

## Three Dimensional Geometry — Assignment 1

Class 12 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.

### Direction Cosines and Direction Ratios

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

- Direction cosines  $l, m, n$  satisfy
  - $l^2 + m^2 + n^2 = 1$
  - $l + m + n = 1$
  - $lm + mn + nl = 1$
  - $l^2 + m^2 + n^2 = 0$
- Direction ratios are proportional to the
  - direction cosines
  - coordinates
  - magnitudes
  - angles
- If a line makes angles  $\alpha, \beta, \gamma$  with the axes, then  $\cos^2\alpha + \cos^2\beta + \cos^2\gamma =$ 
  - 1
  - 0
  - 3
  - 2
- The direction ratios of the line joining  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are
  - $x_2 - x_1, y_2 - y_1, z_2 - z_1$
  - $x_1, y_1, z_1$
  - $x_2, y_2, z_2$
  - sum of coordinates

#### 1 Mark Questions

- Write the relation satisfied by direction cosines.
- What are direction ratios of a line?
- Find the direction ratios of the line joining  $A(1, 2, 3)$  and  $B(4, 5, 6)$ .

#### 2 Mark Questions

- Find the direction cosines of a line whose direction ratios are 1, 2, 2.
- Find the direction cosines of the x-axis.

#### 3 Mark Questions

- Find the direction cosines of the line joining  $P(2, 3, 4)$  and  $Q(4, 5, 6)$ .
- If a line makes angles  $90^\circ, 60^\circ$  and  $\gamma$  with the axes, find  $\gamma$ .

### Equation of a Line

### MCQ Questions (choose the correct option)

- The vector equation of a line through  $a$  with direction  $b$  is
  - $r = a + \lambda b$
  - $r = a \times b$
  - $r = a \cdot b$
  - $r = a/\lambda$
- The Cartesian form of a line through  $(x_1, y_1, z_1)$  with direction ratios  $a, b, c$  is
  - $(x - x_1)/a = (y - y_1)/b = (z - z_1)/c$
  - $(x + x_1)/a = \dots$
  - $x/a = y/b = z/c$
  - $(x - x_1) = (y - y_1) = (z - z_1)$
- Two lines are perpendicular if
  - $a_1a_2 + b_1b_2 + c_1c_2 = 0$
  - $a_1a_2 + b_1b_2 + c_1c_2 = 1$
  - $a_1/a_2 = b_1/b_2 = c_1/c_2$
  - $a_1 + a_2 = 0$
- Two lines are parallel if their direction ratios are
  - proportional
  - equal to zero
  - perpendicular
  - additive

### 1 Mark Questions

- Write the vector equation of a line.
- Write the condition for two lines to be perpendicular.
- When are two lines parallel?

### 2 Mark Questions

- Find the equation of the line through  $(1, 2, 3)$  with direction ratios  $2, 3, 4$ .
- Find the vector equation of the line through  $\hat{i} + \hat{j} + \hat{k}$  with direction  $2\hat{i} - \hat{j} + \hat{k}$ .

### 3 Mark Questions

- Find the equation of the line passing through  $(1, 0, -1)$  and  $(2, 1, 3)$ .
- Show that the lines with direction ratios  $(1, 2, 3)$  and  $(2, 4, 6)$  are parallel.

## Equation of a Plane

### MCQ Questions (choose the correct option)

- The general equation of a plane is
  - $ax + by + cz + d = 0$
  - $ax + by = 0$
  - $ax^2 + by^2 = 0$
  - $ax + by + cz^2 = 0$
- The normal to the plane  $ax + by + cz + d = 0$  is

- (A)  $a\hat{i} + b\hat{j} + c\hat{k}$   
 (B)  $a + b + c$   
 (C)  $d$   
 (D)  $x\hat{i} + y\hat{j} + z\hat{k}$
3. The plane with intercepts  $a, b, c$  has equation  
 (A)  $x/a + y/b + z/c = 1$   
 (B)  $x + y + z = abc$   
 (C)  $ax + by + cz = 0$   
 (D)  $x/a + y/b + z/c = 0$
4. The distance of the plane  $ax + by + cz + d = 0$  from the origin is  
 (A)  $|d|/\sqrt{a^2 + b^2 + c^2}$   
 (B)  $|d|$   
 (C)  $d/\sqrt{a + b + c}$   
 (D)  $\sqrt{a^2 + b^2 + c^2}$

### 1 Mark Questions

- Write the general equation of a plane.
- Write the normal to the plane  $ax + by + cz + d = 0$ .
- Write the intercept form of a plane.

### 2 Mark Questions

- Find the equation of the plane with normal  $2\hat{i} + 3\hat{j} - \hat{k}$  passing through the origin.
- Find the intercepts of the plane  $2x + 3y + 4z = 12$ .

### 3 Mark Questions

- Find the equation of the plane passing through the points  $(1, 0, 0)$ ,  $(0, 1, 0)$  and  $(0, 0, 1)$ .
- Find the distance of the plane  $2x + 3y + 6z = 14$  from the origin.

## Angles and Distances

### MCQ Questions (choose the correct option)

- The angle between two planes is the angle between their  
 (A) normals  
 (B) direction ratios  
 (C) intercepts  
 (D) centroids
- The angle  $\theta$  between planes with normals  $n_1, n_2$  satisfies  
 (A)  $\cos \theta = |n_1 \cdot n_2|/(|n_1||n_2|)$   
 (B)  $\cos \theta = |n_1 \times n_2|$   
 (C)  $\sin \theta = n_1 \cdot n_2$   
 (D)  $\theta = 0$
- The distance of point  $(x_1, y_1, z_1)$  from plane  $ax + by + cz + d = 0$  is  
 (A)  $|ax_1 + by_1 + cz_1 + d|/\sqrt{a^2 + b^2 + c^2}$   
 (B)  $ax_1 + by_1 + cz_1$   
 (C)  $|d|/\sqrt{a^2 + b^2 + c^2}$

(D)  $\sqrt{a^2 + b^2 + c^2}$

4. The angle between a line and a plane uses the line direction and plane

- (A) normal
- (B) intercept
- (C) origin
- (D) centroid

### 1 Mark Questions

1. The angle between two planes is the angle between what?
2. Write the formula for the distance of a point from a plane.
3. Write the condition for two planes to be perpendicular.

### 2 Mark Questions

1. Find the angle between the planes  $x + y + z = 1$  and  $x - y + z = 1$ .
2. Find the distance of the point  $(1, 2, 3)$  from the plane  $x + y + z = 0$ .

### 3 Mark Questions

1. Find the distance of the point  $(2, 5, -3)$  from the plane  $\mathbf{r} \cdot (6\hat{i} - 3\hat{j} + 2\hat{k}) = 4$ .
2. Find the angle between the line  $(x-1)/2 = (y-2)/3 = (z-3)/4$  and the plane  $2x + y - z = 5$ .