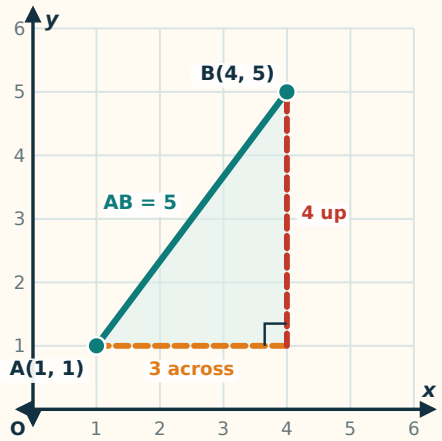
MATHS WITHOUT GUESSWORK

Coordinate Geometry

Understand the Points.
Choose the Formula.
Solve Independently.

A guided problem-solving workbook

CBSE Class 10 Mathematics · Syllabus session 2026–27



See the 3 and the 4 first. Then AB = 5.

SIGNATURE FEATURE

Understand the diagram before choosing the formula.

Every method in this book starts with a picture: where the points sit, what the run and rise are, which end of a segment a point is closer to. The formula comes last, so you know what it calculates and can check it against what you see.

Core topics: Distance formula · Section formula (internal division), with the mid-point as a special case

Original explanations, examples and questions. Not a substitute for the NCERT textbook or your teacher.

Liked this? The full Coordinate Geometry workbook is ₹99 →

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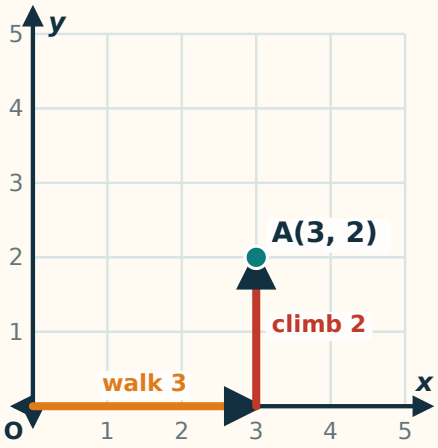
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Ordered pairs: why the order matters

PREREQUISITE

Learning objective: Plot (x, y) correctly every time, and see why (3, 2) and (2, 3) are different points.

Hold this question: *If both numbers are the same, does it matter which comes first?*



A(3, 2): walk 3, climb 2



B(2, 3): walk 2, climb 3

◆ UNDERSTAND

An **ordered pair** is two numbers in a fixed order. The first is always x (across), the second is always y (up/down). Swap them and you get a different point: A(3, 2) is lower and further right than B(2, 3).

Memory rule: walk, then climb. You walk along the corridor (x) before you take the lift (y). The alphabet helps too: x comes before y.

◉ DIAGRAM FIRST

1 SEE · (−1, 4): two moves to make.

2 READ · First number −1: walk 1 **left**. Second number 4: climb 4 **up**.

3 CHOOSE · Mark it. Then read it back from the grid to check: across −1, up 4 ✓.

★ SPOT THE CLUE

A point where both numbers are equal, like (3, 3), is the only kind where swapping does not matter. Every other swap moves the point.

? WHAT IF?

What if only the second number changes? (3, 2) → (3, 5): the walk stays 3, so the point moves straight **up** by 3. Changing only y moves a point vertically; changing only x moves it horizontally. You will use this idea for the shortcut on page 14.

⚠ COMMON TRAP

Reading a grid as "row first". In a classroom seat plan you might say "row 2, column 3". In coordinate geometry the across number (column) always comes first: (3, 2).

✓ CHECK YOURSELF

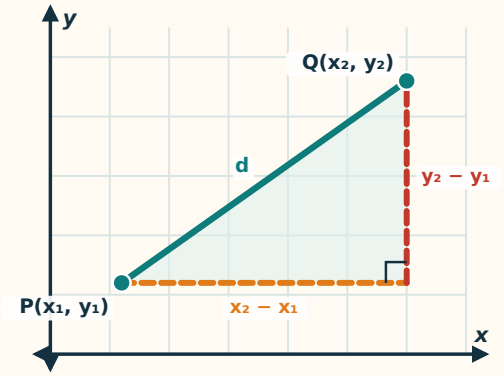
C2. (a) Write the point that is 2 units to the left of the y-axis and 5 units above the x-axis. (b) Are (4, 1) and (1, 4) the same point? Give a reason.

The distance formula

CORE

Learning objective: Write the distance formula, say what every symbol means, and use it in eight clear steps.

Hold this question: *What exactly does each part of the formula calculate in my sketch?*



◆ UNDERSTAND

Exactly the same triangle as on page 11, now with letters. The run is the change in x; the rise is the change in y. Pythagoras gives $d^2 = \text{run}^2 + \text{rise}^2$, so

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

Distance from the origin O(0, 0) to P(x, y): $OP = \sqrt{x^2 + y^2}$

Symbol	Means	In the sketch
(x_1, y_1)	the point you call "first"	P
(x_2, y_2)	the point you call "second"	Q
$x_2 - x_1$	change in x (run)	horizontal leg
$y_2 - y_1$	change in y (rise)	vertical leg
d	straight-line distance PQ	slanted side

➤ CHOOSE THE METHOD

The eight-step routine. (1) Name the two points. (2) Label them: write $x_1 =$, $y_1 =$, $x_2 =$, $y_2 =$. (3) Find $x_2 - x_1$, with brackets round negatives. (4) Find $y_2 - y_1$. (5) Square both. (6) Add. (7) Take the square root. (8) Simplify and compare with your sketch.

? WHY THIS STEP?

Does it matter which point is "first"? No. Swapping the points changes the run from 3 to −3, but $(-3)^2 = 9 = 3^2$. Squaring removes the direction and keeps the size. So $(x_1 - x_2)^2 + (y_1 - y_2)^2$ gives the same answer.

Worked example: find the distance between (2, 3) and (5, 7).

#	Step	Why this step?
1	$x_1 = 2$, $y_1 = 3$, $x_2 = 5$, $y_2 = 7$	Label before substituting: it stops x and y getting mixed.
2	run $= 5 - 2 = 3$; rise $= 7 - 3 = 4$	Change in x, then change in y.
3	$d = \sqrt{(3^2 + 4^2)} = \sqrt{(9 + 16)} = \sqrt{25} = 5$ units	Square, add, then take the root. 5 lies between 4 and 3 + 4 = 7 ✓.

✔ CHECK YOURSELF

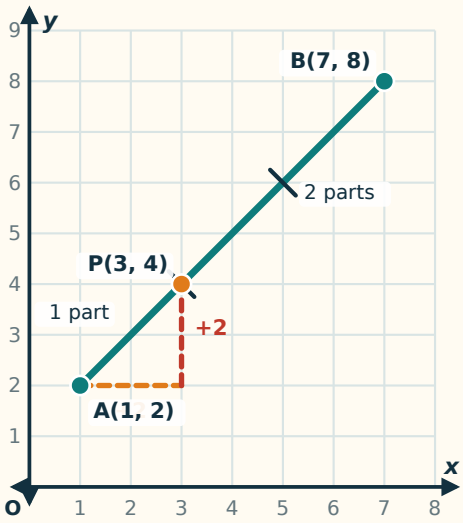
C8. Find the distance between (1, −1) and (7, 7). Sketch first and predict a range for the answer.

Section formula: see the fraction of the way

CORE

Learning objective: Understand what "divides in the ratio $m_1 : m_2$" means on a diagram, and find the point by walking part of the way.

Hold this question: *If P divides AB in the ratio 1 : 2, how far along from A is P?*



◉ DIAGRAM FIRST

1 SEE · P is on AB, closer to A. AP : PB = 1 : 2.

2 READ · Cut AB into 1 + 2 = 3 equal parts. P is after **1 part**: it is **1/3 of the way** from A to B.

3 CHOOSE · Walk 1/3 of the run and 1/3 of the rise from A.
Run = 7 − 1 = 6, so x = 1 + ⅓(6) = **3**.
Rise = 8 − 2 = 6, so y = 2 + ⅓(6) = **4**.
P = (3, 4).

◆ UNDERSTAND

Divides AB internally in the ratio $m_1 : m_2$ means P lies between A and B with AP : PB = $m_1 : m_2$. So P is $\frac{m_1}{m_1 + m_2}$ of the way from A to B. Read the ratio in the same order as the letters: the first number goes with the part next to A.

◆ UNDERSTAND

The mid-point is the 1 : 1 case. Halfway along means half the run and half the rise, which works out as the **average** of the coordinates:

$$\text{Mid-point of } A(x_1, y_1) \text{ and } B(x_2, y_2) = \left(\frac{x_1 + x_2}{2} , \frac{y_1 + y_2}{2} \right)$$

Example: the mid-point of A(−3, 5) and B(5, −1) is ((−3 + 5)/2, (5 + (−1))/2) = **(1, 2)**. Check: from A, run 8 and rise −6; half of each is 4 and −3, and (−3 + 4, 5 − 3) = (1, 2) ✓.

⚠ COMMON TRAP

Thinking 1 : 2 means "P is halfway" or "P is ½ of the way". The ratio compares the two parts with each other, not a part with the whole. 1 : 2 → ⅓ of the way. 3 : 1 → ¾ of the way.

✓ CHECK YOURSELF

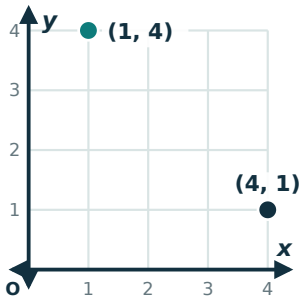
C11. Find the mid-point of (−4, 6) and (2, −2). Then check it by walking half the run and half the rise from (−4, 6).

Doubts 1 and 2: reading points

DOUBT 1 *"(3, 2) and (2, 3) use the same numbers. Aren't they the same point?"*

WHY IT HAPPENS	Both pairs contain a 3 and a 2, and everyday lists like {2, 3} do not care about order.
SIMPLE EXPLANATION	In (x, y) the **position** carries the meaning: first = across, second = up. Swapping the numbers swaps the moves.
★ SPOT THE CLUE	Brackets with a comma mean an **ordered** pair: read the first number as x every time.
WORKED EXAMPLE	Which is higher, (1, 4) or (4, 1)? Compare the **second** numbers: 4 > 1, so (1, 4) is higher. *Why this step? Height is the y-coordinate.*
⚠ COMMON TRAP	Plotting (1, 4) as "up 1, right 4". That is the point (4, 1).
✎ YOUR TURN DB1	Plot P(−1, 4) and Q(4, −1). Which one is in quadrant II?
✔ QUICK CHECK	Read your point back from the grid: across first, then up. It must match the pair you were given.

◉ VISUAL EXPLANATION

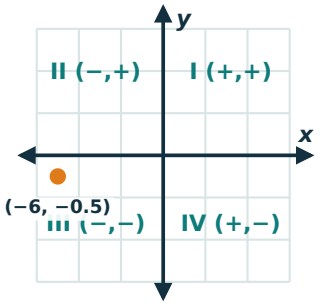


Same digits, different places.

DOUBT 2 *"How do I find the quadrant quickly without drawing anything?"*

WHY IT HAPPENS	Students try to memorise "quadrant II = ..." instead of picturing left/right and up/down.
SIMPLE EXPLANATION	Sign of x: + right, − left. Sign of y: + up, − down. The two signs name a corner of the plane.
★ SPOT THE CLUE	Ignore the sizes of the numbers. Only the two **signs** matter.
WORKED EXAMPLE	(−6, −0.5): x negative → left; y negative → down. Left and down → **quadrant III**. *Why this step? A tiny −0.5 is still below the axis.*
⚠ COMMON TRAP	Calling (5, −2) quadrant II because "one sign is negative, so it's the 2nd". It is right and down: IV.
✎ YOUR TURN DB2	Without plotting, name the quadrants of (−7, −0.5) and (0.2, −9).
✔ QUICK CHECK	Draw a quick "+" sign in the margin and point to the corner your two signs describe.

◉ VISUAL EXPLANATION



Anticlockwise from top right.

Decision tree: from question to formula

Learning objective: Follow the branches to choose a method, and know which check to run before you finish.

◉ **Sketch the points first.** Then ask: what is the answer going to be?

A number of units (a length)

Do the points share x or y?

Yes → subtract: bigger − smaller

No → distance formula $\sqrt{(\text{run}^2 + \text{rise}^2)}$

Shape / collinear / equidistant? → find **all** needed distances and compare or equate

A point (x, y)

Is a ratio given?

1 : 1 or "mid-point", "centre", "bisect" → mid-point formula

$m_1 : m_2$, trisection, "AP = ⅖ AB" → section formula

No ratio, but "equidistant" → unknown point + distance equation

A ratio or an unknown value

What is known about the point?

The point is given → k : 1, use x, check with y

"The x-axis divides" → y = 0; "the y-axis" → x = 0

"Distance is d" → square both sides; expect two answers

Before you finish, always check: Does the answer agree with my sketch? Distance between the larger change and the sum of changes? Dividing point between A and B? Every unknown substituted back? Did I answer the exact question (a point, a ratio, or a length with units)?

⚠ COMMON TRAP

A decision tree is a guide, not a machine. A question can mix ideas: "find the ratio in which the y-axis divides AB, and the length of AB" needs a ratio **and** a distance. Work through each part separately.

? WHY THIS STEP?

Every branch starts from the **type of answer** (length, point or ratio). That is the question students skip most often, and it decides the formula more reliably than any keyword.

✓ CHECK YOURSELF

Try the tree: which branch would you take for "Find the centre of a circle whose diameter has ends (−3, 2) and (5, 6)"? (Hint: what kind of answer is a centre?)

Mistake clinic (1 of 3)

MISTAKE 1 · Reversing the ordered pair

✗ STUDENT'S WORK	*Plot B(2, 5).* The student marks the point 5 to the right and 2 up.
⚠ WHERE IT FAILS	The student plotted (5, 2). The first number is always the move across.
? WHY TEMPTING	Both numbers are positive, so the point still "looks" reasonable in quadrant I.
✓ CORRECTED	B(2, 5): walk 2 right, then climb 5 up. B is higher than it is far across.
➤ PREVENTION RULE	Walk, then climb. Read the point back from the grid before moving on.
✎ FIX IT E1	A student plots (5, −1) by going 1 right and 5 down. Write the correct moves. Is the quadrant affected?

MISTAKE 2 · Wrong direction for a negative, or the wrong region

✗ STUDENT'S WORK	*Plot (−4, 3), and name the region of (0, −2).* The student plots (4, 3), and says "(0, −2) is in quadrant IV".
⚠ WHERE IT FAILS	The minus on −4 was ignored, so the point landed on the wrong side of the y-axis. And (0, −2) has x = 0, so it is **on** the y-axis, in no quadrant.
? WHY TEMPTING	Negative signs are small and easy to miss; and (0, −2) is "below and slightly right-looking" on a rough sketch.
✓ CORRECTED	(−4, 3) is 4 **left**, 3 up: quadrant II. (0, −2) lies on the negative y-axis.
➤ PREVENTION RULE	Say the sign aloud as a direction ("minus four: left four"). A zero coordinate means: on an axis.
✎ FIX IT E2	A student writes "(−4, 0) lies in quadrant II." Correct the statement and explain.

MISTAKE 3 · Substituting coordinates in the wrong places

✗ STUDENT'S WORK	*Distance between (−1, 4) and (3, 1).* $\sqrt{((3-4)^2 + (1-(-1))^2)} = \sqrt{(1+4)} = \sqrt{5}$.
⚠ WHERE IT FAILS	$y_1 = 4$ was put in the x-bracket and $x_1 = -1$ in the y-bracket. The run and rise were mixed up.
? WHY TEMPTING	All four numbers appear somewhere, so the working looks complete.
✓ CORRECTED	run = 3 − (−1) = 4, rise = 1 − 4 = −3. d = $\sqrt{(16+9)} = \sqrt{25} = \mathbf{5}$.
➤ PREVENTION RULE	Fill an x_1, y_1, x_2, y_2 table first (Doubt 16). Only x's in the first bracket.
✎ FIX IT E3	Find the error: the distance between (2, 7) and (5, 3) is written as $\sqrt{((5-7)^2 + (3-2)^2)}$. Correct it.

Practice 1: points and the plane

Learning objective: Read, write and place points confidently, including points on the axes. (Level 1)

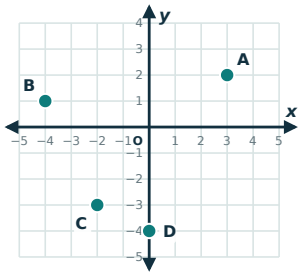
Level 1 | Level 2 | Level 3 | Level 4 | Level 5

Answers: Section H.

P1 Write the coordinates of A, B, C and D in the grid. For each, name its quadrant, or the axis it lies on.

Purpose: read points from a diagram. easy ★☆☆

Working space (use separate paper if needed)



P2 Without plotting, say where each point lies (quadrant or axis): (−6, 3), (4, −4), (0, 7), (−2, −9), (5, 0), (8, 1).

Purpose: use the signs, not the sizes. easy ★☆☆

Sketch first

Working space (use separate paper if needed)

P3 Write the coordinates of the point that is: (a) 3 units left of the y-axis and 4 units below the x-axis; (b) on the x-axis, 6 units to the left of the origin; (c) on the y-axis, 2.5 units above the origin.

Purpose: turn words into ordered pairs. easy ★☆☆

Sketch first

Working space (use separate paper if needed)

P4 True or false? Give a reason for each. (a) (2, −5) and (−5, 2) are the same point. (b) Every point on the y-axis has x-coordinate 0. (c) The origin lies in quadrant I.

Purpose: spot the common misconceptions. easy ★☆☆

Working space (use separate paper if needed)

P5 P is (4, −3). Q has the same y-coordinate as P, but its x-coordinate has the opposite sign. Write Q, name the quadrants of P and Q, and find the length PQ.

Purpose: see how a sign change moves a point. moderate ★★☆

Sketch first

Working space (use separate paper if needed)

P6 Find the length of each segment without the distance formula: (a) (−5, 4) to (7, 4); (b) (−1, −8) to (−1, −2). Say which is horizontal and which is vertical.

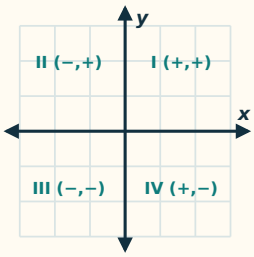
Purpose: use the shortcut correctly. easy ★☆☆

Sketch first

Working space (use separate paper if needed)

Revision map

Learning objective: Recall every key fact, formula and check on one page.

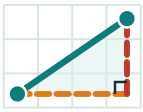


◆ UNDERSTAND

(x, y): walk x (± = right/left), then climb y (± = up/down). x = distance from the y-axis; y = distance from the x-axis.
On the x-axis: (x, 0). **On the y-axis**: (0, y). **Origin**: (0, 0). Points on an axis are in no quadrant.
Same y → horizontal, length = bigger x − smaller x. **Same x** → vertical, length = bigger y − smaller y.

Distance

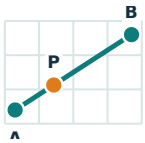
$$d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$$



run² + rise², then root. From O: √(x² + y²).

Section (internal)

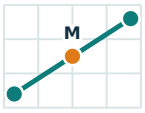
$$\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2} , \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$$



AP : PB = $m_1 : m_2$. Criss-cross. Unknown ratio → k : 1.

Mid-point (1 : 1)

$$\left(\frac{x_1 + x_2}{2} , \frac{y_1 + y_2}{2} \right)$$



Average. Diagonals of a parallelogram share it; a centre is it.

◉ DIAGRAM FIRST

1 SEE · Sketch the points. Quadrants? Which is higher, which further right?

2 READ · Is the answer a length, a point, a ratio or a value? Run/rise? Fraction of the way? Shared x or y?

3 CHOOSE · Shortcut, distance, section (k : 1), or mid-point. Then substitute with brackets.

When the question asks for…	Use
A length between two points	Shortcut if x or y is shared; else distance formula
Triangle type, square, collinear	All distances, then compare
Equidistant / unknown coordinate	Unknown as (x, 0), (0, y) or (x, y); $PA^2 = PB^2$; keep ± answers
Point in a given ratio / trisection	Section formula; check the fraction of the way
"In what ratio" / an axis divides	k : 1; set the known coordinate; check the other
Mid-point, centre, parallelogram	Average, forwards or backwards

⚠ COMMON TRAP

Final error checklist. ☐ x before y (E1) ☐ Negative = left/down; zero = on an axis (E2) ☐ x's with x's (E3) ☐ Brackets round negatives (E4) ☐ $(-a)^2$ is positive (E5) ☐ Square, add, then root (E6) ☐ A difference is a distance only for horizontal/vertical (E7) ☐ Criss-cross the ratio (E8) ☐ Both answers, final line answers the question (E9)

✓ CHECK YOURSELF

Answer-checking routine: (1) Does the answer agree with the sketch? (2) Distance: more than the larger change, less than their sum. (3) Dividing point: between A and B, at the right fraction of the way. (4) Unknowns: substitute back. (5) Mid-point: equal distances to both ends.

MATHS WITHOUT GUESSWORK

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You have just read 10 sample pages. The full workbook is 50 pages + cover.

What is in the full workbook

- **Diagnostic challenge.** A short warm-up to find what you already know before you start.
- **Foundation.** Concept explanations that build the ideas the chapter depends on.
- **Core methods.** Worked examples with a reason for every step, and quick checks to try.
- **Doubt Bank.** 16 common doubts answered clearly, each followed by a question to try.
- **Method recognition.** Clue tables, decision charts and look-alike questions that train you to choose the method.
- **Mistake Clinic.** 9 common mistakes: the wrong work, why it is tempting, and the fix.

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