

Three Dimensional Geometry — Assignment 2

Class 12 Maths · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
 (2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
 (3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Direction Cosines and Direction Ratios

1. Find the direction cosines of a line whose direction ratios are 1, 2, 2.
2. Find the direction cosines of the x-axis.
3. Find the direction cosines of the line joining P(2, 3, 4) and Q(4, 5, 6).

Equation of a Line

1. Find the equation of the line through (1, 2, 3) with direction ratios 2, 3, 4.
2. Find the vector equation of the line through $\hat{i} + \hat{j} + \hat{k}$ with direction $2\hat{i} - \hat{j} + \hat{k}$.
3. Find the equation of the line passing through (1, 0, -1) and (2, 1, 3).

Equation of a Plane

1. Find the equation of the plane with normal $2\hat{i} + 3\hat{j} - \hat{k}$ passing through the origin.
2. Find the intercepts of the plane $2x + 3y + 4z = 12$.
3. Find the equation of the plane passing through the points (1, 0, 0), (0, 1, 0) and (0, 0, 1).

Angles and Distances

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. Find the distance of the point (2, 5, -3) from the plane $r \cdot (6\hat{i} - 3\hat{j} + 2\hat{k}) = 4$.

Part B — Integrated problems (multi-topic)

1. Find the direction cosines of a line whose direction ratios are 1, 2, 2.
2. Find the equation of the plane with normal $2\hat{i} + 3\hat{j} - \hat{k}$ passing through the origin.
3. Find the angle between the planes $x + y + z = 1$ and $x - y + z = 1$.
4. Find the distance of the point (1, 2, 3) from the plane $x + y + z = 0$.
5. Find the direction cosines of the line joining P(2, 3, 4) and Q(4, 5, 6).

Answer Key

Direction Cosines and Direction Ratios

$1/3, 2/3, 2/3$. 1, 0, 0. $1/\sqrt{3}, 1/\sqrt{3}, 1/\sqrt{3}$.

Equation of a Line

$$(x-1)/2 = (y-2)/3 = (z-3)/4. \quad r = (\hat{i} + \hat{j} + \hat{k}) + \lambda(2\hat{i} - \hat{j} + \hat{k}). \quad (x-1)/1 = y/1 = (z+1)/4.$$

Equation of a Plane

$$2x + 3y - z = 0. \quad 6, 4, 3. \quad x + y + z = 1.$$

Angles and Distances

$$\cos \theta = 1/3. \quad \sqrt{3}. \quad 7.$$

Integrated problems

$$1: 1/3, 2/3, 2/3. \quad 2: 2x + 3y - z = 0. \quad 3: \cos \theta = 1/3. \quad 4: \sqrt{3}. \quad 5: 1/\sqrt{3}, 1/\sqrt{3}, 1/\sqrt{3}.$$