

Introduction to Three Dimensional Geometry — Assignment 2

Class 11 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

Coordinate Axes and Planes in Space

1. Name the octant in which the point $(2, -3, 4)$ lies.
2. Find the distances of the point $(3, 4, 5)$ from the coordinate planes.
3. Determine the octant of each of the points $(1, 2, 3)$, $(-1, 2, 3)$ and $(1, -2, -3)$.

Distance Between Two Points

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

Section Formula

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

Direction Cosines and Direction Ratios

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. Find the direction cosines of the line joining the points $A(2, 3, 4)$ and $B(4, 5, 8)$.

Angle Between Two Lines

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. 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

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

Part B — Integrated problems (multi-topic)

1. Find the distance between the points (2, 3, 4) and (1, 0, 5).
2. Find the midpoint of the join of (2, 4, 6) and (4, 8, 10).
3. Find the direction cosines of the line with direction ratios (2, 3, 6).
4. Find the angle between the lines with direction ratios (1, 1, 2) and (2, -1, 1).
5. Show that the points A(1, 2, 3), B(3, 4, 5) and C(5, 6, 7) are collinear.

Answer Key

Coordinate Axes and Planes in Space

(2, -3, 4) lies in the octant with $x > 0$, $y < 0$, $z > 0$. Distances from yz -, xz -, xy -planes for (3, 4, 5) are 3, 4, 5.

Distance Between Two Points

Distance = $\sqrt{11}$. Distance of (4, 3, 5) from y -axis = $\sqrt{4^2 + 5^2} = \sqrt{41}$. Parallelogram: $AB = DC$ and $AD = BC$ $\Rightarrow$ parallelogram.

Section Formula

(5/3, 10/3, 5). Centroid = (1/3, 1/3, 1/3). External division of A(2,1,4), B(4,3,2) in 3:2 = (8, 7, -2).

Direction Cosines and Direction Ratios

(2, 3, 6)/7 = (2/7, 3/7, 6/7). Direction ratios of join of (1, 0, 0), (0, 1, 1) = (-1, 1, 1). For A(2,3,4), B(4,5,8): direction ratios (2, 2, 4) $\rightarrow$ direction cosines (1/ $\sqrt{6}$, 1/ $\sqrt{6}$, 2/ $\sqrt{6}$).

Angle Between Two Lines

$\cos \theta = (1 \cdot 2 + 1 \cdot (-1) + 2 \cdot 1) / (\sqrt{6} \cdot \sqrt{6}) = 3/6 = 1/2 \Rightarrow \theta = 60^\circ$. For (2, 3, -1) and (1, -1, -1): $2 - 3 + 1 = 0 \Rightarrow 90^\circ$. Angle between join of (1,2,3)-(2,3,4) and (0,0,0)-(3,3,3) = 0° .

Collinearity of Three Points

Direction ratios $AB = (2, 2, 2)$, $BC = (2, 2, 2)$ $\Rightarrow$ proportional $\Rightarrow$ collinear. (1,1,1), (2,2,2), (4,4,4) are collinear. A(-1,2,1), B(2,3,4), C(5,4,7): $AB = (3,1,3)$, $BC = (3,1,3)$ $\Rightarrow$ collinear.

Integrated problems

1: $\sqrt{11}$. 2: (3, 6, 8). 3: (2/7, 3/7, 6/7). 4: 60° . 5: AB and BC have proportional direction ratios.