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CHAPTER NOTES

Coordinate Geometry Class 9 Notes | CBSE Maths Chapter 1

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Source: <https://chaptersnotes.in/cbse/class-9-maths/chapter-1-coordinate-geometry/notes/>



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Hi, I am **Ira**. I teach this syllabus all day, so **Coordinate Geometry** is very much my home ground.

Ask me anything from this chapter. A concept, a numerical, or that one doubt you did not want to raise in class. Pick one to start:

Explain Coordinate Geometry simply

What can the board exam ask?

Most important formulas

Quiz me on this chapter

Ask Ira anything...



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Coordinate Geometry Class 9 Notes | CBSE Maths Chapter 1

Coordinate Geometry is Chapter 1 of CBSE Class 9 Maths. In the new 2026-27 NCERT book, Ganita Manjari (Grade 9, Part I), the chapter is titled "Orienting Yourself: The Use of Coordinates". It shows how two perpendicular number lines, the x-axis and the y-axis, let us describe the exact position of any point on a flat surface with just two numbers, and how those two numbers let us measure distances without a ruler.

The chapter covers the Cartesian plane, the origin, the sign convention, the four quadrants, distances along grid lines, the distance formula from the Baudhāyana-Pythagoras theorem, and the midpoint of a segment, then uses them to test collinearity, right angles, circles and squares. In the CBSE Class IX course structure for 2026-27, Unit III, Coordinate Geometry, carries 4 marks in the annual theory paper. The same ideas return in Class 10 where the distance formula and the midpoint are used again in harder problems.

Quick Answer - Coordinate Geometry

Two perpendicular number lines, the horizontal x-axis and the vertical y-axis, intersect at the **origin O (0, 0)**. Right and up are positive directions. Distances are measured in units from the y-axis and x units from the x-axis. The four **quadrants** with signs (+, +), (-, +), (-, -), and (+, -). Points on the x-axis are (x, 0) and on the y-axis are (0, y). The distance between two points (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. The midpoint is $((x_1 + x_2)/2, (y_1 + y_2)/2)$.



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All Key Formulas at a Glance

Idea	Rule or Formula	Remember
Origin	$O = (0, 0)$	Where the x-axis and y-axis cross
Point on the x-axis	$(x, 0)$	y-coordinate is 0
Point on the y-axis	$(0, y)$	x-coordinate is 0
Quadrant signs	I (+, +), II (-, +), III (-, -), IV (+, -)	Counted anticlockwise from the top right
Order of coordinates	$(x, y) = (y, x)$ only when $x = y$	$(2, 5)$ and $(5, 2)$ are different points
Same y-coordinate	Distance between (x_1, y) and $(x_2, y) = x_2 - x_1 $	
Same x-coordinate	Distance between (x, y_1) and $(x, y_2) = y_2 - y_1 $	
Distance formula	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	
Distance from the origin	$OP = \sqrt{x^2 + y^2}$	
Midpoint	$M = ((x_1 + x_2)/2, (y_1 + y_2)/2)$	
Collinearity test	$PQ + QR = PR$	



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Key Concepts

1. Why We Need a System of Coordinates

NCERT defines a **system of coordinates** as a structured framework, like the grid lines on a map or on graph paper, that lets us use numbers to describe the exact physical locations of points or objects. Two numbers, counted from a fixed starting point along two fixed directions, pin down a place exactly.

A short history from the chapter. Streets in the **Sindhu-Sarasvatī Civilisation** ran North-South and East-West about 10 metres apart, so a merchant could find a shop by counting units from the city centre: a coordinate system in practice. **Baudhāyana** used East-West and North-South lines in his constructions and developed the Baudhāyana-Pythagoras theorem. **Brahmagupta** (c. 628 CE) formalised zero and negative numbers; the origin is zero and the negative axes hold values below zero, so the four-quadrant plane depends on his work. **René Descartes** (1637 CE), following related work of Fermat, formalised the fact that any point in a plane is fixed by two numbers, its distances from two perpendicular lines.

Reiaan's room. Reiaan cannot see, and his father maps his room on a rectangular grid, with the positions of objects so he can feel their positions. He can't see, but he can feel the positions of objects.

The map shows only the floor. A window shows the sky, but cannot show height. The floor is a two-dimensional plane; a point in the air of the room would not be on the map.

2. Coordinate Axes, Origin and Sign Convention

The number line from earlier grades is one-dimensional. A coordinate system uses **two number lines** to locate points in a plane.

- The horizontal line is called the **x-axis**.
- The vertical line is called the **y-axis**.
- The point where they intersect is called the **origin**.
- Distances from O are marked off in **equal units**.

Sign convention. Distances to the **right** of the origin are **positive**. Distances to the **left** or **downwards** are **negative**.

Points on the axes. NCERT uses these three points to show the location of a point on the axes.



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Point	Where it is	Coordinates
B	On the x-axis, 4.5 units to the right of O	(4.5, 0)
G	On the y-axis, 4.5 units below O	(0, -4.5)
H	On the y-axis, 4 units above O	(0, 4)

A point $(x, 0)$ lies on the **x-axis**, right of O if $x > 0$ and left if $x < 0$. A point $(0, y)$ lies on the **y-axis**, above O if $y > 0$ and below if $y < 0$. The origin is the only point on both axes.

Notation. $B = (4.5, 0)$ is often written without the "=" sign as $B (4.5, 0)$, especially on a graph.

3. Coordinates of a Point and the Four Quadrants

The plane of the axes is called the **Cartesian plane**, the **coordinate plane** or the **xy-plane**. The axes divide it into four **quadrants**: I is top-right, II top-left, III bottom-left and IV bottom-right.

Meaning of the coordinates. The coordinates of a point P are given by (x, y) .

- **x** is the perpendicular distance of P from the y-axis. It is called the **x-coordinate**.
- **y** is the perpendicular distance of P from the x-axis. It is called the **y-coordinate**.

Signs in each quadrant.

Quadrant	Position	Signs
I	Top right	Pos x, Pos y
II	Top left	Neg x, Pos y
III	Bottom left	Neg x, Neg y
IV	Bottom right	Pos x, Neg y

NCERT's examples: S (3, -5) is in Quadrant IV. To locate S, move 3 units right of O along the x-axis, then 5 units down.



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Points on the axes belong to no quadrant. $(-3, 0)$ and $(0, 6)$ lie on the boundaries between quadrants.

Order matters. $(2, 5)$ is 2 right and 5 up; $(5, 2)$ is 5 right and 2 up. The chapter summary states:

- If $x = y$, then $(x, y) = (y, x)$.
- If $x \neq y$, then $(x, y) \neq (y, x)$.

So $Q(y, x)$ coincides with $P(x, y)$ only when $x = y$, for points such as $(3, 3)$ or $(-2, -2)$.

Why negative numbers are needed. With only zero and positive numbers we could name points in Quadrant I and on the positive axes. Everything left of the y-axis or below the x-axis, three quarters of the plane, would have no name.

4. Distance Along Grid Lines

Same y-coordinate (horizontal segment).

absolute value of the difference of the x-coordinates

$$\text{distance} = |x_2 - x_1|$$

Same x-coordinate (vertical segment). The

$$\text{distance} = |y_2 - y_1|$$

The absolute value keeps a distance positive.

- $(3, 0)$ and $(-5, 0)$: $|-5 - 3| = |-8| = 8$ units.
- $(0, 1.5)$ and $(0, 4)$: $|4 - 1.5| = 2.5$ units. The door is 2.5 units wide.
- $(-5, -2)$ and $(-5, 2)$: $|2 - (-2)| = 4$ units.

Mirror images in an axis. Reflecting in the x-axis changes (x, y) to $(x, -y)$. So $(-5, -2)$ and $(-5, 2)$ are mirror images of each other in the x-axis.

5. The Distance Formula

What if the segment joining two points is parallel to neither axis?

Baudhāyana-Pythagoras theorem from Geometry says that the square of the hypotenuse equals the sum of the squares of the other two sides.



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NCERT's triangle ADM. Take A (3, 4), D (7, 1) and M (9, 6), all in the first quadrant. To find AD, mark C (3, 1), directly below A and level with D. Triangle ACD has a right angle at C.

- Distance moved along the x-axis: $CD = x\text{-coordinate of D} - x\text{-coordinate of A} = 7 - 3 = 4$.
- Distance moved along the y-axis: $AC = y\text{-coordinate of A} - y\text{-coordinate of D} = 4 - 1 = 3$.
- By the Baudhāyana-Pythagoras theorem: $AD = \sqrt{4^2 + 3^2} = \sqrt{25} = \mathbf{5 \text{ units}}$.
- DM: shifts $9 - 7 = 2$ and $6 - 1 = 5$, so $DM = \sqrt{2^2 + 5^2} = \mathbf{\sqrt{29} \text{ units}}$.
- MA: shifts $9 - 3 = 6$ and $6 - 4 = 2$, so $MA = \sqrt{6^2 + 2^2} = \mathbf{\sqrt{40} \text{ units}}$ (which simplifies to $2\sqrt{10}$).

The general formula. For any two points (x_1, y_1) and (x_2, y_2) , draw the horizontal and vertical lines through them to form a right triangle with its right angle at F (x_1, y_2) . One leg is the shift along the x-axis, $x_2 - x_1$; the other is the shift along the y-axis, $y_2 - y_1$. The segment itself is the hypotenuse, so

$$\text{distance} = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$$

It makes no difference whether the shifts are -4 or 4 . $(-4)^2$ and 4^2 are both 16. So you may substitute

Distance from the origin. Put $(x_1, y_1) = (0, 0)$. For example, $(-6, 8)$ is $\sqrt{(36 + 64)} = \sqrt{100} = 10$ units from the origin.

Negative coordinates and reflection. NCERT gives A (3, 4), D' (-7, 1), M' (-9, 6). Now $C'D' = -3 - (-7) = 4$ and $M'A' = -6 - (-9) = 3$. So $C'D' = 4$ and $M'A' = 3$. $C'D' = \sqrt{4^2 + 1^2} = \sqrt{17}$ and $M'A' = \sqrt{3^2 + 2^2} = \sqrt{13}$.

Reflection preserves the lengths of the segments. Reflection from Quadrant I to Quadrant II. Reflection in the y-axis. The shift only changes sign.

6. Midpoint of a Segment

The **midpoint** M of a segment ST is the point that divides ST into two equal parts. It asks you to find the connection between the coordinates of S and T. The **average** of the matching coordinates of S and T.

For S (x_1, y_1) and T (x_2, y_2) :

$$\mathbf{M = ((x_1 + x_2)/2, (y_1 + y_2)/2)}$$



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Why the average works. Halfway from S to T you have made half of each shift, so the x-coordinate of M is $x_1 + (x_2 - x_1)/2 = (x_1 + x_2)/2$. The y-coordinate works the same way.

Check. For S (2, 3) and T (4, 5), M = (3, 4), and SM = MT = $\sqrt{2}$.

Running it backwards. Knowing M and one end A, apply the shift from A to M once more, starting at M, to reach the other end B.

Points of trisection. P and Q divide AB into three equal parts, P closer to A. P is the midpoint of AQ and Q is the midpoint of PB. To compute them, step one-third of the shift from A to B twice from A.

Vertices from midpoints. If D, E, F are the midpoints of BC, CA, AB, then $B + C = 2D$, $C + A = 2E$, $A + B = 2F$ (coordinate by coordinate), so $A + B + C = D + E + F$. Solved Example 10 uses this.

7. Using Distances: Collinearity, Right Angles, Circles and Squares

With the distance formula, many geometry plotting.

(a) Three points on one straight line (collinearity) If two smaller distances add up exactly to the third, the point sits on the segment joining the other two. For a triangle.

PQ + QR = PR $\Rightarrow$ P, Q, R are collinear

A second check: from M (-3, -4) to A (0, 8), exactly double. The direction never changes.

(b) Is a triangle right-angled? By the converse of Pythagoras, a triangle is right-angled exactly when the largest side squared is equal to the sum of the squares of the other two sides. For a triangle, the largest angle is opposite the longest side. For a triangle, the largest angle; NCERT calls ADM acute-angled.

(c) Points and a circle centred at the origin The set of all points at distance r from O. For a point (x, y), $x^2 + y^2 = r^2$.



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Comparison	Position of P
$x^2 + y^2 = r^2$	On the circle
$x^2 + y^2 < r^2$	Inside the circle
$x^2 + y^2 > r^2$	Outside the circle

For a circle with centre C, use the distance from C instead. Two circles with centres d apart and radii r_1, r_2 cross when d is less than $r_1 + r_2$ and greater than the difference of the radii.

(d) Identifying quadrilaterals. Four equal sides give a rhombus; add equal diagonals and it is a square, with area side^2 . Diagonals sharing a midpoint give a parallelogram; a parallelogram with equal diagonals is a rectangle.



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Formula and Theorem Sheet

Result	Statement or Formula	When to use it
Quadrant signs	I (+, +); II (-, +); III (-, -); IV (+, -)	Naming the quadrant of a point
Horizontal distance	(x_1, y) to $(x_2, y) = x_2 - x_1 $	Same y-coordinate
Vertical distance	(x, y_1) to $(x, y_2) = y_2 - y_1 $	Same x-coordinate
Distance formula	$\sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$	Any two points
Distance from origin	$\sqrt{(x^2 + y^2)}$	Circles centred at O
Midpoint	$((x_1 + x_2)/2, (y_1 + y_2)/2)$	Halfway point; missing end
Points of trisection of AB	$A + (1/3)(\text{shift from A to B})$ $(2/3)(\text{shift from A to B})$	
Reflection in the y-axis	$(x, y) \rightarrow (-x, y)$	
Collinearity	$PQ + QR = PR$	
Right-angle test	Largest side squared = sum of squares of the other two sides	
Point and circle (centre O, radius r)	Compare $x^2 + y^2$ with r^2	



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Important Definitions

Term	Definition
System of coordinates	A structured framework, like the grid lines on a map or graph paper, that lets us use numbers to describe the exact physical locations of points or objects
Origin	The point of intersection of the x-axis and the y-axis; its coordinates are (0, 0)
Cartesian plane	The plane in which the coordinate axes lie; also called the coordinate plane or the xy-plane
Quadrants	The four parts into which the coordinate axes divide the plane, numbered I, II, III and IV
x-coordinate	The perpendicular distance of a point from the y-axis, measured along the x-axis,
y-coordinate	The perpendicular distance of a point from the x-axis, measured along the y-axis,
Distance between two points	The length of the line segment joining the two points
Midpoint of a segment	The point on the segment such that its distances from the endpoints are equal
Collinear points	Points that lie on the same line
Circle	The set of all points in a plane at a fixed distance (the radius) from a fixed point (the centre)



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Solved Examples (NCERT-Based)

Example 1: The fourth foot of Reiaan's table (Exercise Set 1.2)

"Place Reiaan's rectangular study table with three of its feet at the points (8, 9), (11, 9) and (11, 7).
(i) Where will the fourth foot of the table be? ... (iii) What is the width of the table? The length?
Can you make out the height of the table?"

Solution: Label the feet P (8, 9), Q (11, 9) and R (11, 7).

Step 1: P and Q share $y = 9$, so PQ is horizontal; Q and R share $x = 11$, so QR is vertical. The right angle is at Q.

Step 2: The fourth foot S must be directly below P (same x-coordinate, 8) and level with R (same y-coordinate, 7). So **S = (8, 7)**.

Step 3: $PQ = |11 - 8| = 3$ units and $QR = |9 - 7| = 2$ units.
wide. Shalini's scale is 1 cm : 1 foot and the table is 3 feet by 2 feet.

Step 4: The height cannot be found from a

Part (ii) depends on the other furniture in t

Example 2: The quadrilateral RAM

"Consider the points R (3, 0), A (0, -2), M (-5, -2) and P (-5, 2) in order, predict: (i) Two sides of RAMP that are parallel to one of the axes. (ii) Two sides that are parallel to one of the axes. (iii) Two sides that are perpendicular to one of the axes. Which axis will this be?"

Solution: The sides are RA, AM, MP and PR.

Step 1: A (0, -2) and M (-5, -2) have the same y-coordinate. They are parallel to the x-axis. Its length is $|-5 - 0| = 5$.

Step 2: M (-5, -2) and P (-5, 2) have the same x-coordinate. They are parallel to the y-axis. Its length is $|2 - (-2)| = 4$.

Step 3: A horizontal line and a vertical line are perpendicular. Either AM (parallel to the x-axis) or MP (parallel to the y-axis) answers (iii).



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Step 4: M (-5, -2) and P (-5, 2) differ only in the sign of the y-coordinate. So **M and P are mirror images of each other in the x-axis**. This answers (iii).

Example 3: Sides of triangle ADM (Section 1.4)

Find the lengths of the sides of the triangle with vertices A (3, 4), D (7, 1) and M (9, 6).

Solution:

AD: shifts $7 - 3 = 4$ and $1 - 4 = -3$. $AD = \sqrt{4^2 + (-3)^2} = \sqrt{16 + 9} = \sqrt{25} = \mathbf{5 \text{ units}}$.

DM: shifts $9 - 7 = 2$ and $6 - 1 = 5$. $DM = \sqrt{4 + 25} = \mathbf{\sqrt{29} \text{ units}}$.

MA: shifts $3 - 9 = -6$ and $4 - 6 = -2$. $MA = \sqrt{36 + 4} = \mathbf{\sqrt{40} = 2\sqrt{10} \text{ units}}$.

Example 4: Three points on a line (End-of-Chapter Exercise 6)

"Are the points M (-3, -4), A (0, 0) and G (6, 8) on the same straight line? Check this without plotting and joining the points."

Solution: Method: find the three distances and see if any two are the largest.

$MA = \sqrt{[(0 + 3)^2 + (0 + 4)^2]} = \sqrt{9 + 16} = 5$

$AG = \sqrt{[(6 - 0)^2 + (8 - 0)^2]} = \sqrt{36 + 64} = 10$

$MG = \sqrt{[(6 + 3)^2 + (8 + 4)^2]} = \sqrt{81 + 144} = 15$

$MA + AG = 5 + 10 = 15 = MG$. So **M, A and G** are on the same straight line.

Example 5: Testing R, B and C (End-of-Chapter Exercise 6)

"Use your method (from Problem 6) to check if the points R (3, 4), B (0, 0) and C (6, 8) are on the same straight line."

Solution:

RB: shifts 3 and -4. $RB = \sqrt{9 + 16} = 5$.

BC: shifts 6 and -7. $BC = \sqrt{36 + 49} = \sqrt{85}$.



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RC: shifts 9 and -11. $RC = \sqrt{(81 + 121)} = \sqrt{202}$.

RC is the largest. Is $5 + \sqrt{85}$ equal to $\sqrt{202}$? Square the left side: $(5 + \sqrt{85})^2 = 25 + 10\sqrt{85} + 85 = 110 + 10\sqrt{85}$. Since $\sqrt{85}$ is more than 9.2, this is more than $110 + 92 = 202$. So $5 + \sqrt{85} > \sqrt{202}$, and **R, B and C are not on the same straight line**.

The shifts confirm it: R to B is (3, -4), B to C is (6, -7), and a straight line would need (6, -8). Rounded decimals (14.22 against 14.21) would have misled you.

Example 6: Is M the midpoint of ST? (End-of-Chapter Exercise 9)

“The following table shows the coordinates of points S, M and T. In each case, state whether M is the midpoint of segment ST. Justify your answer.”

Solution: Compute the true midpoint $((x_S + x_T)/2, (y_S + y_T)/2)$ and compare.

S	M	T	True mid
(-3, 0)	(0, 0)	(3, 0)	(0/2, 0/2) 0)
(2, 3)	(3, 4)	(4, 5)	(6/2, 8/2) 4)
(0, 0)	(0, 5)	(0, -10)	(0, -10/2) -5)
(-8, 7)	(0, -2)	(6, -3)	(-2/2, 4/2) (-1, 2)



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Example 7: Finding a missing end

“Use the connection you found to find the coordinates of the midpoint of segment AB. A (3, -4) and B (x, y).”

Solution:

x-coordinates: $(3 + x)/2 = -7$, so $3 + x = -14$

y-coordinates: $(-4 + y)/2 = 1$, so $-4 + y = 2$

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B = (-17, 6).

Check: the shift from A to M is (-10, 5); the same shift from M gives (-17, 6).

Example 8: Points of trisection (End-of-Chapter Exercise 11)

"Let P, Q be points of trisection of AB, with P closer to A, and Q closer to B. Using your knowledge of how to find the coordinates of the midpoint of a segment, how would you find the coordinates of P and Q? Do this for the case when the points are A (4, 7) and B (16, -2)."

Solution: $AP = PQ = QB$, so P is the midpoint of AQ and Q is the midpoint of PB. Equivalently, P is one-third of the way from A to B and Q is two-thirds of the way.

Step 1: Shift from A to B = $(16 - 4, -2 - 7) = (12, -9)$.

Step 2: One-third of the shift = $(4, -3)$.

Step 3: P = $(4 + 4, 7 - 3) = (8, 4)$. Q = $(8 + 8, 4 - 6) = (16, -2)$.

Check: midpoint of A and Q is $(16/2, 8/2) = (8, 4) = P$.
Midpoint of P and B is $(12, -2) = Q$.

Example 9: Points on a circle centered at the origin (Exercise 12)

"(i) Given the points A (1, -8), B (-4, 7) and C (5, 9), check whether D and E lie within the circle with center is the origin O (0, 0). What is the radius?"

Solution: (i) Use $OP^2 = x^2 + y^2$.

$OA^2 = 1 + 64 = 65$. $OB^2 = 16 + 49 = 65$. $OC^2 = 25 + 81 = 106$.

All three points are the same distance $\sqrt{65}$ from the origin. So the radius is $\sqrt{65}$ units (about 8.06 units).

(ii) $OD^2 = 25 + 36 = 61 < 65$, so D lies inside the circle.
 $OE^2 = 16 + 16 = 32 < 65$, so E lies inside the circle.



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Example 10: Vertices from the midpoints of the sides (End-of-Chapter Exercise 13)

"The midpoints of the sides of triangle ABC are the points D, E, and F. Given that the coordinates of D, E, and F are (5, 1), (6, 5), and (0, 3), respectively, find the coordinates of A, B and C."

Solution: The question does not say which side each point bisects. Take the usual labelling: D is the midpoint of BC (the side opposite A), E of CA and F of AB. Work with x-coordinates and y-coordinates separately.

x-coordinates: $x_B + x_C = 10$, $x_C + x_A = 12$, $x_A + x_B = 0$. Adding: $2(x_A + x_B + x_C) = 22$, so $x_A + x_B + x_C = 11$. Then $x_A = 11 - 10 = 1$, $x_B = 11 - 12 = -1$, $x_C = 11 - 0 = 11$.

y-coordinates: $y_B + y_C = 2$, $y_C + y_A = 10$, $y_A + y_B = 6$. Adding: $2(\text{sum}) = 18$, so the sum is 9. Then $y_A = 9 - 2 = 7$, $y_B = 9 - 10 = -1$, $y_C = 9 - 6 = 3$.

A = (1, 7), B = (-1, -1), C = (11, 3).

Check: midpoint of BC = $(10/2, 2/2) = (5, 1)$
midpoint of AB = $(0/2, 6/2) = (0, 3) = F$.

About the labelling. Any other matching of the letters to the points is possible, but only the letters A, B, C swap. State the labelling.

Example 11: Icons on a computer screen

"A computer graphics program displays icons on a screen. The origin of the coordinate system has the origin at the bottom-left corner of the screen. The screen is 800 pixels wide and 600 pixels high. A circular icon of radius 80 pixels is drawn with its centre at (20, 130). A circular icon of radius 100 pixels is drawn with its centre at (180, 330). Determine whether any part of either circle lies outside the screen."

Solution: The screen runs from $x = 0$ to $x = 800$ and $y = 0$ to $y = 600$.

(i) Circle A spans x from 20 to 180 and y from 130 to 330. All values lie inside 0 to 800 and 0 to 600. Circle A is **entirely inside the screen**.

(ii) Distance between the centres: shifts 20 units right and 200 units up.
 $\sqrt{20^2 + 200^2} = \sqrt{400 + 40000} = \sqrt{40400} \approx 201$ pixels.



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Sum of the radii = $80 + 100 = 180$ pixels. Difference of the radii = 20 pixels. Since $20 < 170 < 180$, the centres are closer than the sum of the radii, and neither circle sits wholly inside the other. So **the two circles intersect**.

Example 12: Is ABCD a square? (End-of-Chapter Exercise 16)

"Plot the points A (2, 1), B (-1, 2), C (-2, -1), and D (1, -2) in the coordinate plane. Is ABCD a square? Can you explain why? What is the area of this square?"

Solution:

Sides: AB: shifts (-3, 1), $AB = \sqrt{(-3)^2 + 1^2} = \sqrt{10}$. BC: shifts (-1, -3), $BC = \sqrt{1^2 + 9} = \sqrt{10}$. CD: shifts (3, -1), $CD = \sqrt{9 + 1} = \sqrt{10}$. DA: shifts (1, 3), $DA = \sqrt{1 + 9} = \sqrt{10}$.

Diagonals: AC: shifts (-4, -2), $AC = \sqrt{16 + 4} = \sqrt{20}$. BD: shifts (2, -4), $BD = \sqrt{4 + 16} = \sqrt{20}$.

All four sides are equal and the two diagonals are equal. To check for the right angle: $AB^2 + BC^2 = 10 + 10 = 20 = AC^2$. So, $\angle ABC = 90^\circ$.

Area = $\text{side}^2 = (\sqrt{10})^2 = 10$ square units, etc.

Competency-Based Questions

1. Case-based: The school campus

A school draws its campus on a grid with the x-axis pointing east and the y-axis pointing north, and 1 unit stands for 20 m. The library is at L (-3, 4), the playground at P (-5, -2) and the school at S (3, 2).

(a) What shape is LCPB, and what are its dimensions?
L (-3, 4), C (-1, 4), P (-5, -2), B (-3, -2).
LC = 2 units = 40 m. CP = 6 units = 120 m. PB = 4 units = 80 m. BL = 2 units = 40 m.
LC and PB are vertical, CP and BL are horizontal. So, LCPB is a rectangle 80 m by 40 m.

(b) How far is it from the library to the playground?
Distance LP = $\sqrt{(-5 - (-3))^2 + (-2 - 4)^2} = \sqrt{4 + 36} = \sqrt{40} = 2\sqrt{10}$ units = $40\sqrt{10}$ m.

(c) A water cooler is placed exactly halfway between the library and the playground. Find its coordinates and its quadrant. Midpoint of LP = $\left(\frac{-3 + (-5)}{2}, \frac{4 + (-2)}{2}\right) = (-4, 1)$. It is in the second quadrant.



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m west and 10 m north of the gate.

2. Case-based: A delivery drone

A drone depot is at the origin of a grid in which 1 unit = 1 km. The drone can fly at most 12 km from the depot. Orders come from A (6, 8) and B (-5, -12).

(a) How far is A from the depot? $OA = \sqrt{(36 + 64)} = \sqrt{100} = 10$ km.

(b) In which quadrant is B, and how far is it from the depot? Both coordinates are negative, so B is in Quadrant III. $OB = \sqrt{(25 + 144)} = \sqrt{169} = 13$ km.

(c) Which orders can the drone reach? $OA^2 = 100 < 144$, so A is inside and can be served. $OB^2 = 169 > 144$, so B is outside and cannot be served from this depot.

3. Source-based: From city streets to Descartes

Read the passage: "City streets in the Sindhu Valley were spaced at regular intervals. The streets were West about 10 metres apart. Brahmagupta showed that any point in a plane is defined by two perpendicular axes."

(a) Which two numbers fix a point in the plane? The signs: the x-coordinate (distance from the y-axis) and the y-coordinate (distance from the x-axis).

(b) Why does the passage connect Brahmagupta to the Cartesian coordinate system? Brahmagupta showed that any point in a plane is defined by two perpendicular axes, which is the basis of the Cartesian coordinate system.

(c) Taking the street spacing as 10 m, a street is 36.1 m from the centre. Give its coordinates in metres, with distance from the centre. Coordinates (36.1, 0) and (0, 36.1).

4. Assertion-Reason

Assertion (A): The point (-3, 0) lies in Quadrant II.
Reason (R): Points on the x-axis belong to no quadrant.

Answer: (d) A is false, R is true. The y-coordinate of a point on an axis belongs to no quadrant.



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5. Assertion-Reason

Assertion (A): Reflecting a triangle in the y-axis does not change the lengths of its sides.

Reason (R): Reflection in the y-axis sends (x, y) to $(-x, y)$, which only changes the sign of each x-shift, and the square of a shift does not depend on its sign.

Answer: (a) Both A and R are true, and R is the correct explanation of A.

6. Assertion-Reason

Assertion (A): The points P (1, 2), Q (2, 3) and R (3, 4) lie on one straight line. **Reason (R):** $PQ = QR$.

Answer: (b) Both A and R are true, but R is not the correct explanation of A. $PQ = QR = \sqrt{2}$ and $PR = \sqrt{8} = 2\sqrt{2}$, so $PQ + QR = PR$, which proves A. Equal distances alone do not prove collinearity.

7. Assertion-Reason

Assertion (A): (4, -7) and (-7, 4) represent a line $x = y$.

Answer: (d) A is false, R is true. Since 4 is in Quadrant IV and (-7, 4) is in Quadrant II

8. Data reasoning: A right-angled

An architect marks three corners of a triangle in metres. She wants the corner at B to be a right angle.

(a) Is angle B a right angle? $AB^2 = 3^2 + 4^2$
 $AB^2 + BC^2 = 50 = AC^2$, the triangle is right-angled at B, the longest side AC.

(b) What else can you say about the triangle?
It is a right-angled triangle.

(c) Find its area. The two legs meeting at B are 3 m and 4 m.
 $\text{Area} = \frac{1}{2} \times 3 \times 4 = 6 \text{ m}^2$.



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Important Questions for Exams

1-Mark Questions

- 1. What are the coordinates of the point where the two axes intersect?** $(0, 0)$, the origin.
- 2. In which quadrant does the point $(-4, -9)$ lie?** Quadrant III, since both coordinates are negative.
- 3. What is the x-coordinate of every point on the y-axis?** 0. Every point on the y-axis has the form $(0, y)$.
- 4. Find the distance of the point $(-6, 8)$ from the origin.** $\sqrt{(36 + 64)} = \sqrt{100} = 10$ units.
- 5. Find the distance between $(-3, 5)$ and $(4, 5)$.** The y-coordinates are equal, so the distance is $|4 - (-3)| = 7$ units.

2-Mark Questions

1. Find the distance between P (-2, -3) and Q (6, 9).
 $\sqrt{(36 + 64)} = \sqrt{100} = 10$ units.
2. Find the midpoint of the segment joining P (-2, -3) and Q (6, 9).
 $(-2+6)/2 = (4/2) = (2)$, $(-3+9)/2 = (6/2) = (3)$.
3. Find the values of k if the point (k, 4) is equidistant from P (-2, -3) and Q (6, 9).
Distance from P to (k, 4) = Distance from Q to (k, 4)
 $\sqrt{k^2 + 7^2} = \sqrt{(k-6)^2 + 12^2}$
 $k^2 + 49 = k^2 - 12k + 36 + 144$
 $49 = -12k + 180$
 $-12k = 180 - 49$
 $-12k = 131$
 $k = -131/12$
4. Does point Q (y, x) ever coincide with P (x, y)?
Ordered pairs are equal only when both coordinates are equal.
Needed. (3, 3) is the same either way; (3, 3) is the same as (3, 3).

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3-Mark Questions

1. **"Point W has x-coordinate equal to -5 on the line through W parallel to the y-axis."** Since the line through W parallel to the y-axis is vertical, so every point on this line has x-coordinate equal to -5. If $y > 0$, in Quadrant II; if $y < 0$, in Quadrant III; if $y = 0$, on the negative x-axis.
2. **Find the point on the x-axis that is equidistant from A(2, 5) and B(-8, 9).** Let P(x, 0) be the point on the x-axis. PA² = PB² gives $(x - 2)^2 + 25 = (x + 8)^2 + 81$, so $-8x = 56$ and $x = -7$. P = (-7, 0)
3. **"Plot point Z (5, -6) on the Cartesian plane. Find the lengths of the three sides."** Answer: Length of side NW = 5 units (horizontal) and NZ = $|0 - (-6)| = 6$ units. So, length of hypotenuse WZ = $\sqrt{5^2 + 6^2} = \sqrt{61}$ units.

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5-Mark Questions

This unit carries only 4 marks in the annual paper, so a 5-mark question on it is not expected there. These are multi-step practice sets; each part matches 1, 2 or 3-mark working.

- The vertices of quadrilateral ABCD are A (1, 2), B (4, 3), C (6, 6) and D (3, 5). (i) Find the lengths of all four sides. (ii) Find the lengths of both diagonals. (iii) Show that the diagonals have the same midpoint. (iv) Name the quadrilateral and say whether it is a rectangle.**
(i) $AB = \sqrt{(9 + 1)} = \sqrt{10}$; $BC = \sqrt{(4 + 9)} = \sqrt{13}$; $CD = \sqrt{(9 + 1)} = \sqrt{10}$; $DA = \sqrt{(4 + 9)} = \sqrt{13}$. (ii) $AC = \sqrt{(25 + 16)} = \sqrt{41}$; $BD = \sqrt{(1 + 4)} = \sqrt{5}$. (iii) Midpoint of $AC = (7/2, 8/2) = (3.5, 4)$; midpoint of $BD = (7/2, 8/2) = (3.5, 4)$. They are the same point. (iv) Opposite sides are equal in pairs and the diagonals bisect each other, so ABCD is a parallelogram. The diagonals are unequal ($\sqrt{41} \neq \sqrt{5}$), so it is not a rectangle, and adjacent sides are unequal, so it is not a rhombus.
- A (-3, 5) and B (9, -4) are two points. (i) Find AB. (ii) Find the midpoint M of AB. (iii) Find the points of trisection P and Q of AB, with P closer to A. (iv) Verify that AP is one-third of AB.**
(i) Shifts 12 and -9, so $AB = \sqrt{(144 + 81)} = \sqrt{225} = 15$ units. (ii) $M = ((-3 + 9)/2, (5 - 4)/2) = (3, 0.5)$. (iii) One-third of the shift (12, -9) is (4, -3) = (5, -1). (iv) $AP = \sqrt{(16 + 9)} = 5 = 15/3$, the three parts are equal.



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Common Mistakes and Ex

- Swapping the meaning of x and y.** The x-coordinate is the distance from the y-axis, then parallel to the x-axis. The y-coordinate is the distance from the x-axis, then parallel to the y-axis.
- Writing coordinates in the wrong order.** Always write the x-coordinate first. The two orders give different points.
- Placing points on an axis in a quadrant.** Answer "on the x-axis" or "on the y-axis", not "in the x-axis" or "in the y-axis".
- Adding the shifts instead of using square root.** The distance is $\sqrt{(16 + 9)} = 5$, never $4 + 3 = 7$.
- Forgetting the square root.** Writing $AD = 10$ instead of $AD = \sqrt{10}$.
- Dropping a minus sign inside a bracket.** $-3 - 9 = -12$. Put negative coordinates correctly.
- Forgetting to divide by 2 in the midpoint.** Use half the *sum*, never half the *difference*.

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8. **Deciding collinearity from rounded decimals.** $5 + \sqrt{85} \approx 14.22$ and $\sqrt{202} \approx 14.21$ look equal, but R (-5, -1), B (-2, -5), C (4, -12) are not collinear. Square both sides or compare the shifts to settle it exactly.
9. **Treating two equal distances as proof of collinearity.** $PQ = QR$ only says Q is equally far from P and R. You need $PQ + QR = PR$.
10. **Using the diagonal for the area of a square.** $\text{Area} = \text{side}^2$. For the square with side $\sqrt{10}$ and diagonal $\sqrt{20}$, the area is 10 square units, not 20.

Quick Revision Points

- The 2-D Cartesian system uses two number lines at right angles: the horizontal x-axis and the vertical y-axis
- The axes meet at the origin $O = (0, 0)$; distances are marked in equal units on both axes
- Right of O and above O are positive; left of O and below O are negative
- Points on the x-axis are $(x, 0)$; points on the y-axis are $(0, y)$
- x-coordinate = distance from the y-axis; y-coordinate = distance from the x-axis
- Quadrant signs: I (+, +), II (-, +), III (-, -), IV (+, -)
- $(x, y) = (y, x)$ if and only if $x = y$
- Same y: distance = $|x_2 - x_1|$; same x: distance = $|y_2 - y_1|$
- Distance formula: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Distance of (x, y) from the origin = $\sqrt{x^2 + y^2}$
- NCERT triangle A (3, 4), D (7, 1), M (9, 6) is right-angled at D
- Reflection in the y-axis: $(x, y) \rightarrow (-x, y)$; reflection in the x-axis: $(x, y) \rightarrow (x, -y)$
- Midpoint = $((x_1 + x_2)/2, (y_1 + y_2)/2)$
- Missing end B from midpoint M and end A: $B = (2M_x - A_x, 2M_y - A_y)$
- Points of trisection: step one-third of the distance from the origin
- Collinear: the two smaller distances add up to the larger distance
- Right-angled: the largest side² equals the sum of the squares of the other two sides
- Circle with centre O and radius r: circumference = $2\pi r$; area = πr^2
- Square: four equal sides and equal diagonals; area = side²



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- A floor map is 2-D, so it cannot show heights such as windows or the height of a table

Weightage and Exam Pattern

Class 9 has no board exam. This chapter is assessed in school exams: periodic tests, the half-yearly exam and the annual exam. In the CBSE Class IX Mathematics course structure for 2026-27, **Unit III, Coordinate Geometry, carries 4 marks** out of the 80-mark theory paper and is allotted 6 teaching periods. The remaining 20 marks of the year are internal assessment: pen-paper tests and multiple assessment (10), portfolio (5) and lab practical (5).

Unit	Marks (out of 80)
I. Number System	07
II. Algebra	
III. Coordinate Geometry	
IV. Geometry	
V. Mensuration	
VI. Statistics and Probability	
Total	

The course structure lists the competencies of one point relative to another using coordinate distance between two points, decide whether of a segment, check whether a triangle is plane to verify geometric properties. The for practice, from recall to multi-step work

The CBSE Class IX question paper design remembering and understanding, 24% ap

This chapter is the foundation for Class 10



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