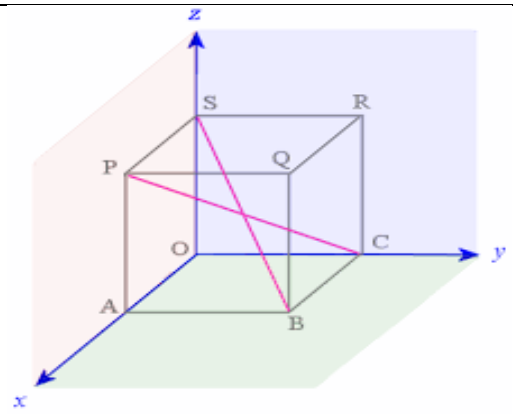
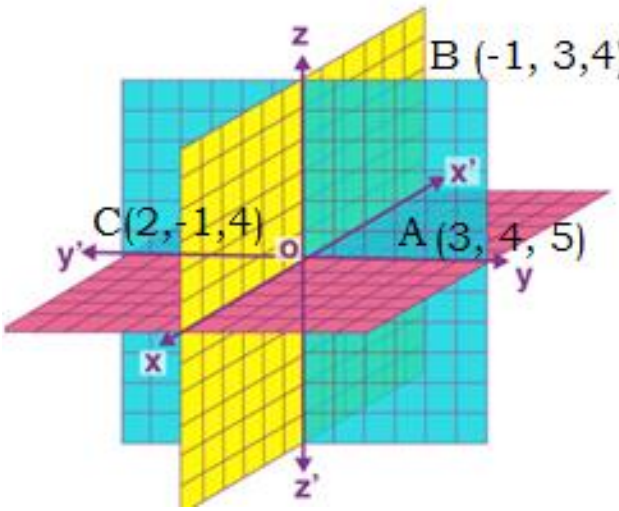
CHAPTER-12

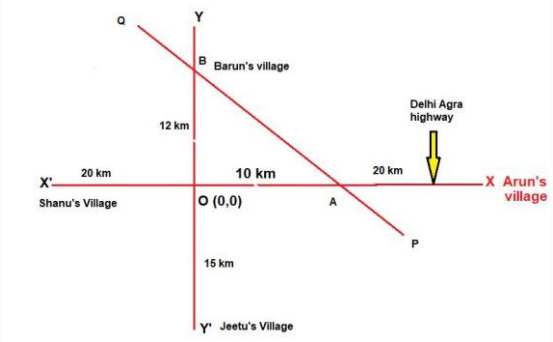
INTRODUCTION TO 3D

05 MARK TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	 , In the given figure there is a cube of side 5 metres and the three edges of cube OA,OC and OS are along X -axis, Y- axis and Z- axis. O is origin, then (i) The coordinates of point Q are ------- (a) (5,5,5) (b) (0,0,5) (c) (5,5,0) (d) (0,5,5) (ii) The length of the diagonal OQ is----- (a) $5\sqrt{3}$ units (b) $5\sqrt{2}\ units$ (c)5 units (d) $\sqrt{50}$units (iii) The coordinates of mid points of OP are------ (a) $\left(\frac{5}{2},\frac{5}{2},\frac{5}{2}\right)$ $(b)\left(0,\frac{5}{2},\frac{5}{2}\right)$ $(c)\left(\frac{5}{2},0,\frac{5}{2}\right)$ $(d)\left(\frac{5}{2},\frac{5}{2},0\right)$. (iv) The face parallel to XZ plane is------- (a) AOCB (b) PSRQ (c) OCRS (d) BQRC (v) The coordinates of the point which divides line QP in 1:2 internally are ----- (a) $\left(5,5,\frac{10}{3}\right)$ $(b)\left(0,\frac{10}{3},5\right)$ $(c)\left(5,\frac{10}{3},5\right)$ $(d)\left(5,\frac{10}{3},0\right)$	5
2.	 A boy is standing at point O and observe three kites A, B and C in space. Taking O as origin if the coordinates of three kites A, B and C are (3,4,5), (-1,3,4) and (2,-1,4) respectively, then	5

	(i) The distance between kites A and B is (a) $\sqrt{6}\,units$ $(b)\ 3\sqrt{2}\,units$ $(c)\ 9\sqrt{2}\,units (d)\ 5\,units$ (ii) The ratio in which the XZ plane divide the line joining kites B and C is (a) 1:3 (b) 1:2 (c) 3:1 (d) 2:1 (iii) The centroid of triangle OAB is (a) $\left(\frac{2}{3},\frac{7}{3},3\right)(b)\left(\frac{4}{3},2,\frac{13}{3}\right)$ $(c)\left(\frac{5}{3},1,3\right)(d)\left(\frac{1}{3},\frac{2}{3},\frac{8}{3}\right)$. (iv) The coordinates of a point on the Y- axis which is at a distance of $\sqrt{35}$ units from kites A are (a) (0,0,5) (b) (0,7,0) (c) (3,0,0) (d) (0,5,0) (v) The coordinates of point D so that ABCD is a parallelogram are (a) (6,0,5) (b) (4,9,5) (c) (-1,3,2) (d) (5,6,0)	
3.	For arranging the students of class Xll A in the morning assembly Harish is given the charge of drawing a line which is equidistant from the linesof class X C :3x+2y+6=0 &class Xll B:9x+6y-7=0. Find the equation of the line. 	5
4.	For the Teacher's Day function students arranged a Game for the Teachers. They were asked to stand in a straight line by making acute angle with the Boundary Wall on North side as positive direction of x-axis, that passes through point (-5, 0) and is at a perpendicular distance of 3 units from origin. Find the equation of the line.	5
5.	Show that the triangle ABC with vertices A(0,4,1) B(2,3,-1) and C(4,5,0) is right angled.	5
6.	If a parallelepiped is formed by planes drawn through the points (5,8,10) and (3,6,8) parallel to the coordinate planes, then find the length of edges and diagonal of the parallelepiped by using distance formula.	5
7.	Read the following scenario and answer the multiple-choice questions that follow. Sophia is learning about Three-Dimensional Geometry in her class 11 Maths CBSE course. She's excited to apply her knowledge to real-world scenarios. One day, she decided to explore her surroundings by considering different objects in three-dimensional space. **Scenario:** Sophia went to a park and noticed a tall lamp post, a bench, and a playground structure. She imagined the lamp post as a vertical line, the bench as a horizontal plane, and the playground structure as a combination of various geometric shapes. She thought about their coordinates and orientations to better understand their positions in the park. **(i)**What mathematical concept helps Sophia understand the position of the lamp post, bench, and playground structure in three-dimensional space? (a) Trigonometry (b) Algebra (c) Three-Dimensional Geometry (d) Calculus **(ii)**If Sophia wants to determine the position of a point on the playground structure precisely, how many coordinates will she need to specify?	5

	(a) 1 (b) 2 (c) 3 (d) 4 **(iii)**What does Sophia mean by imagining the lamp post as a vertical line? (a) The lamp post is tilted (b) The lamp post is horizontal (c) The lamp post extends infinitely in both horizontal directions. (d) The lamp post is curved. . **(iv)** Which mathematical tool would Sophia most likely use to find the distance between the bench and the playground structure? (a) Pythagoras' theorem (b) Mean value theorem (c) Integration (d) Quadratic formula	
8.	John, an architect, is working on designing a modern sculpture for a public plaza. The sculpture consists of three unique points in a three-dimensional space. The points are labeled as A, B, and C. John is interested in exploring the concepts of distance and collinearity to determine certain properties of these points in space. **(i)** Given the coordinates of the points A(2, -1, 3), B(4, 5, -2), and C(1, -3, 6), what is the distance between points A and B? (a)) $\sqrt{42}$ (b) $\sqrt{52}$ (c) $\sqrt{58}$ (d) $\sqrt{63}$ **(ii)** If the points A, B, and C are collinear, which of the following statements must be true? (a) The distance between A and B is equal to the distance between B and C. (b) The vectors AB and BC have the same direction. (c) The sum of the distances between A and B, and B and C is equal to the distance between A and C. (d) The cross product of vectors AB and BC is the zero vector. **(iii)**Given that points A(2, -1, 3), B(4, 5, -2), and C(1, -3, 6) are non-collinear, what are the coordinates of the point D that lies on the same line as points A, B, and C, such that AD = 3AB + 2BC? (a) (6, 8, -7) (b) (-1, -5, 4) (c) (5, 2, -4) (d) (3, 1, 2)	5
9.	A triangular board is supported at its centroid D which is at origin, if the three vertices of triangle are A(2a ,2, 6) , B(-4, 3b,-10), C(8 , 14, 2c), then (i)Find the value of a , b and c . (ii) Find the length of median through vertex A . (iii)Find the coordinates of mid point of CD. (iv) Find distance between point D and midpoint of BC. (v) Find the lenth between mid points of AD and BD respectively.	5
10.	The mid-points of the sides of a triangle are (5, 7, 11), (0, 8, 5) and (2, 3, -1). Find the coordinates of the vertices of the triangle.	5
11.	**Read the Case study given below and attempt any 5 sub parts:** **Raj and his** father were walking in a large park. They saw a kite flying in the sky. The position of kite. Raj and his father are at (20,30,10), (4,3,7) and (5,3,7) respectively. i)The distance between Raj and kite is	5

	(a) 41.32 units (b) 31.52 units (c) 38.32 units (d) 40.39 units. ii) The distance between Raj's father and kite is (a)31.30 units (b) 38.43 units (c) 31.03 units (d)29.00 units iii) The co-ordinates of kite, Raj and Raj's father form a triangle, then the centroid of it. (a)(9.67,12,8) (b) (9.6,8,12) (c) (12,8,10) (d) (7,9,7.2) iv) The co-ordinates of raj lei in (a) IV quadrant (b) III quadrant (c) II quadrant (d) I quadrant. v) The co-ordinates of points in the XY-plane are of the form (a) (0,0, z) (b) (x, y,0) (c) (x,0, y) (d) (0, x, y). 	
12.	**Read the Case study given below and attempt any 5 sub parts:** villages of Shanu and Arun's are 50km apart and are situated on Delhi Agra highway as shown in the following picture. Another highway YY' crosses Agra Delhi highway at O(0,0). A small local road PQ crosses both the highways at pints A and B such that OA=10 km and OB =12 km. Also, the villages of Barun and Jeetu are on the smaller high way YY'. Barun's village B is 12km from O and that of Jeetu is 15 km from O.  **Now answer the following questions:** a) What are the coordinates of A? i)(10, 0) ii)(10, 12) iii)(0,10) iv)(0,15) b) What is the equation of line AB? i)5x + 6y = 60 ii)6x + 5y = 60 iii)x = 10 iv) y = 12 c)What is the distance of AB from O (0, 0)? i)60 km ii)60/√61 km iii) √61 km iv)61 km d)What is the slope of line AB? i)6/5 ii)5/6 iii)-6/5 iv)10/12 e) What is the length of line AB? i)√61 km ii)12 km iii)10 km iv)2√ 61 km	5

13.	a) Three points A (1, -2, 3), B (2, 1, 5), and C (4, 3, 6) form a triangle. Determine whether the triangle is equilateral, isosceles, or scalene. b) Find the ratio in which the join the $A(2,1,5)$ and $B(3,4,3)$ is divided by the plane. $2x+2y-2z=1$ Also find the co-ordinate of the point of division	5
14.	I. Consider the points A (1, 2, 3), B (4, 5, 6), and C (7, 8, 9). Determine whether these points are collinear. II. Given points A (1, 2, 3) and B (4, 5, 6), find the coordinates of the point C on the line AB such that AC = 2/3 AB.	5

ANSWERS:

Q. NO	ANSWER	MARKS
1.	(i) (a) (5,5,5) (ii) (a) $5\sqrt{3}$ units (iii) $(b)\left(0,\frac{5}{2},\frac{5}{2}\right)$ (iv) (d) BQRC (v) (c) Q(5,5,5)and P(5,0,5) The coordinates of point which divides PQ is 1:2 $=\left(5,\frac{10}{3},5\right)$	5
2.	(i) (b) $3\sqrt{2}$ (ii) (c) 3:1 (iii) (a) $\left(\frac{2}{3},\frac{7}{3},3\right)$ (iv) (d) (0,5,0) (v) (a) (6,0,5)	5
3.	The given parallel lines are 3x+2y+6=0 (i) & 9x + 6y - 7 = 0 (ii) The eq. of family of lines parallel to eq.1 is 3x+2y+k=0 (iii) Any point on the line (iii) is (0, - k/2). For the required member of the family, (iii) is equidistant from (i) and (ii) l 3.0 + 2 (-k/2)+6 l/$\sqrt{(3^2+2^2)}$ = l9.0+6(- k/2)-7 l/$\sqrt{(9^2+6^2)}$ 3l-k + 6 l =l - 3k – 7l => k =11/6 Substituting this value of k in (iii), the equation of the required line is 3x + 2y +11/6 = 0 i.e. 18x + 12y + 11 = 0.	1 +1 +1 +1 +1
4.	Let slope of line is m Eq. of line through (-5,0) is y=m(x+5) ⇨ mx-y+5m=0 (eq.1) ⇨ Perpendicular distance from origin is 3 ⇨ $\left\lvert\frac{5m}{\sqrt{m^2+1}}\right\rvert$=3 ⇨ $16m^2$=9 ⇨ $m = \pm 3/4$	1 +1 +1 +1

	⇨ But line making acute angle ⇨ m=3/4 ⇨ Eq. is y=(3/4)(x+5) ⇨ 3x-4y+15=0	 +1
5.	Points are A(0,4,1) B(2,3,-1) and C(4,5,0) If $P(x_1,y_1,z_1)$ and $Q(x_2,y_2,z_2)$ are the two points then the distance between these points can be given by the distance formula PQ = $\sqrt{(x_1-x_2)^2+(y_1-y_2)^2+(z_1-z_2)^2}$ AB = $\sqrt{(0-2)^2+(4-3)^2+(1-(-1))^2}$ $\Rightarrow \sqrt{(-2)^2+(1)^2+(2)^2} \Rightarrow \sqrt{4+1+4}$ $\Rightarrow \sqrt{9} = 3$ BC = $\sqrt{(2-4)^2+(3-5)^2+(-1-0)^2}$ $\Rightarrow \sqrt{(-2)^2+(-2)^2+(-1)^2}$ $\Rightarrow \sqrt{9} = 3$ AC = $\sqrt{(0-4)^2+(4-5)^2+(1-0)^2}$ $\Rightarrow \sqrt{(-4)^2+(-1)^2+(1)^2} = \sqrt{18} = 3\sqrt{2}$ In a right angled triangle, sum of the square of two sides is equal to the square of the largest side. $\Rightarrow (AB)^2+(BC)^2 = (AC)^2$ $\Rightarrow (3)^2 + (3)^2 = (3\sqrt{2})^2$ $\Rightarrow 9+9 = 18$ $\Rightarrow 18 = 18$ Since $(AB)^2 + (BC)^2 = (AC)^2$ Hence ▲ABC is a right angled triangle.	5
6.	Let P = (3,6,8) and Q = (5,8,10) PE = Distance between parallel lines ABCP and FQDE = |10 - 8| [∵ these planes are perpendicular to z – axis] = 2 units PE = Distance between parallel planes ABQF and PCDE = | 5 – 3| [∵ these planes are perpendicular to X – axis] = 2 units PC = Distance between parallel planes APEF and BCDQ = | 8 – 6 | [∵ these planes are perpendicular to Y – axis] = 2 units ∴ Length of diagonal = Distance between P and Q = $\sqrt{(5-3)^2+(8-6)^2+(10-8)^2}$ [using the distance formula] = $\sqrt{2^2+2^2+2^2}$ = $\sqrt{4+4+4}$ = $\sqrt{12}$ = $2\sqrt{3}$ units	5

	Hence, the length of each edge of parallelepiped is 2 units and the length of its diagonal is $2\sqrt{3}$ units.	
7.	(i) (c) Three-Dimensional Geometry (ii) **(**c) 3 (iii) **(**c) The lamp post extends infinitely in both horizontal directions (iv) (a) Pythagoras' theorem	5
8.	(i) (c) √58 (ii) (b) The vectors AB and BC have the same direction. (iii)(a) (6, 8, -7)	5
9.	(i) (ii) (iii) (iv) (v)	5
10.	Let $A(x^1, y^1, z^1)$, $B(x^2, y^2, z^2)$ and $C(x^3, y^3, z^3)$ be the vertices of ΔABC , such that D(5, 7, 11) E(0, 8, 5) and F(2, 3, - 1) be the mid-points of the sides BC, CA and AB respectively. The vertex A is (-3, 4, -7). The vertex B is (7, 2, 5). . The vertex C is (3, 12, 17).	5
11.	i)(b)31.52 units, ii) (c) 31.03 units iii) (a) (9.67,12,8) iv) (d) I quadrant v) (b) XY-plane,z=0.	
12.	(a) i) (10, 0) (b) ii) 6x + 5y = 60 c) ii) 60/√ 61 km d) iii) -6/5 (e) iv)2√61 km	
13.	Step 1: Find the lengths of the sides AB, BC, and CA using the distance formula. - AB = √((2 - 1)² + (1 - (-2))² + (5 - 3)²) = √15. - BC = √((4 - 2)² + (3 - 1)² + (6 - 5)²) = √10. - CA = √((1 - 4)² + (-2 - 3)² + (3 - 6)²) = √27. Step 2: Compare the side lengths to determine the type of triangle. - Since all three sides have different lengths, the triangle is scalene. b) Suppose plane $2x+2y-2z=1$ divides $A(2,1,5)$ and $B(3,4,5)$ in the ratio $\lambda:1$ at plane C Point C lies on the plane $2x+2y-2z=1$ Points must satisfy the equation of plane $\left(\frac{3\lambda+2}{\lambda+1}, \frac{4\lambda+1}{\lambda+1} \frac{3\lambda+5}{\lambda+1}\right)$	5
14.	Answer I: Step 1: Find the direction ratios of AB and AC. - Direction ratios of AB: (4 - 1, 5 - 2, 6 - 3) = (3, 3, 3). - Direction ratios of AC: (7 - 1, 8 - 2, 9 - 3) = (6, 6, 6). Step 2: Check if direction ratios are proportional. - If the direction ratios of AB and AC are proportional, then the points are collinear. - In this case, (3/6) = (3/6) = (3/6), so the points A, B, and C are collinear.	5

	Answer II : Step 1: Find the direction ratios of the line AB. - Direction ratios of AB: (4 - 1, 5 - 2, 6 - 3) = (3, 3, 3). Step 2: Use the direction ratios of AB to find the coordinates of point C. - Coordinates of C: (1 + 2/3 * 3, 2 + 2/3 * 3, 3 + 2/3 * 3) = (5, 4, 5).	