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CHAPTER NOTES

Coordinate Geometry Class 10 Notes | CBSE Maths Chapter 7

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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 10 Notes | CBSE Maths Chapter 7

Coordinate Geometry is Chapter 7 of CBSE Class 10 Maths. It builds on the Class 9 idea of locating a point with a pair of perpendicular axes and uses algebra to answer geometry questions. The chapter covers two tools: the **distance formula**, which gives the distance between any two points from their coordinates, and the **section formula**, which gives the point dividing a line segment internally in a given ratio, with the mid-point formula as its special case.

For board exams the chapter is short and fully formula-driven, so marks come from clean substitution and careful signs. Questions ask you to find a distance, test whether points are collinear or form a right, isosceles or equilateral triangle, name a quadrilateral, find a point equidistant from two points, find the ratio in which a point or an axis divides a segment, and find a missing vertex of a parallelogram using mid-points.

Quick Answer - Coordinate Geometry

The distance between $P(x_1, y_1)$ and $Q(x_2, y_2)$ is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ from Pythagoras theorem. A point's distance from a line $ax + by + c = 0$ is $\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$. A point dividing the join of $A(x_1, y_1)$ and $B(x_2, y_2)$ in the ratio $m_1 : m_2$ is $(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2})$. The mid-point formula is $(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$. To test collinearity and shapes; use the k :



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All Key Formulas at a Glance

Idea	Formula or rule	Use it when
Point on the x-axis	$(x, 0)$	A point lies on the x-axis, or a segment is cut by the x-axis
Point on the y-axis	$(0, y)$	A point lies on the y-axis, or a segment is cut by the y-axis
Distance formula	$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	Length of a side or diagonal between two given points
Distance from the origin	$OP = \sqrt{x^2 + y^2}$	One of the two points is $O(0, 0)$
Collinearity by distances	$AB + BC = AC$	
Equidistant point	$PA^2 = PB^2$	
Section formula $(m_1 : m_2)$	$x = \frac{(m_1x_2 + m_2x_1)}{(m_1 + m_2)}$ $y = \frac{(m_1y_2 + m_2y_1)}{(m_1 + m_2)}$	
Section formula $(k : 1)$	$\left(\frac{kx_2 + x_1}{k + 1}, \frac{ky_2 + y_1}{k + 1}\right)$	
Mid-point formula	$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$	
Points of trisection	Ratios $1 : 2$ and $2 : 1$	



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Key Concepts

1. Coordinates, Axes and Distances Along an Axis

To locate a point on a plane we use a pair of perpendicular lines called the coordinate axes. The horizontal line is the **x-axis**, the vertical line is the **y-axis**, and they meet at the **origin O(0, 0)**. Every point is then named by an ordered pair (x, y).

- The **x-coordinate**, or **abscissa**, is the distance of the point from the y-axis.
- The **y-coordinate**, or **ordinate**, is the distance of the point from the x-axis.
- A point on the x-axis has the form **(x, 0)**, because it is at zero distance from the y-axis.
- A point on the y-axis has the form **(0, y)**, because it is at zero distance from the x-axis.

The signs of the coordinates tell you the quadrant. Measured anticlockwise from the positive x-axis:

Quadrant	Sign of x
I	+
II	-
III	-
IV	+

Distance along an axis. When two points subtraction. The NCERT chapter uses A(4, 0) and B(6, 0) on the x-axis. $AB = 6 - 4 = 2$ units. For C(0, 3) and D(0, 8) on the y-axis, $CD = 8 - 3 = 5$ units.

One point on each axis. A(4, 0) and C(0, 3) are on the x-axis and y-axis respectively. The angle at O. By Pythagoras theorem $AC = \sqrt{4^2 + 3^2} = 5$ units. For B(6, 0) and D(0, 8) on the x-axis and y-axis respectively, $BD = \sqrt{6^2 + 8^2} = 10$ units.

2. The Distance Formula

For two points that are not on an axis, drop perpendiculars from each point to the x-axis and y-axis.

Worked illustration (NCERT). Take P(4, 6) and Q(6, 0). Draw PR perpendicular to the y-axis, so R is (4, 0) and S is (6, 0). Draw PT perpendicular to QS. Then



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$RS = 6 - 4 = 2$, $QS = 8$ and $TS = PR = 6$. So $QT = 8 - 6 = 2$ and $PT = RS = 2$. Triangle PTQ has a right angle at T , so $PQ^2 = PT^2 + QT^2 = 4 + 4 = 8$, and $PQ = 2\sqrt{2}$ units.

Points in different quadrants (NCERT). For $P(6, 4)$ and $Q(-5, -3)$, the horizontal gap is $6 - (-5) = 11$ and the vertical gap is $4 - (-3) = 7$. So $PT = 11$, $QT = 7$ and $PQ = \sqrt{11^2 + 7^2} = \sqrt{121 + 49} = \sqrt{170}$ units. Subtracting a negative coordinate makes the gap larger.

General case. Let $P(x_1, y_1)$ and $Q(x_2, y_2)$ be any two points. Draw PR and QS perpendicular to the x -axis and PT perpendicular to QS . Then $OR = x_1$ and $OS = x_2$, so $PT = RS = x_2 - x_1$. Also $SQ = y_2$ and $ST = PR = y_1$, so $QT = y_2 - y_1$. Pythagoras theorem in triangle PTQ gives

$$PQ^2 = PT^2 + QT^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

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

This is the **distance formula**. Distance is never negative, so we take only the positive square root.

- **Remark 1:** the distance of $P(x, y)$ from the origin is $\sqrt{x^2 + y^2}$.
- **Remark 2:** $PQ = \sqrt{[(x_1 - x_2)^2 + (y_1 - y_2)^2]}$ the points does not matter.

Quick check (the two towns in NCERT Section 3.2) Find the distance between two towns A and B. With A as the origin and 1 km as one unit, the coordinates of B are $(3, 4)$.
 $AB = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ km.
 $AB = 5 \times 1 = 5$ km.

3. Using Distances: Triangles and

Once you can find the three sides of a triangle, you can check if a triangle exists at all.



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What you find	Conclusion
Sum of the two smaller distances equals the largest	Points are collinear (no triangle)
Sum of any two distances is greater than the third	Points form a triangle
Two sides equal	Isosceles triangle
All three sides equal	Equilateral triangle
Square of the longest side = sum of squares of the other two	Right triangle (converse of Pythagoras theorem)

Worked illustration (NCERT Example 1). Do $P(3, 2)$, $Q(-2, -3)$ and $R(2, 2)$ form a triangle?

- $PQ = \sqrt{[(3 + 2)^2 + (2 + 3)^2]} = \sqrt{(25 + 25)}$
- $QR = \sqrt{[(-2 - 2)^2 + (-3 - 3)^2]} = \sqrt{(16 + 36)}$
- $PR = \sqrt{[(3 - 2)^2 + (2 - 3)^2]} = \sqrt{(1 + 1)} = \sqrt{2}$

The sum of any two distances is greater than the third. $PQ + PR = 5\sqrt{2} + \sqrt{2} = 6\sqrt{2} > QR^2$, so by the converse of the triangle inequality, they form a triangle.

Collinearity (NCERT Example 3). Ashima, Bhaavika and Chhavi are three friends. Their coordinates are $A(1, 1)$, $B(4, 4)$ and $C(9, 9)$ respectively. Are they collinear?
 $AB = \sqrt{(9 - 1)^2 + (4 - 1)^2} = \sqrt{18} = 3\sqrt{2}$, $BC = \sqrt{(4 - 9)^2 + (4 - 9)^2} = \sqrt{18} = 3\sqrt{2}$
 $AB + BC = 3\sqrt{2} + 3\sqrt{2} = 6\sqrt{2} = AC$, the points are collinear.

4. Naming a Quadrilateral from Its Vertices

Find all four sides and both diagonals, then name the quadrilateral in the order given.



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Shape	Sides	Diagonals
Square	All four equal	Equal
Rhombus (not a square)	All four equal	Unequal
Rectangle (not a square)	Opposite sides equal	Equal
Parallelogram (not a rectangle)	Opposite sides equal	Unequal

Worked illustration (NCERT Example 2). Show that A(1, 7), B(4, 2), C(−1, −1) and D(−4, 4) are the vertices of a square.

- $AB = \sqrt{[(1 - 4)^2 + (7 - 2)^2]} = \sqrt{(9 + 25)} = \sqrt{34}$
- $BC = \sqrt{[(4 + 1)^2 + (2 + 1)^2]} = \sqrt{(25 + 9)} = \sqrt{34}$
- $CD = \sqrt{[(-1 + 4)^2 + (-1 - 4)^2]} = \sqrt{(9 + 25)} = \sqrt{34}$
- $DA = \sqrt{[(1 + 4)^2 + (7 - 4)^2]} = \sqrt{(25 + 9)} = \sqrt{34}$
- $AC = \sqrt{[(1 + 1)^2 + (7 + 1)^2]} = \sqrt{(4 + 64)} = \sqrt{68}$
- $BD = \sqrt{[(4 + 4)^2 + (2 - 4)^2]} = \sqrt{(64 + 4)} = \sqrt{68}$

All four sides are equal and the diagonals are equal.

Alternative method. Find the four sides and check that $\angle D = 90^\circ$ by the converse of Pythagoras theorem. If one of the angles is a right angle is a square.

Watch out. Four equal sides alone only prove that the quadrilateral is a rhombus. To reach a square, you also need to check that one of the angles is a right angle. Also check that the four points do not form a quadrilateral at all.

5. Points Equidistant from Two Given Points

If P(x, y) is equidistant from A and B, then $PA = PB$. Squaring both sides, $PA^2 = PB^2$. The x^2 and y^2 terms cancel, leaving a linear equation in x and y.

Worked illustration (NCERT Example 4). Find the equation of the line of points equidistant from A(7, 1) and B(3, 5).



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$$(x - 7)^2 + (y - 1)^2 = (x - 3)^2 + (y - 5)^2$$

$$x^2 - 14x + 49 + y^2 - 2y + 1 = x^2 - 6x + 9 + y^2 - 10y + 25$$

$$-14x - 2y + 50 = -6x - 10y + 34$$

$$-8x + 8y = -16, \text{ so } x - y = 2.$$

The graph of $x - y = 2$ is a line. A point equidistant from A and B lies on the **perpendicular bisector** of AB, so this line is the perpendicular bisector of AB. You can check: the mid-point of AB is (5, 3), and $5 - 3 = 2$.

Point on an axis (NCERT Example 5). Find a point on the y-axis equidistant from A(6, 5) and B(-4, 3). A point on the y-axis is (0, y).

$$(6 - 0)^2 + (5 - y)^2 = (-4 - 0)^2 + (3 - y)^2$$

$$36 + 25 + y^2 - 10y = 16 + 9 + y^2 - 6y$$

$$61 - 10y = 25 - 6y, \text{ so } 4y = 36 \text{ and } y = 9.$$

The point is (0, 9). Check: $AP = BP = \sqrt{52}$. y-axis.

6. The Section Formula

A point P on segment AB divides it **internally**.

The relay tower (NCERT). A tower P is to be built with its distance from B twice its distance from A. Using similar triangles (AA criterion) give $x/(36 - x) = 1/2$. At P(12, 5): $AP = \sqrt{(144 + 25)} = 13$ km and $BP = 26$ km.

General derivation. Let P(x, y) divide the line segment AB in the ratio $m_1 : m_2$. Draw AR, PS and BT perpendicular to the line containing AB. By similarity, $\Delta PAQ \sim \Delta BPC$, so $PA/BP = AQ/PC$ and $BC = y_2 - y$. So

$$m_1/m_2 = (x - x_1)/(x_2 - x) = (y - y_1)/(y_2 - y)$$

Solving each equation for x and y gives the coordinates of P.

$$P(x, y) = ((m_1x_2 + m_2x_1)/(m_1 + m_2), (m_1y_2 + m_2y_1)/(m_1 + m_2))$$

A memory aid: **cross-multiply**. m_1 (the part next to B) multiplies the coordinate of A, and m_2 (the part next to A) multiplies the coordinate of B.



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The k : 1 form. If P divides AB in the ratio $k : 1$, then $P = ((kx_2 + x_1)/(k + 1), (ky_2 + y_1)/(k + 1))$. Use this whenever the ratio is unknown, because it leaves only one unknown, k .

Worked illustration (NCERT Example 6). The point dividing the join of $(4, -3)$ and $(8, 5)$ internally in the ratio $3 : 1$ is $x = (3 \times 8 + 1 \times 4)/(3 + 1) = 28/4 = 7$ and $y = (3 \times 5 + 1 \times (-3))/4 = 12/4 = 3$, that is $(7, 3)$.

Finding the ratio (NCERT Example 7). In what ratio does $(-4, 6)$ divide the join of $A(-6, 10)$ and $B(3, -8)$? Let the ratio be $k : 1$. Then $-4 = (3k - 6)/(k + 1)$, so $-4k - 4 = 3k - 6$, $7k = 2$ and $k = 2/7$. The ratio is $2 : 7$. The y-coordinate gives the same ratio.

Division by an axis (NCERT Example 9). In what ratio does the y-axis divide the join of $(5, -6)$ and $(-1, -4)$? A point on the y-axis has abscissa 0. With ratio $k : 1$, the point is $((-k + 5)/(k + 1), (-4k - 6)/(k + 1))$. Setting $(-k + 5)/(k + 1) = 0$ gives $k = 5$, so the ratio is $5 : 1$. The point is $(0, (-20 - 6)/6) = (0, -13/3)$.

Rule for axes: for the x-axis set the y-coordinate to 0.

External division. The NCERT chapter notes that if a point divides AB externally, its formula comes in with a negative k . If k is positive, the division is internal and a correct k is positive.

7. Mid-point, Trisection and Parallel Lines

The mid-point divides a segment in the ratio $1 : 1$.

Mid-point of $A(x_1, y_1)$ and $B(x_2, y_2)$ = $((x_1 + x_2)/2, (y_1 + y_2)/2)$

Points of trisection (NCERT Example 8). Find the points of trisection of the line segment joining $A(2, -2)$ and $B(-7, 4)$, let P and Q be the points of trisection.

- P divides AB in $1 : 2$: $P = ((1 \times (-7) + 2 \times 2)/3, (1 \times 4 + 2 \times (-2))/3) = (-1, -2/3)$
- Q divides AB in $2 : 1$: $Q = ((2 \times (-7) + 1 \times 2)/3, (2 \times 4 + 1 \times (-2))/3) = (-10/3, 10/3)$

Q is also the mid-point of PB: $((-1 - 7)/2, (-2/3 + 4)/2) = (-4, 5/3)$

Missing vertex of a parallelogram (NCERT Example 10). Find the missing vertex D of a parallelogram ABCD, where A(1, 2), B(4, 3), and C(6, 4). The diagonals AC and BD bisect each other, so the mid-point of AC equals the mid-point of BD. Let D be (p, q) . Mid-point of AC = $((1 + 6)/2, (2 + 4)/2) = (3.5, 3)$. Mid-point of BD = $((4 + p)/2, (3 + q)/2)$. Equating: $(4 + p)/2 = 3.5$ and $(3 + q)/2 = 3$. Solving: $4 + p = 7$, $p = 3$; $3 + q = 6$, $q = 3$. So D is $(3, 3)$.



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Other uses. The centre of a circle is the mid-point of any diameter, so the other end of a diameter is $2 \times \text{centre} - \text{known end}$, coordinate by coordinate. For four equal parts, find the mid-point first, then the mid-points of the two halves.



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Formula and Theorem Sheet

Result	Statement	Remember
Distance formula	$PQ = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$	Comes from Pythagoras theorem; take the positive root
Distance from origin	$OP = \sqrt{(x^2 + y^2)}$	Special case with (0, 0)
Collinear points	$AB + BC = AC$	Sum of the two smaller equals the largest
Right triangle test	Longest ² = sum of squares of the other two	Converse of Pythagoras theorem
Equidistant point	$PA^2 = PB^2$	
Section formula	$((m_1x_2 + m_2x_1)/(m_1 + m_2), (m_1y_2 + m_2y_1)/(m_1 + m_2))$	
k : 1 form	$((kx_2 + x_1)/(k + 1), (ky_2 + y_1)/(k + 1))$	
Mid-point formula	$((x_1 + x_2)/2, (y_1 + y_2)/2)$	
Trisection	Ratios 1 : 2 and 2 : 1	
Parallelogram	Mid-point of AC = Mid-point of BD	
Area of a rhombus	$(1/2) \times d_1 \times d_2$	



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Important Definitions

- **Coordinate axes:** a pair of perpendicular number lines, the x-axis and the y-axis, used to locate points on a plane.
- **Abscissa (x-coordinate):** the distance of a point from the y-axis.
- **Ordinate (y-coordinate):** the distance of a point from the x-axis.
- **Collinear points:** three or more points that lie on one straight line.
- **Equidistant point:** a point whose distances from two given points are equal. All such points lie on the perpendicular bisector of the segment joining the two points.
- **Internal division:** a point P on segment AB divides it internally in the ratio $m_1 : m_2$ when $PA : PB = m_1 : m_2$.
- **Mid-point:** the point dividing a segment in the ratio 1 : 1, found by averaging the x-coordinates and the y-coordinates.
- **Points of trisection:** the two points that divide a segment in the ratio 1 : 2 and 2 : 1.



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Solved Examples (NCERT)

Example 1: Distance between pair

Q. Find the distance between the following points: (a, b) , $(-a, -b)$

Solution.

- (i) $d = \sqrt{[(4 - 2)^2 + (1 - 3)^2]} = \sqrt{4 + 4} = \sqrt{8} = 2\sqrt{2}$
- (ii) $d = \sqrt{[(-1 + 5)^2 + (3 - 7)^2]} = \sqrt{16 + 16} = \sqrt{32} = 4\sqrt{2}$
- (iii) $d = \sqrt{[(-a - a)^2 + (-b - b)^2]} = \sqrt{4a^2 + 4b^2} = 2\sqrt{a^2 + b^2}$

Example 2: Collinear or not (NCERT)

Q. Determine if the points $(1, 5)$, $(2, 3)$ and $(-2, -11)$ are collinear.

Solution. Let $A(1, 5)$, $B(2, 3)$, $C(-2, -11)$.

- $AB = \sqrt{[(2 - 1)^2 + (3 - 5)^2]} = \sqrt{1 + 4} = \sqrt{5} \approx 2.24$

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- $BC = \sqrt{(-2 - 2)^2 + (-11 - 3)^2} = \sqrt{16 + 196} = \sqrt{212} \approx 14.56$
- $AC = \sqrt{(-2 - 1)^2 + (-11 - 5)^2} = \sqrt{9 + 256} = \sqrt{265} \approx 16.28$

The largest is AC. $AB + BC \approx 16.80$, which is not equal to $AC \approx 16.28$. No sum of two distances equals the third, so the points are **not collinear**.

Example 3: Isosceles triangle (NCERT Exercise 7.1)

Q. Check whether (5, -2), (6, 4) and (7, -2) are the vertices of an isosceles triangle.

Solution. Let A(5, -2), B(6, 4), C(7, -2). $AB = \sqrt{(1 + 36)} = \sqrt{37}$, $BC = \sqrt{(1 + 36)} = \sqrt{37}$, $AC = \sqrt{(4 + 0)} = 2$. $AB + AC > BC$ and the other sums also exceed the third side, so a triangle exists. Since **$AB = BC = \sqrt{37}$** , the triangle is isosceles.

Example 4: Name the quadrilateral (NCERT Exercise 7.1)

Q. Name the type of quadrilateral formed, if any, by the following points, and give reasons for your answer: (i) (-1, -2), (1, 0), (-1, 2), (-3, 0), (1, 2)

(i) A(-1, -2), B(1, 0), C(-1, 2), D(-3, 0). $AB = 2\sqrt{2}$, $DA = \sqrt{(4 + 4)} = 2\sqrt{2}$. $AC = \sqrt{(0 + 16)} = 4$, $BD = \sqrt{(0 + 16)} = 4$. Equal diagonals: **square**.

(ii) A(-3, 5), B(3, 1), C(0, 3), D(-1, -4). $AB = \sqrt{(9 + 16)} = 5$, $CD = \sqrt{(1 + 49)} = 5$. $AC = \sqrt{(9 + 4)} = \sqrt{13}$. So $AC + CB = \sqrt{13} + \sqrt{13} = 2\sqrt{13}$. Three of the points lie on one line, so **no quadrilateral**.

(iii) A(4, 5), B(7, 6), C(4, 3), D(1, 2). $AB = \sqrt{(9 + 1)} = \sqrt{10}$, $CD = \sqrt{(9 + 1)} = \sqrt{10}$. $DA = \sqrt{(9 + 9)} = \sqrt{18}$. $AC = \sqrt{(0 + 4)} = 2$ and the diagonals are unequal: **parallelogram**.

Example 5: Point on the x-axis (NCERT Exercise 7.1)

Q. Find the point on the x-axis which is equidistant from A(2, 5) and B(-2, 9).

Solution. Let the point be P(x, 0). $PA^2 = PB^2$

$$(x - 2)^2 + (0 + 5)^2 = (x + 2)^2 + (0 - 9)^2$$

$$x^2 - 4x + 4 + 25 = x^2 + 4x + 4 + 81$$

$$-8x = 56, \text{ so } x = -7.$$



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The point is **$(-7, 0)$** . Check: $PA^2 = 81 + 25 = 106$ and $PB^2 = 25 + 81 = 106$.

Example 6: Values of y (NCERT Exercise 7.1)

Q. Find the values of y for which the distance between the points $P(2, -3)$ and $Q(10, y)$ is 10 units.

Solution. $PQ^2 = 100$, so $(10 - 2)^2 + (y + 3)^2 = 100$. Then $64 + (y + 3)^2 = 100$, $(y + 3)^2 = 36$ and $y + 3 = \pm 6$. So **$y = 3$ or $y = -9$** . Both values are correct: there are two points, $(10, 3)$ and $(10, -9)$, at distance 10 from P .

Example 7: Q equidistant from P and R (NCERT Exercise 7.1)

Q. If $Q(0, 1)$ is equidistant from $P(5, -3)$ and $R(x, 6)$, find the values of x . Also find the distances QR and PR .

Solution. $QP^2 = 25 + 16 = 41$. $QR^2 = x^2 + 25$. Setting them equal, $x^2 + 25 = 41$, so $x = \pm 4$.

- $QR = \sqrt{41}$ in both cases.
- If $x = 4$, R is $(4, 6)$ and $PR = \sqrt{(4 - 5)^2 + (6 + 3)^2} = \sqrt{10}$.
- If $x = -4$, R is $(-4, 6)$ and $PR = \sqrt{(-4 - 5)^2 + (6 + 3)^2} = \sqrt{10}$.

Example 8: Relation for an equidistant point

Q. Find a relation between x and y such that the point (x, y) is equidistant from the points $(-3, 4)$ and $(-3, -4)$.

Solution. $(x - 3)^2 + (y - 6)^2 = (x + 3)^2 + (y + 6)^2$
 $x^2 - 6x + 9 + y^2 - 12y + 36 = x^2 + 6x + 9 + y^2 + 12y + 36$
 $-6x - 12y + 45 = 6x + 12y + 45$
 $-12x - 24y = 0$, so **$3x + y = 0$** .

Check with the mid-point $(0, 5)$: $3(0) + 5 = 5$.

Example 9: Section formula and its converse

Q1. Find the coordinates of the point which divides the line segment joining $(2, 4)$ and $(-1, 3)$ in the ratio $3:1$.

$x = (2 \times 4 + 3 \times (-1))/(2 + 3) = (8 - 3)/5 = 1$
 $y = (2 \times 3 + 3 \times 4)/(2 + 3) = (6 + 12)/5 = 6$
The point is **$(1, 6)$** .



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Q2. Find the coordinates of the points of trisection of the line segment joining $(4, -1)$ and $(-2, -3)$.

Let $A(4, -1)$, $B(-2, -3)$. P divides AB in $1 : 2$: $x = (1 \times (-2) + 2 \times 4)/3 = 6/3 = 2$; $y = (1 \times (-3) + 2 \times (-1))/3 = -5/3$. So **P(2, -5/3)**. Q divides AB in $2 : 1$: $x = (2 \times (-2) + 1 \times 4)/3 = 0$; $y = (2 \times (-3) + 1 \times (-1))/3 = -7/3$. So **Q(0, -7/3)**.

Example 10: Finding the ratio (NCERT Exercise 7.2)

Q1. Find the ratio in which the line segment joining the points $(-3, 10)$ and $(6, -8)$ is divided by $(-1, 6)$.

Let the ratio be $k : 1$. From x : $(6k - 3)/(k + 1) = -1$, so $6k - 3 = -k - 1$, $7k = 2$ and $k = 2/7$. The ratio is **2 : 7**. Check with y : $(-8 \times 2/7 + 10)/(2/7 + 1) = (54/7)/(9/7) = 6$. Correct.

Q2. Find the ratio in which the line segment joining $A(1, -5)$ and $B(-4, 5)$ is divided by the x -axis. Also find the coordinates of the point of division.

Let the ratio be $k : 1$. On the x -axis the y -coordinate is 0. $(-5k + 5)/(k - 4) = 0$.
1 : 1, so the point is the mid-point: $((1 - 4)/2, (-5 + 5)/2) = (-3/2, 0)$.

Example 11: Parallelogram and diagonals

Q1. If $(1, 2)$, $(4, y)$, $(x, 6)$ and $(3, 5)$ are the vertices of a parallelogram, find x and y .

Let $A(1, 2)$, $B(4, y)$, $C(x, 6)$, $D(3, 5)$. Diagonals AC and BD are equal: $((1 + x)/2, (2 + 6)/2) = ((4 + 3)/2, (y + 5)/2)$.
gives **$y = 3$** .

Q2. Find the coordinates of a point A, where the line segment joining $B(-3, 4)$ and $C(5, -1)$ is bisected at $D(2, -3)$ and B is $(1, 4)$.

The centre is the mid-point of AB. Let $A(x, y)$. $((x - 3)/2, (y + 4)/2) = (2, -3)$.
gives **$y = -10$** . So **A(3, -10)**.

Example 12: P with $AP = (3/7) AB$ (NCERT Exercise 7.2)

Q. If A and B are $(-2, -2)$ and $(2, -4)$, respectively, find the coordinates of P, where $AP = (3/7) AB$ and P lies on the line segment AB.

Solution. $AP = (3/7) AB$ means $PB = (4/7) AB$.

$m_1 = 3, m_2 = 4$: $x = (3 \times 2 + 4 \times (-2))/7 = (6 - 8)/7 = -2/7$; $y = (3 \times (-4) + 4 \times (-2))/7 = (-12 - 8)/7 = -20/7$.



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$8)/7 = -20/7$. So $P(-2/7, -20/7)$.

Example 13: Four equal parts and a rhombus (NCERT Exercise 7.2)

Q1. Find the coordinates of the points which divide the line segment joining $A(-2, 2)$ and $B(2, 8)$ into four equal parts.

Let P, Q, R divide AB into four equal parts. Q is the mid-point of AB : $(0, 5)$. P is the mid-point of AQ : $((-2 + 0)/2, (2 + 5)/2) = (-1, 7/2)$. R is the mid-point of QB : $((0 + 2)/2, (5 + 8)/2) = (1, 13/2)$. The points are $(-1, 7/2)$, $(0, 5)$ and $(1, 13/2)$.

Q2. Find the area of a rhombus if its vertices are $(3, 0)$, $(4, 5)$, $(-1, 4)$ and $(-2, -1)$ taken in order. [Hint: Area of a rhombus = $(1/2)$ (product of its diagonals)]

Let $A(3, 0)$, $B(4, 5)$, $C(-1, 4)$, $D(-2, -1)$. $AC = \sqrt{(-1 - 3)^2 + (4 - 0)^2} = \sqrt{32} = 4\sqrt{2}$. $BD = \sqrt{(-2 - 4)^2 + (-1 - 5)^2} = \sqrt{72} = 6\sqrt{2}$. Area = $(1/2) \times 4\sqrt{2} \times 6\sqrt{2} = (1/2) \times 48 = \mathbf{24 \text{ square units}}$.

Competency-Based Questions

1. Case-based: Three places on a town map

On a town map with 1 unit = 100 m, the school is at $S(1, 1)$, the library is at $L(13, 2)$, and the water cooler is at $P(13, 2)$.

(a) Find SL , LP and SP . $SL = \sqrt{(36 + 64)} = 10$ units.

(b) What type of triangle do the three places form? $10^2 + 10^2 = 200 \neq 144$, so it is not right-angled.

(c) A water cooler is placed exactly halfway between the school and the library. Mid-point of $SP = ((1 + 13)/2, (2 + 2)/2) = (7, 2)$.

(d) How far is the library from the water cooler? Distance = 10 units = 800 m.

2. Case-based: Checking a garden

A gardener marks the corners of a plot at $A(1, 1)$, $B(4, 1)$, $C(4, 4)$ and $D(1, 4)$. She claims the plot is a square.



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(a) Find the four sides. $AB = \sqrt{(16 + 9)} = 5$, $BC = \sqrt{(9 + 16)} = 5$, $CD = \sqrt{(16 + 9)} = 5$, $DA = \sqrt{(9 + 16)} = 5$ m.

(b) Find the diagonals. $AC = \sqrt{(49 + 1)} = \sqrt{50}$ and $BD = \sqrt{(1 + 49)} = \sqrt{50}$.

(c) Is she right? Yes. All four sides are equal and the diagonals are equal, so ABCD is a square.

(d) Find the area of the plot. $\text{Side}^2 = 5^2 = 25 \text{ m}^2$.

3. Source-based: The perpendicular bisector

The NCERT chapter states: "a point which is equidistant from A and B lies on the perpendicular bisector of AB." Take A(-1, 3) and B(5, 7).

(a) Find the relation between x and y for a point (x, y) equidistant from A and B. $(x + 1)^2 + (y - 3)^2 = (x - 5)^2 + (y - 7)^2$ gives $2x + 1 - 6y + 9 = -10x + 25 - 14y + 49$, so $12x + 8y = 64$, that is $3x + 2y = 16$.

(b) Show that the mid-point of AB lies on the line.

(c) Find the point on the x-axis equidistant from A and B. (16/3, 0).

4. Assertion-Reason

Assertion (A): The point (0, -7) lies on the line.

Reason (R): The x-coordinate of every point on the line is 0.

Choose: (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.

Answer: (a). Points on the y-axis have the x-coordinate 0. So, (0, -7) lies on the y-axis. This is exactly why it lies on the y-axis.

5. Assertion-Reason

Assertion (A): The mid-point of the segment AB is (2, 5).

Reason (R): The mid-point of the join of (x₁, y₁) and (x₂, y₂) is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.

Choose: (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.



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Answer: (c). $((4 - 2)/2, (-1 + 5)/2) = (1, 2)$, so A is true. The mid-point formula adds the coordinates, $((x_1 + x_2)/2, (y_1 + y_2)/2)$, so R is false.

6. Assertion-Reason

Assertion (A): The distance between (a, b) and $(-a, -b)$ is $2(a + b)$.

Reason (R): The distance of a point $P(x, y)$ from the origin is $\sqrt{x^2 + y^2}$.

Choose: (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.

Answer: (d). The distance is $\sqrt{4a^2 + 4b^2} = 2\sqrt{a^2 + b^2}$, which is not $2(a + b)$ in general. For $a = 3, b = 4$ it is 10, while $2(a + b) = 14$. R is the true remark from the chapter.

7. Error analysis: The lost minus sign

A student finds the distance between $(-3, 2)$ and $(5, -4)$ as follows: " $d = \sqrt{(5 - 2)^2 + (-4 - 2)^2} = \sqrt{4 + 36} = \sqrt{40}$." Find the error and give the correct answer.

Answer: The student wrote $5 - 3$ instead of $5 - (-3)$. Correct: $d = \sqrt{(5 + 3)^2 + (-4 - 2)^2} = \sqrt{64 + 36} = \sqrt{100} = 10$.

8. Competency MCQ: Which quadrant

The point dividing the join of $A(-4, 6)$ and $B(8, -3)$ in the ratio 1:2 is in which quadrant? (a) I (b) II (c) III (d) IV

Answer: (b). $x = (1 \times 8 + 3 \times (-4))/4 = (8 - 12)/4 = -1$. The point $(-1, 3)$ has x negative and y positive, so it is in the second quadrant.

Important Questions for

1-Mark Questions

Q1. Find the distance of the point $(-6, 8)$ from the origin.

OP $= \sqrt{36 + 64} = \sqrt{100} = 10$ units.

Q2. Find the mid-point of the segment joining $(2, -4)$ and $(-3, 7)$.

Mid-point $= ((2 - 3)/2, (-4 + 7)/2) = (-0.5, 1.5)$.



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Q3. What is the distance of the point (3, -4) from the x-axis?

The distance from the x-axis is the size of the ordinate: 4 units.

Q4. If the distance between (4, p) and (1, 0) is 5, find p.

$9 + p^2 = 25$, so $p^2 = 16$ and $p = \pm 4$.

Q5. In what ratio does the x-axis divide the join of (2, -3) and (5, 6)?

$(6k - 3)/(k + 1) = 0$ gives $k = 1/2$. The ratio is 1 : 2.

2-Mark Questions

Q6. Find the point on the y-axis which is equidistant from (5, -2) and (-3, 2).

Let $P(0, y)$. $25 + (y + 2)^2 = 9 + (y - 2)^2$ gives $25 + 4y + 4 = 9 - 4y + 4$, so $8y = -16$ and $y = -2$. The point is (0, -2). Check: both squared distances are 25.

Q7. Show that (-2, 3), (8, 3) and (6, 7) are the vertices of a right triangle.

$AB = \sqrt{(100 + 0)} = 10$, $BC = \sqrt{(4 + 16)} = \sqrt{20}$, $AC = \sqrt{(64 + 16)} = \sqrt{80}$.
 $AB^2 = 100$, $BC^2 = 20$, $AC^2 = 80$.
 $AB^2 = BC^2 + AC^2$. By the converse of Pythagoras theorem, $\triangle ABC$ is a right triangle.

Q8. P(4, m) divides the join of A(2, 3) and B(6, 7) in the ratio 1 : 3, find m.

Let the ratio be $k : 1$. From x: $(6k + 2)/(k + 1) = 4$, $6k + 2 = 4k + 4$, $2k = 2$, $k = 1$.
From y: $(7k + 3)/(k + 1) = m$, $7k + 3 = m(k + 1)$, $7 + 3 = m(1 + 1)$, $10 = 2m$, $m = 5$.

Q9. The mid-point of the segment joining A(2, 3) and B(6, 7) is P. Find the coordinates of P.

From x: $(x/2 + x + 1)/2 = 5$, so $3x/2 + 1 = 10$, $3x/2 = 9$, $x = 6$.
From y: $(y/2 + y + 3)/2 = 7$, so $3y/2 + 3 = 14$, $3y/2 = 11$, $y = 14/3$.

3-Mark Questions

Q10. Show that A(1, 1), B(-1, -1) and C(-√3, 1) are the vertices of an equilateral triangle.

$AB^2 = 4 + 4 = 8$. $BC^2 = (-1 + \sqrt{3})^2 + (-1 - 1)^2 = (4 - 2\sqrt{3}) + 4 = 8 - 2\sqrt{3}$.
 $AC^2 = (-\sqrt{3} - 1)^2 + (1 - 1)^2 = (3 + 2\sqrt{3}) + 0 = 3 + 2\sqrt{3}$.
All sides are equal.

Q11. Find the ratio in which the y-axis divides the line segment joining A(2, 3) and B(6, 7). Also find the point of division.

Let the ratio be $k : 1$. On the y-axis $x = 0$: $(6k + 2)/(k + 1) = 0$, $6k + 2 = 0$, $k = -1/3$.
From y: $(7k + 3)/(k + 1) = y$, $7(-1/3) + 3 = y(-1/3 + 1)$, $-7/3 + 3 = y(2/3)$, $2/3 = 2y/3$, $y = 1$. The point is (0, 1).

Q12. Find the coordinates of the points which divide the line segment joining A(2, 3) and B(6, 7) in the ratio 1 : 2.

From x: $(6k + 2)/(k + 1) = x$, $6k + 2 = x(k + 1)$, $6k + 2 = xk + x$, $6k - xk = x - 2$, $k(6 - x) = x - 2$, $k = (x - 2)/(6 - x)$.
From y: $(7k + 3)/(k + 1) = y$, $7k + 3 = y(k + 1)$, $7k + 3 = yk + y$, $7k - yk = y - 3$, $k(7 - y) = y - 3$, $k = (y - 3)/(7 - y)$.



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Mid-point Q of AB = $(-2, 3)$. Mid-point of AQ = $(-3, 3/2)$. Mid-point of QB = $(-1, 9/2)$. The points are $(-3, 3/2)$, $(-2, 3)$ and $(-1, 9/2)$.

5-Mark Questions

Q13. A(-2, 1), B(a, 0), C(4, b) and D(1, 2) are the vertices of parallelogram ABCD. Find a and b. Find the lengths of the sides and diagonals, name the figure, and find its area.

Mid-point of AC = $((-2 + 4)/2, (1 + b)/2) = (1, (1 + b)/2)$. Mid-point of BD = $((a + 1)/2, 1)$. So $a + 1 = 2$ gives $a = 1$, and $1 + b = 2$ gives $b = 1$. B is (1, 0) and C is (4, 1).

$AB = \sqrt{(9 + 1)} = \sqrt{10}$, $BC = \sqrt{(9 + 1)} = \sqrt{10}$, $CD = \sqrt{(9 + 1)} = \sqrt{10}$, $DA = \sqrt{(9 + 1)} = \sqrt{10}$. $AC = \sqrt{(36 + 0)} = 6$ and $BD = \sqrt{(0 + 4)} = 2$.

All sides are equal and the diagonals are unequal, so ABCD is a rhombus (not a square). Area = $(1/2) \times 6 \times 2 = 6$ square units.

Q14. P and Q trisect the segment joining A(0, 2) and B(4, 0) and show that PQ = (1/3) AB.

P divides AB in 1 : 2: $P = ((0 + 2 \times (-2))/3, (-2)/3, (16 + 0)/3) = (-2/3, 16/3)$.

$PQ = \sqrt{[(2/3)^2 + (8/3)^2]} = \sqrt{(68/9)} = (2\sqrt{17})/3$



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Common Mistakes and Ex

- Dropping the sign of a negative coordinate** in brackets before you subtract.
- Forgetting the square root.** Many students find the length of a line segment unless the question only needs PQ^2 , as in Q13.
- Swapping m_1 and m_2 in the section formula.** A check: a ratio like 1 : 3 must be used with A's. A check: a ratio like 1 : 3 must be used with A's.
- Claiming a square from four equal sides.** Show equal diagonals, or one right angle.
- Ignoring collinear vertices.** In NCERT Ex 10.1, Q1, a quadrilateral is formed. Fix: if one side is a straight line, no quadrilateral is formed. Fix: if one side is a straight line, no quadrilateral is formed.

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6. **Using the wrong axis condition.** On the x-axis the y-coordinate is zero, and on the y-axis the x-coordinate is zero. Fix: say the rule in words before you set up the equation.
7. **Keeping only one answer for a squared equation.** $(y + 3)^2 = 36$ gives $y = 3$ and $y = -9$. Fix: write $\pm$ and keep both values unless the question rules one out.
8. **Taking parallelogram vertices out of order.** For ABCD, the diagonals are AC and BD. Fix: equate the mid-points of AC and BD, never AB and CD.
9. **Finding the ratio from x and never checking with y.** Fix: substitute the ratio in the y-coordinate. If it does not match, either the arithmetic is wrong or the point is not on the segment.
10. **Leaving surds unsimplified in a collinearity test.** $3\sqrt{2} + 2\sqrt{2} = 5\sqrt{2}$ is easy to see; $\sqrt{18} + \sqrt{8} = \sqrt{50}$ is not. Fix: simplify each surd before adding.

Quick Revision Points

- The abscissa (x) is the distance from the y-axis.
- A point on the x-axis is (x, 0); a point on the y-axis is (0, y).
- Quadrant signs: I (+, +), II (-, +), III (-, -), IV (+, -).
- Distance formula: $PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Distance from the origin: $\sqrt{x^2 + y^2}$.
- Collinear: the sum of the two smaller distances equals the largest distance.
- Right triangle: longest side squared equals sum of squares of other two sides.
- Square: four equal sides and equal diagonals.
- Equidistant point: set $PA^2 = PB^2$; the square root is not needed.
- All points equidistant from A and B lie on the perpendicular bisector of AB.
- Section formula: $((m_1x_2 + m_2x_1)/(m_1 + m_2), (m_1y_2 + m_2y_1)/(m_1 + m_2))$
- Unknown ratio: take $k : 1$, solve from one coordinate.
- Divided by the x-axis: set $y = 0$. Divided by the y-axis: set $x = 0$.
- Mid-point: $((x_1 + x_2)/2, (y_1 + y_2)/2)$, the average of the coordinates.
- Points of trisection: ratios 1 : 2 and 2 : 1.
- Parallelogram: mid-point of one diagonal is the same as the other.



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- External division is left for higher classes; every ratio in this chapter is internal and positive.

Weightage in Board Exams

The 2026-27 NCERT chapter covers two formulas: the distance formula and the section formula, with the mid-point formula as a special case. Study from the current book, and check the current CBSE course structure for the marks given to this chapter.

Question type	What is usually asked
MCQ and Assertion-Reason	Distance from the origin or an axis; mid-point; ratio in which an axis divides a segment; points on the axes
Short answers	Point on an axis equidistant from two points; unknown coordinate from a given dist
Longer answers	Type of triangle; area of triangle; area of parallelogram; trapezium
Case-based	A map, classroom layout, etc. to find distances, a half

Every answer in this chapter can be checked by using the example and exercise question first, since



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