose the correct option)

- In three-dimensional space, the number of coordinate planes is
  - 3
  - 2
  - 1
  - 6
- In the octant XYZ, the coordinates  $(x, y, z)$  all satisfy
  - $x > 0, y > 0, z > 0$
  - $x < 0, y < 0, z < 0$
  - $x > 0, y < 0, z > 0$
  - $x = 0$
- The coordinates of the origin in space are
  - $(0, 0, 0)$
  - $(1, 1, 1)$
  - $(0, 0)$
  - $(1, 0, 0)$
- A point on the x-axis has coordinates of the form
  - $(x, 0, 0)$
  - $(0, y, 0)$
  - $(0, 0, z)$
  - $(x, y, 0)$

#### 1 Mark Questions

- How many coordinate planes are there in space?
- Write the coordinates of the origin in space.
- Write the coordinates of a general point on the x-axis.

#### 2 Mark Questions

- Name the octant in which the point  $(2, -3, 4)$  lies.
- Find the distances of the point  $(3, 4, 5)$  from the coordinate planes.

#### 3 Mark Questions

- Determine the octant of each of the points  $(1, 2, 3)$ ,  $(-1, 2, 3)$  and  $(1, -2, -3)$ .
- Find the coordinates of the foot of the perpendicular from the point  $(3, 4, 5)$  to the xy-plane and to the x-axis.

### Distance Between Two Points

### MCQ Questions (choose the correct option)

- The distance between the points  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  is
  - $\sqrt{[(x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2]}$
  - $\sqrt{[(x_2+x_1)^2 + (y_2+y_1)^2 + (z_2+z_1)^2]}$
  - $(x_2-x_1) + (y_2-y_1) + (z_2-z_1)$
  - $x_2-x_1$
- The distance of the point  $(3, 4, 12)$  from the origin is
  - 13
  - 19
  - 25
  - 7
- The distance between  $(1, 2, 3)$  and  $(1, 2, 6)$  is
  - 3
  - 9
  - 6
  - $\sqrt{3}$
- The distance of the point  $(x, y, z)$  from the y-axis is
  - $\sqrt{(x^2 + z^2)}$
  - $\sqrt{(x^2 + y^2)}$
  - $\sqrt{(y^2 + z^2)}$
  - $|y|$

### 1 Mark Questions

- Write the distance formula for two points in space.
- Find the distance of  $(3, 4, 12)$  from the origin.
- Find the distance between  $(1, 2, 3)$  and  $(1, 2, 6)$ .

### 2 Mark Questions

- Find the distance between the points  $(2, 3, 4)$  and  $(1, 0, 5)$ .
- Find the distance of the point  $(4, 3, 5)$  from the y-axis.

### 3 Mark Questions

- Show that the points  $A(1, 2, 3)$ ,  $B(-1, -2, -1)$ ,  $C(2, 3, 2)$  and  $D(4, 7, 6)$  are the vertices of a parallelogram.
- Find the point on the y-axis which is equidistant from the points  $(2, 3, 4)$  and  $(4, 1, 5)$ .

## Section Formula

### MCQ Questions (choose the correct option)

- The coordinates of the point dividing the join of P and Q internally in the ratio  $m : n$  are
  - $((mx_2 + nx_1)/(m + n), (my_2 + ny_1)/(m + n), (mz_2 + nz_1)/(m + n))$
  - $((x_1 + x_2)/2, (y_1 + y_2)/2, (z_1 + z_2)/2)$
  - $(mx_1 + nx_2, my_1 + ny_2, mz_1 + nz_2)$
  - $(x_2 - x_1, y_2 - y_1, z_2 - z_1)$
- The midpoint of the join of  $(2, 4, 6)$  and  $(4, 8, 10)$  is

- (A) (3, 6, 8)
  - (B) (6, 12, 16)
  - (C) (2, 4, 4)
  - (D) (1, 2, 2)
3. The coordinates of the point dividing the join of A and B externally in the ratio  $m : n$  are obtained by
- (A) replacing  $n$  with  $-n$  in the section formula
  - (B) adding the coordinates
  - (C) averaging the coordinates
  - (D) multiplying the coordinates
4. The centroid of a triangle with vertices  $(x_1, y_1, z_1)$ ,  $(x_2, y_2, z_2)$ ,  $(x_3, y_3, z_3)$  is
- (A)  $((x_1+x_2+x_3)/3, (y_1+y_2+y_3)/3, (z_1+z_2+z_3)/3)$
  - (B)  $((x_1+x_2)/2, (y_1+y_2)/2, (z_1+z_2)/2)$
  - (C)  $(x_1+x_2+x_3, y_1+y_2+y_3, z_1+z_2+z_3)$
  - (D) (0, 0, 0)

### 1 Mark Questions

1. Write the section formula for internal division in space.
2. Find the midpoint of the join of (2, 4, 6) and (4, 8, 10).
3. Write the formula for the centroid of a triangle in space.

### 2 Mark Questions

1. Find the coordinates of the point dividing the join of (1, 2, 3) and (3, 6, 9) internally in the ratio 1 : 2.
2. Find the centroid of the triangle with vertices (1, 0, 0), (0, 1, 0) and (0, 0, 1).

### 3 Mark Questions

1. Find the coordinates of the point which divides the join of A(2, 1, 4) and B(4, 3, 2) externally in the ratio 3 : 2.
2. Find the ratio in which the point (2, 4, 6) divides the join of A(1, 2, 3) and B(4, 8, 12).

## Direction Cosines and Direction Ratios

### MCQ Questions (choose the correct option)

1. If  $l, m, n$  are the direction cosines of a line, then
  - (A)  $l^2 + m^2 + n^2 = 1$
  - (B)  $l + m + n = 1$
  - (C)  $l^2 + m^2 = n^2$
  - (D)  $lmn = 1$
2. Direction ratios of a line are proportional to
  - (A) its direction cosines
  - (B) its length
  - (C) the origin
  - (D) the coordinate axes
3. The direction cosines of the x-axis are
  - (A) (1, 0, 0)
  - (B) (0, 1, 0)
  - (C) (0, 0, 1)

(D) (1, 1, 1)

4. If  $a, b, c$  are direction ratios, the direction cosines are

(A)  $l = a/\sqrt{a^2+b^2+c^2}$ , etc.

(B)  $l = a, m = b, n = c$

(C)  $l = a^2, m = b^2, n = c^2$

(D)  $l = 1/a$ , etc.

### 1 Mark Questions

1. Write the relation between the direction cosines of a line.
2. Write the direction cosines of the x-axis.
3. How are direction cosines obtained from direction ratios?

### 2 Mark Questions

1. Find the direction cosines of the line with direction ratios (2, 3, 6).
2. Find the direction ratios of the line joining the points (1, 0, 0) and (0, 1, 1).

### 3 Mark Questions

1. Find the direction cosines of the line joining the points A(2, 3, 4) and B(4, 5, 8).
2. If a line makes angles  $90^\circ$ ,  $60^\circ$  and  $30^\circ$  with the x, y and z axes respectively, find its direction cosines and verify  $l^2 + m^2 + n^2 = 1$ .

## Angle Between Two Lines

### MCQ Questions (choose the correct option)

1. The angle  $\theta$  between two lines with direction cosines  $(l_1, m_1, n_1)$  and  $(l_2, m_2, n_2)$  satisfies
  - (A)  $\cos \theta = l_1 l_2 + m_1 m_2 + n_1 n_2$
  - (B)  $\cos \theta = l_1 + m_1 + n_1$
  - (C)  $\cos \theta = l_1^2 + m_1^2 + n_1^2$
  - (D)  $\cos \theta = l_1 l_2 - m_1 m_2 - n_1 n_2$
2. Two lines are perpendicular if
  - (A)  $l_1 l_2 + m_1 m_2 + n_1 n_2 = 0$
  - (B)  $l_1 = l_2$
  - (C)  $l_1 l_2 + m_1 m_2 + n_1 n_2 = 1$
  - (D)  $m_1 = m_2$
3. Two lines are parallel if their direction ratios are
  - (A) proportional
  - (B) equal to zero
  - (C) perpendicular
  - (D) reciprocal
4. The angle between the x-axis and the y-axis is
  - (A)  $90^\circ$
  - (B)  $0^\circ$
  - (C)  $45^\circ$
  - (D)  $180^\circ$

### 1 Mark Questions

1. Write the condition for two lines to be perpendicular using direction cosines.
2. Write the condition for two lines to be parallel using direction ratios.
3. Write the formula for the angle between two lines.

## 2 Mark Questions

1. Find the angle between the lines with direction ratios  $(1, 1, 2)$  and  $(2, -1, 1)$ .
2. Show that the lines with direction ratios  $(2, 3, -1)$  and  $(1, -1, -1)$  are perpendicular.

## 3 Mark Questions

1. Find the angle between the lines joining the points  $A(0, 0, 0)$ ,  $B(1, 1, 1)$  and  $C(0, 1, 0)$ ,  $D(2, 2, 2)$ .
2. Find the angle between the line joining the points  $(1, 2, 3)$ ,  $(2, 3, 4)$  and the line joining  $(0, 0, 0)$ ,  $(3, 3, 3)$ .

## Collinearity of Three Points

### MCQ Questions (choose the correct option)

1. Three points A, B, C are collinear if
  - (A)  $AB + BC = AC$
  - (B)  $AB = BC$
  - (C)  $AB \cdot BC = 0$
  - (D)  $AB - BC = AC$
2. Three points in space are collinear if their direction ratios between consecutive points are
  - (A) proportional
  - (B) zero
  - (C) perpendicular
  - (D) reciprocal
3. The points  $(1, 0, 0)$ ,  $(2, 1, 1)$  and  $(3, 2, 2)$  are
  - (A) collinear
  - (B) not collinear
  - (C) vertices of a triangle
  - (D) coincident
4. If A, B, C are collinear and B lies between A and C, then
  - (A)  $AB + BC = AC$
  - (B)  $AB = AC + BC$
  - (C)  $BC = AB + AC$
  - (D)  $AB = BC$

## 1 Mark Questions

1. State the condition for three points to be collinear in space.
2. Check whether  $(1, 0, 0)$ ,  $(2, 1, 1)$  and  $(3, 2, 2)$  are collinear.
3. If A, B, C are collinear, what is the relation between AB, BC and AC?

## 2 Mark Questions

1. Show that the points  $A(1, 2, 3)$ ,  $B(3, 4, 5)$  and  $C(5, 6, 7)$  are collinear.
2. Verify whether the points  $(1, 1, 1)$ ,  $(2, 2, 2)$  and  $(4, 4, 4)$  are collinear.

## 3 Mark Questions

1. Show that the points  $A(-1, 2, 1)$ ,  $B(2, 3, 4)$  and  $C(5, 4, 7)$  are collinear.
2. Using direction ratios, determine whether the points  $(2, 3, 4)$ ,  $(3, 5, 8)$  and  $(4, 7, 12)$  are collinear.