

# NCERT Solutions Class 11 Maths

## Chapter 11: Introduction to Three Dimensional Geometry

### EXERCISE 11.2

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#### Document Information:

Class: 11 | Subject: Mathematics | Chapter: 11 | Exercise: 11.2

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**Quick Summary:** In NCERT Solutions Class 11 Maths Chapter 11 Exercise 11.2, students learn to apply the distance formula in three-dimensional coordinate geometry. This exercise covers calculating distances between points in 3D space, verifying collinearity of points, and proving geometric properties of triangles and parallelograms, which are essential concepts for CBSE board exams and competitive tests.

#### Key Takeaways:

- Distance formula in 3D space:  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$  for points  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$
- Finding equations of loci for points equidistant from given points using distance formula
- Verifying geometric properties like collinearity, triangle vertices, and parallelogram conditions in 3D coordinate system
- Application of distance formula to solve real-world problems involving three-dimensional measurements

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## Question 1

### QUESTION

Find the distance between the following pairs of points:

- (i) (2, 3, 5) and (4, 3, 1)
- (ii) (-3, 7, 2) and (2, 4, -1)
- (iii) (-1, 3, -4) and (1, -3, 4)
- (iv) (2, -1, 3) and (-2, 1, 3)

### SOLUTION

This question tests our understanding of the distance formula in three-dimensional space. We need to apply the formula to find the distance between the given pairs of points.

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(i) Points: and

**Step 1: Recall the distance formula in 3D**

The distance between two points and is given by:

**Step 2: Apply the formula**

Let and .

**Step 3: Simplify**

**Step 4: Further simplification**

**Final Answer:** The distance between the points and is .

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(ii) Points: and

**Step 1: Apply the distance formula**

Let and .

**Step 2: Simplify**

**Final Answer:** The distance between the points and is .

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(iii) Points: and

**Step 1: Apply the distance formula**

Let and .

**Step 2: Simplify**

**Step 3: Further simplification**

**Final Answer:** The distance between the points and is .

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(iv) Points: and

**Step 1: Apply the distance formula**

Let and .

**Step 2: Simplify**

**Step 3: Further simplification**

**Final Answer:** The distance between the points and is .

**ANSWER**

(i)  $2\sqrt{5}$

(ii)  $\sqrt{43}$

(iii)  $2\sqrt{26}$

(iv)  $2\sqrt{5}$

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## Question 2

### QUESTION

Show that the points  $(-2, 3, 5)$ ,  $(1, 2, 3)$  and  $(7, 0, -1)$  are collinear.

### SOLUTION

To show that the points , and are collinear, we need to show that the direction ratios of the line joining any two pairs of points are proportional.

#### Step 1: Define the points

Let the points be , and .

#### Step 2: Find the direction ratios of line AB

The direction ratios of the line joining two points and are given by .

Therefore, the direction ratios of line AB are:

#### Step 3: Find the direction ratios of line BC

The direction ratios of line BC are:

#### Step 4: Check for proportionality

We need to check if the direction ratios of AB and BC are proportional. That is, if:

Simplifying the fractions, we get:

Since the ratios are equal, the direction ratios of AB and BC are proportional.

#### Step 5: Conclusion

Since the direction ratios of AB and BC are proportional, and B is a common point, the points A, B, and C are collinear.

### Question 3

#### QUESTION

Verify the following:

- (i) (0, 7, -10), (1, 6, -6) and (4, 9, -6) are the vertices of an isosceles triangle.
- (ii) (0, 7, 10), (-1, 6, 6) and (-4, 9, 6) are the vertices of a right angled triangle.
- (iii) (-1, 2, 1), (1, -2, 5), (4, -7, 8) and (2, -3, 4) are the vertices of a parallelogram.

#### SOLUTION

This question requires us to verify geometric properties of triangles and parallelograms in 3D space using the distance formula.

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(i) To prove that the points are the vertices of an isosceles triangle, we need to show that at least two sides of the triangle have equal lengths.

**Step 1: Calculate the distance between each pair of points.**

Let , , and .

The distance formula between two points and is given by:

**Step 2: Calculate AB**

**Step 3: Calculate BC**

**Step 4: Calculate AC**

**Step 5: Conclusion**

Since , the triangle is an isosceles triangle.

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(ii) To prove that the points are the vertices of a right-angled triangle, we need to show that the square of the length of the longest side is equal to the sum of the squares of the lengths of the other two sides (Pythagorean theorem).

**Step 1: Calculate the distance between each pair of points.**

Let , , and .

**Step 2: Calculate AB**

**Step 3: Calculate BC**

**Step 4: Calculate AC**

**Step 5: Check Pythagorean theorem**

Since , the triangle is a right-angled triangle.

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(iii) To prove that the points and are the vertices of a parallelogram, we need to show that the opposite sides are equal.

**Step 1: Calculate the distance between each pair of points.**

Let , , and .

**Step 2: Calculate AB**

**Step 3: Calculate BC**

**Step 4: Calculate CD**

**Step 5: Calculate DA**

**Step 6: Conclusion**

Since and , the quadrilateral is a parallelogram.

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## Question 4

### QUESTION

Find the equation of the set of points which are equidistant from the points (1, 2, 3) and (3, 2, -1).

### SOLUTION

We need to find the equation of the set of all points that are equidistant from the points and . This means we are looking for the locus of a point such that .

#### Step 1: Write the distance formula

The distance between two points and in 3D space is given by:

#### Step 2: Express PA and PB using the distance formula

Let be any point equidistant from and . Then . Therefore:

#### Step 3: Set PA = PB and simplify

Since , we have:

Squaring both sides to remove the square roots:

#### Step 4: Expand the squares and cancel out common terms

Expanding the squares, we get:

Notice that , , , , , and appear on both sides, so we can cancel them out:

#### Step 5: Rearrange the equation

Rearranging the terms, we get:

#### Step 6: Simplify to get the final equation

Dividing both sides by 4, we get:

**Final Answer:** The equation of the set of points is .

### ANSWER

$$x - 2z = 0$$

## Question 5

### QUESTION

Find the equation of the set of points P, the sum of whose distances from A(4, 0, 0) and B(-4, 0, 0) is equal to 10.

### SOLUTION

We are asked to find the equation of the set of points such that the sum of its distances from two fixed points and is equal to 10.

#### Step 1: Define the distances PA and PB

Let be any point in the set. The distance between and is given by:

Similarly, the distance between and is given by:

#### Step 2: Use the given condition PA + PB = 10

We are given that . Therefore:

#### Step 3: Simplify the equation

Isolate one of the square roots:

Square both sides:

Expand and simplify:

Divide by 4:

#### Step 4: Square both sides again

#### Step 5: Simplify to get the final equation

Thus, the equation of the set of points is:

### ANSWER

$$9x^2 + 25y^2 + 25z^2 - 225 = 0$$

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## Key Formulas

### Important Formulas for Exercise 11.2

Formula / Concept	Description
Distance Formula in 3D	The distance between two points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ is given by: $PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$
Distance from the Origin	The distance of a point $P(x, y, z)$ from the origin $O(0, 0, 0)$ is: $OP = \sqrt{x^2 + y^2 + z^2}$
Section Formula (Internal Division)	The coordinates of the point $R$ which divides the line segment joining points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ internally in the ratio $m:n$ are: $R = \left( \frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}, \frac{mz_2 + nz_1}{m+n} \right)$
Section Formula (External Division)	The coordinates of the point $R$ which divides the line segment joining points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ externally in the ratio $m:n$ are: $R = \left( \frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n}, \frac{mz_2 - nz_1}{m-n} \right)$
Midpoint Formula	The coordinates of the midpoint of the line segment joining points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$ are found by taking the average of the coordinates: $M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right)$
Centroid of a Triangle	The coordinates of the centroid of a triangle with vertices $A(x_1, y_1, z_1)$ , $B(x_2, y_2, z_2)$ , and $C(x_3, y_3, z_3)$ are: $G = \left( \frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}, \frac{z_1 + z_2 + z_3}{3} \right)$
Condition for Collinearity	Three points $P, Q,$ and $R$ are collinear if they lie on the same line. This can be verified using the distance formula: the sum of the distances between two pairs of points equals the distance between the third pair. For example, $PQ + QR = PR$ .

## 7 Top FAQs

### Q1. How many questions are in NCERT Solutions Class 11 Maths Chapter 11 Introduction to Three Dimensional Geometry Exercise 11.2?

Exercise 11.2 of NCERT Solutions for Class 11 Maths Chapter 11 Introduction to Three Dimensional Geometry contains exactly 5 questions. These questions focus on the Distance Formula in 3D and Section Formula applications, which carry 3 marks weightage from Unit III Coordinate Geometry in CBSE board exam 2025-26.

### Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 11 Introduction to Three Dimensional Geometry Exercise 11.2 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 11 Maths Chapter 11 Introduction to Three Dimensional Geometry Exercise 11.2 from the official NCERT website or various educational platforms offering step by step solutions. These PDFs are updated for CBSE session 2025-26 and include detailed explanations of Distance Formula and Section Formula problems.

### Q3. How many marks does Introduction to Three Dimensional Geometry Exercise 11.2 carry in CBSE Class 11 board exam 2025-26?

Introduction to Three Dimensional Geometry Chapter 11 Exercise 11.2 questions typically carry 3 marks in CBSE Class 11 board exam 2025-26. This chapter is part of Unit III Coordinate Geometry, and the Distance Formula and Section Formula concepts from Exercise 11.2 are frequently asked in examinations.

### Q4. Which is the most difficult question in NCERT Solutions for Class 11 Maths Chapter 11 Introduction to Three Dimensional Geometry Exercise 11.2?

Question 5 of Exercise 11.2 in NCERT Solutions for Class 11 Maths Chapter 11 Introduction to Three Dimensional Geometry is considered the most difficult by students as it involves complex applications of the Distance Formula in 3D coordinate system. However, with step by step solutions and practice, this question becomes manageable for CBSE board exam 2025-26 preparation.

### Q5. What is the Distance Formula in 3D covered in NCERT Class 11 Maths Chapter 11 Introduction to Three Dimensional Geometry Exercise 11.2?

The Distance Formula in 3D from NCERT Class 11 Maths Chapter 11 Exercise 11.2 states that the distance between two points  $P(x_1, y_1, z_1)$  and  $Q(x_2, y_2, z_2)$  is  $\sqrt{[(x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2]}$ . This formula is crucial for solving all 5 questions in Exercise 11.2 and is important for CBSE board exam 2025-26 preparation.

## More Exercises

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