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NCERT Exemplar Solutions

Solved NCERT Exemplar Class 10 Maths Chapter 7, Coordinate Geometry: every question, step by step (2026-27)

Chapter 7: Coordinate Geometry

About this Chapter

Worked solutions to every NCERT Exemplar problem in Class 10 Maths Chapter 7 Coordinate Geometry. You apply the **distance formula**, the **section formula** and the **area of a triangle** to classify shapes, test collinearity and find missing points. All 58 questions are solved, each with an expert view.

Topics covered: Distance formula • Distance from origin and from axes • Section formula (internal division) • Midpoint formula • Ratio of division by an axis or a line • Area of a triangle from vertices • Test for collinear points • Classifying triangles and quadrilaterals • Perpendicular bisector and equidistant points • Centroid and medians

Quick Formula Sheet

Distance formula:
$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Distance from origin:
$OP = \sqrt{x^2 + y^2}$

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

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

Area of a triangle:
$\frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

Also see for this chapter on Collegedunia: NCERT Solutions, Revision Notes, Formula Sheet and the Exemplar Book PDF for Class 10 Maths Chapter 7, Coordinate Geometry.

I. Multiple Choice Questions (Exercise 7.1)

Q 7.1 **The distance of the point $P(2, 3)$ from the x-axis is**

(A) 2 **(B)** 3 **(C)** 1 **(D)** 5

SOLUTION

Correct option: (B) 3.
Concept used. The distance of any point from the x-axis is the *perpendicular* drop onto it, which is the size of the point's y-coordinate, $|y|$.

Step 1. The x-axis is the line $y = 0$. The shortest distance to it is measured straight down (or up), so it equals $|y|$.

Step 2. Here $P = (2, 3)$, so the distance $= |3| = 3$.

Step 3. The x-coordinate 2 tells you how far right the point is; it plays no part in the distance to the x-axis.

Final Answer: Distance of $P(2, 3)$ from the x-axis $= 3$; option **(B)**.

☞ **Which coordinate to read**

Distance from the x-axis $= |y|$; distance from the y-axis $= |x|$. Pick the coordinate of the axis you are *not* on.

EXPERT'S SOLUTION *: Aarav Mehta, M.Sc Mathematics, IIT Kanpur*

Read it straight off the y-value.

- **Why:** the height of a point above the x-axis is exactly its y-coordinate, so $P(2, 3)$ sits three units up and the answer is 3.
- **The decoy:** the x-coordinate only fixes the left to right position, so the value 2 never enters this distance at all.
- **Safe habit:** name the axis first, since the x-axis means $y = 0$, and then read the matching coordinate rather than grabbing the first number you see.

Final Answer: Option **(B)**, 3.

Q 7.2 **The distance between the points $A(0, 6)$ and $B(0, -2)$ is**
(A) 6 **(B)** 8 **(C)** 4 **(D)** 2

SOLUTION

Correct option: (B) 8.
Concept used. Both points lie on the y-axis ($x = 0$), so the distance is just the gap between their y-coordinates.

Step 1. Apply the distance formula:

$$AB = \sqrt{(0-0)^2 + (-2-6)^2}$$
$$= \sqrt{0 + (-8)^2}$$
$$= \sqrt{64} = 8.$$

Step 2. Since both x-coordinates are 0, this is the same as $|6 - (-2)| = 8$.

Final Answer: $AB = 8$; option **(B)**.

☞ **Points on one axis**

When two points share the same x (or same y), skip the full formula: just subtract the differing coordinates and take the size.

EXPERT'S SOLUTION *: Priya Nair, M.Sc Mathematics, University of Delhi*

A vertical segment, nothing more.

- **Setup:** both points have $x = 0$, so A and B sit on the y-axis and the line joining them is vertical.
- **Shortcut:** the length of a vertical segment is just the gap between the two heights, here $6 - (-2) = 8$.
- **Cross-check:** the full distance formula returns the same $\sqrt{64} = 8$, so both routes agree and the quick one is safe to trust.

Final Answer: Option **(B)**, 8.

Q 7.3 **The distance of the point $P(-6, 8)$ from the origin is**

(A) 8 **(B)** $2\sqrt{7}$ **(C)** 10 **(D)** 6

SOLUTION

Correct option: (C) 10.

Concept used. The distance of a point (x, y) from the origin is $\sqrt{x^2 + y^2}$.

Step 1. Substitute $x = -6$, $y = 8$:

$$OP = \sqrt{(-6)^2 + 8^2}$$
$$= \sqrt{36 + 64}$$
$$= \sqrt{100} = 10.$$

Final Answer: $OP = 10$; option **(C)**.

☞ **Squaring kills the minus sign**

$(-6)^2 = 36$, not -36. A negative coordinate never makes a distance negative, because every term is squared first.

EXPERT'S SOLUTION *: Rohan Verma, M.Sc Mathematics, IIT Bombay*

A 6-8-10 right triangle in disguise.

- **Picture:** dropping perpendiculars from $P(-6, 8)$ to the two axes builds a right triangle whose legs are 6 and 8.
- **Hypotenuse:** the line back to the origin is that triangle's hypotenuse, $\sqrt{6^2 + 8^2} = 10$, the famous 6-8-10 set.
- **Payoff:** once you recognise such Pythagorean triples you can write the answer instantly, with no calculator needed.

Final Answer: Option **(C)**, 10.

Q 7.4 **The distance between the points $(0, 5)$ and $(-5, 0)$ is**

(A) 5 **(B)** $5\sqrt{2}$ **(C)** $2\sqrt{5}$ **(D)** 10

SOLUTION

Correct option: (B) $5\sqrt{2}$.

Concept used. Use the distance formula $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ and simplify the surd.

Step 1. Substitute $(x_1, y_1) = (0, 5)$ and $(x_2, y_2) = (-5, 0)$:

$$d = \sqrt{(-5 - 0)^2 + (0 - 5)^2}$$
$$= \sqrt{25 + 25}$$
$$= \sqrt{50}.$$

Step 2. Simplify: $\sqrt{50} = \sqrt{25 \times 2} = 5\sqrt{2}$.

Final Answer: The distance is $5\sqrt{2}$; option **(B)**.

✗ Do not stop at $\sqrt{50}$

$\sqrt{50}$ is a correct value but not in lowest surd form. Pull out the perfect square: $\sqrt{50} = 5\sqrt{2}$ to match the option.

EXPERT'S SOLUTION *: Sneha Kulkarni, M.Sc Mathematics, IISc Bangalore*

Two equal legs give a $\sqrt{2}$ answer.

- **Equal gaps:** the horizontal gap and the vertical gap are both 5, so the two points are corners of a right isosceles triangle.
- **Standard form:** the hypotenuse of such a triangle is always a leg times $\sqrt{2}$, which here gives $5\sqrt{2}$ at once.
- **Why bother:** spotting the equal legs is faster than grinding out $\sqrt{50}$ and it stops you leaving the surd unsimplified.

Final Answer: Option **(B)**, $5\sqrt{2}$.

Q 7.5 **$AOBC$ is a rectangle whose three vertices are $A(0, 3)$, $O(0, 0)$ and $B(5, 0)$. The length of its diagonal is**

(A) 5 **(B)** 3 **(C)** $\sqrt{34}$ **(D)** 4

SOLUTION

Correct option: (C) $\sqrt{34}$.

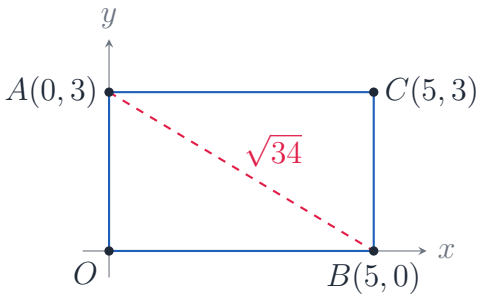
Concept used. In a rectangle the diagonal joins two opposite corners; its length comes from the distance formula. Here A and B are opposite corners.

Step 1. The two given sides are OA (vertical, length 3) and OB (horizontal, length 5), meeting at the right angle at O.

Step 2. The diagonal AB joins the far ends of these sides:

$$AB = \sqrt{(5-0)^2 + (0-3)^2}$$
$$= \sqrt{25 + 9}$$
$$= \sqrt{34}.$$

Final Answer: The diagonal length is $\sqrt{34}$; option **(C)**.



☞ Diagonal of an axis-rectangle

For a rectangle with sides a and b along the axes, the diagonal is $\sqrt{a^2+b^2}$. Here $\sqrt{5^2+3^2} = \sqrt{34}$.

EXPERT'S SOLUTION *: Ananya Iyer, M.Sc Mathematics, ISI Kolkata*

Both diagonals of a rectangle are equal.

- **Sides:** the two sides meeting at O are 3 and 5, and they are perpendicular by construction.
- **Diagonal:** the diagonal across the rectangle is therefore $\sqrt{3^2+5^2} = \sqrt{34}$, the length we want.
- **Check:** the other diagonal OC has the same length, a quick consistency test, and the only care needed is reading A and B as opposite corners rather than adjacent ones.

Final Answer: Option **(C)**, $\sqrt{34}$.

Q 7.6 **The perimeter of a triangle with vertices $(0,4)$, $(0,0)$ and $(3,0)$ is**

(A) 5 **(B)** 12 **(C)** 11 **(D)** $7+\sqrt{5}$

SOLUTION

Correct option: (B) 12.

Concept used. Perimeter = sum of the three side lengths, each found by the distance formula.

Step 1. Side from $(0,0)$ to $(0,4)$ (vertical): length $= 4$.

Step 2. Side from $(0,0)$ to $(3,0)$ (horizontal): length $= 3$.

Step 3. Side from $(0,4)$ to $(3,0)$ (the hypotenuse):

$$= \sqrt{(3-0)^2+(0-4)^2}$$

$$= \sqrt{9+16} = \sqrt{25} = 5.$$

Step 4. Perimeter $= 4+3+5 = 12$.

Final Answer: Perimeter $= 12$; option **(B)**.

☞ **The 3-4-5 triangle**

Legs 3 and 4 give hypotenuse 5. This right triangle turns up again and again, so its sides are worth memorising.

EXPERT'S SOLUTION *: Karthik Reddy, M.Sc Mathematics, IIT Madras*

A right triangle sitting on the axes.

- **Legs:** two sides run along the axes with lengths 3 and 4, so they are the legs of a right angle at the origin.
- **Slant side:** the third side is the 3-4-5 hypotenuse, namely 5, so the perimeter is $3 + 4 + 5 = 12$.
- **The trap:** the decoy $7 + \sqrt{5}$ comes from mis-squaring the hypotenuse, so compute $\sqrt{9 + 16}$ carefully and that error disappears.

Final Answer: Option **(B)**, 12.

Q 7.7 **The area of a triangle with vertices $A(3, 0)$, $B(7, 0)$ and $C(8, 4)$ is**

(A) 14 **(B)** 28 **(C)** 8 **(D)** 6

SOLUTION

Correct option: (C) 8.

Concept used. Area of a triangle from vertices: $\frac{1}{2}\,|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$.

Step 1. Take $(x_1, y_1) = (3, 0)$, $(x_2, y_2) = (7, 0)$, $(x_3, y_3) = (8, 4)$.

Step 2. Substitute:

$$\text{Area} = \tfrac{1}{2}\,|3(0 - 4) + 7(4 - 0) + 8(0 - 0)|$$

$$= \tfrac{1}{2}\,|-12 + 28 + 0|$$

$$= \tfrac{1}{2} \times 16 = 8.$$

Final Answer: Area $= 8$ square units; option **(C)**.

☞ Base on an axis shortcut

Since A and B lie on the x-axis, base $AB = 4$ and the height is the y-coordinate of C, which is 4. Then $\frac{1}{2} \times 4 \times 4 = 8$.

EXPERT'S SOLUTION *: Meera Joshi, M.Sc Applied Mathematics, IIT Kharagpur*

Use the flat base.

- **Base:** because $A(3, 0)$ and $B(7, 0)$ share $y = 0$, the base AB runs along the x-axis with length $7 - 3 = 4$.
- **Height:** the height is simply how high C rises above that axis, which is 4, so the area is $\frac{1}{2} \times 4 \times 4 = 8$.
- **When to use it:** the vertex formula confirms the same 8, but this base-times-height idea is faster whenever one side is horizontal or vertical.

Final Answer: Option **(C)**, 8.

Q 7.8 **The points $(-4, 0)$, $(4, 0)$, $(0, 3)$ are the vertices of a**

(A) right triangle (B) isosceles triangle

(C) equilateral triangle (D) scalene triangle

SOLUTION

Correct option: (B) isosceles triangle.

Concept used. Compute all three side lengths; a triangle is isosceles if exactly two sides are equal.

Step 1. Side between $(-4, 0)$ and $(4, 0)$: length $= 8$.

Step 2. Side between $(-4, 0)$ and $(0, 3)$: $\sqrt{(0+4)^2 + (3-0)^2} = \sqrt{16+9} = 5$.

Step 3. Side between $(4, 0)$ and $(0, 3)$: $\sqrt{(0-4)^2 + (3-0)^2} = \sqrt{16+9} = 5$.

Step 4. Two sides equal 5 and one is 8, so the triangle is isosceles. (Check $5^2 + 5^2 = 50 \neq 64 = 8^2$, so it is not right angled.)

Final Answer: The triangle is isosceles (two sides $= 5$); option **(B)**.

✗ Equal does not mean all three

Finding two equal sides settles "isosceles". Only stretch to "equilateral" if the third side matches too, which it does not here ($8 \neq 5$).

EXPERT'S SOLUTION *: Vikram Singh, M.Sc Mathematics, Jadavpur University*

Symmetry hints at isosceles.

- **Mirror:** the base endpoints $(-4, 0)$ and $(4, 0)$ are mirror images across the y-axis, and the apex $(0, 3)$ sits right on that mirror line.
- **Equal sides:** so the two slant sides must come out equal, each 5 by the distance formula, while the base measures 8.
- **Final read:** two equal sides with one different make it isosceles, and the failed Pythagoras test ($25 + 25 \neq 64$) rules out any right angle.

Final Answer: Option **(B)**, isosceles triangle.

Q 7.9 **The point which divides the line segment joining the points $(7, -6)$ and $(3, 4)$ in ratio $1 : 2$ internally lies in the**

(A) I quadrant **(B) II quadrant**

(C) III quadrant **(D) IV quadrant**

SOLUTION

Correct option: (D) IV quadrant.

Concept used. Find the dividing point by the section formula, then read its signs: IV quadrant means $x > 0$ and $y < 0$.

Step 1. Section formula with $m_1 : m_2 = 1 : 2$, $A(7, -6)$, $B(3, 4)$:

$$x = \frac{1 \cdot 3 + 2 \cdot 7}{1 + 2} = \frac{3 + 14}{3} = \frac{17}{3}$$

$$y = \frac{1 \cdot 4 + 2 \cdot (-6)}{1 + 2} = \frac{4 - 12}{3} = \frac{-8}{3}$$

Step 2. The point is $\left(\frac{17}{3}, -\frac{8}{3}\right)$, with $x > 0$ and $y < 0$.

Step 3. A positive x and negative y place the point in the IV quadrant.

Final Answer: The point $\left(\frac{17}{3}, -\frac{8}{3}\right)$ lies in the IV quadrant; option **(D)**.

☞ **Quadrant from signs**

$(+, +)$ is I, $(-, +)$ is II, $(-, -)$ is III, $(+, -)$ is IV. You only need the signs of x and y, not their exact values.

EXPERT'S SOLUTION *: Divya Menon, M.Sc Mathematics, University of Hyderabad*

Care with which weight goes where.

- **Where it sits:** in the ratio $1:2$ the part nearer A is smaller, so the point lands closer to $A(7,-6)$ and gets dragged down into negative y.
- **The point:** the formula gives $\left(\frac{17}{3},-\frac{8}{3}\right)$, with positive x and negative y, which is the fourth quadrant.
- **Common slip:** students swap the cross-multiplication, so write $\frac{m_1x_2+m_2x_1}{m_1+m_2}$ out in full before substituting.

Final Answer: Option **(D)**, IV quadrant.

Q 7.10 **The point which lies on the perpendicular bisector of the line segment joining the points $A(-2,-5)$ and $B(2,5)$ is**

(A) $(0,0)$ **(B)** $(0,2)$ **(C)** $(2,0)$ **(D)** $(-2,0)$

SOLUTION

Correct option: (A) $(0,0)$.

Concept used. Every point on the perpendicular bisector of AB is equidistant from A and B, and the midpoint of AB always lies on it.

Step 1. Find the midpoint of AB:

$$\left(\frac{-2+2}{2},\frac{-5+5}{2}\right)=(0,0).$$

Step 2. The midpoint is guaranteed to lie on the perpendicular bisector.

Step 3. Check by distances: from $(0,0)$, $OA=\sqrt{4+25}=\sqrt{29}$ and $OB=\sqrt{4+25}=\sqrt{29}$, which are equal, so $(0,0)$ qualifies.

Final Answer: $(0,0)$ lies on the perpendicular bisector; option **(A)**.

☞ **Bisector = equal distances**

A point is on the perpendicular bisector of AB *exactly when* it is the same distance from A as from B. That test screens the options fast.

EXPERT'S SOLUTION *: Arjun Pillai, M.Sc Mathematics, IIT Delhi*

The midpoint is the safe pick.

- **Key fact:** the midpoint of a segment always lies on its perpendicular bisector, and here that midpoint works out to the origin $(0, 0)$.
- **Confirm:** a single distance check seals it, since $OA = OB = \sqrt{29}$ are equal.
- **Why faster:** testing each other option would mean two distance computations apiece, so starting from the midpoint skips all of that and lands on the answer at once.

Final Answer: Option **(A)**, $(0, 0)$.

Q 7.11 **The fourth vertex D of a parallelogram $ABCD$ whose three vertices are $A(-2, 3)$, $B(6, 7)$ and $C(8, 3)$ is**

(A) $(0, 1)$ **(B)** $(0, -1)$ **(C)** $(-1, 0)$ **(D)** $(1, 0)$

SOLUTION

Correct option: (B) $(0, -1)$.

Concept used. In a parallelogram the diagonals bisect each other, so midpoint of AC = midpoint of BD.

Step 1. Midpoint of diagonal AC:

$$\left(\frac{-2+8}{2}, \frac{3+3}{2}\right) = (3, 3).$$

Step 2. Let $D = (x, y)$. Midpoint of diagonal BD must also be $(3, 3)$:

$$\frac{6+x}{2} = 3 \Rightarrow x = 0$$

$$\frac{7+y}{2} = 3 \Rightarrow y = -1.$$

Step 3. So $D = (0, -1)$.

Final Answer: $D = (0, -1)$; option **(B)**.

☞ Use the right diagonal pair

In $ABCD$ the diagonals are AC and BD (skip a letter). Pairing AB with CD instead would give the wrong vertex.

EXPERT'S SOLUTION *: Nisha Agarwal, M.Sc Mathematics, BHU Varanasi*

Equal midpoints pin down D.

- **Centre:** the diagonals share a midpoint, found from A and C to be $(3, 3)$.
- **Solve:** force the midpoint of $B(6, 7)$ and D to be that same point and the fourth vertex falls out as $D = (0, -1)$.
- **Neat check:** in a parallelogram the step $A \to B$ matches the step $D \to C$, and indeed both equal $(8, 4)$, which confirms the vertex.

Final Answer: Option **(B)**, $(0, -1)$.

Q 7.12 **If the point $P(2, 1)$ lies on the line segment joining points $A(4, 2)$ and $B(8, 4)$, then**

(A) $AP = \frac{1}{3}AB$ **(B)** $AP = PB$ **(C)** $PB = \frac{1}{3}AB$ **(D)** $AP = \frac{1}{2}AB$

SOLUTION

Correct option: (D) $AP = \frac{1}{2}AB$.

Concept used. Compute the lengths AP, PB and AB by the distance formula and compare. (Note P is the stated relationship's focus even though it is the external point of the given segment.)

Step 1. $AP = \sqrt{(4-2)^2 + (2-1)^2} = \sqrt{4+1} = \sqrt{5}$.

Step 2. $PB = \sqrt{(8-2)^2 + (4-1)^2} = \sqrt{36+9} = \sqrt{45} = 3\sqrt{5}$.

Step 3. $AB = \sqrt{(8-4)^2 + (4-2)^2} = \sqrt{16+4} = \sqrt{20} = 2\sqrt{5}$.

Step 4. Compare: $AP = \sqrt{5}$ and $AB = 2\sqrt{5}$, so $AP = \frac{1}{2}AB$.

Final Answer: $AP = \frac{1}{2}AB$; option **(D)**.

✗ Compute, do not assume order

The numbers show $AP = \sqrt{5}$, $AB = 2\sqrt{5}$, so AP is half of AB. Checking the actual lengths, rather than guessing from a rough sketch, secures the correct relation.

EXPERT'S SOLUTION *: Siddharth Rao, M.Sc Applied Mathematics, IIT Roorkee*

Compare in units of $\sqrt{5}$.

- **Common unit:** all three lengths come out as multiples of $\sqrt{5}$, namely $AP = \sqrt{5}$, $AB = 2\sqrt{5}$ and $PB = 3\sqrt{5}$.

- **Read off:** once they share that common factor the relations are easy to compare, and $AP = \frac{1}{2}AB$ is the one that holds.
- **Why it helps:** working in the single surd unit removes the clutter of separate square roots and makes the matching option obvious.

Final Answer: Option **(D)**, $AP = \frac{1}{2}AB$.

Q 7.13 **If $P\left(\frac{a}{3}, 4\right)$ is the mid-point of the line segment joining the points $Q(-6, 5)$ and $R(-2, 3)$, then the value of a is**

(A) -4 **(B)** -12 **(C)** 12 **(D)** -6

SOLUTION

Correct option: (B) -12.

Concept used. The midpoint of QR is $\left(\frac{x_Q+x_R}{2}, \frac{y_Q+y_R}{2}\right)$; set it equal to the given point.

Step 1. Midpoint of $Q(-6, 5)$ and $R(-2, 3)$:

$$\left(\frac{-6+(-2)}{2}, \frac{5+3}{2}\right) = (-4, 4).$$

Step 2. Match the x-coordinate with the given $\frac{a}{3}$:

$$\frac{a}{3} = -4.$$

Step 3. Solve: $a = -4 \times 3 = -12$. (The y-coordinate 4 already matches, which confirms the setup.)

Final Answer: $a = -12$; option **(B)**.

☞ Match coordinate by coordinate

A point equation is really two equations, one for x and one for y. Use the one that contains the unknown (x here), and let the other act as a check.

EXPERT'S SOLUTION *: Kavya Desai, M.Sc Mathematics, Savitribai Phule Pune University*

The y-value is a free check.

- **Midpoint:** averaging the coordinates of Q and R gives the midpoint $(-4, 4)$.
- **Real work:** the given point already shows $y = 4$, matching perfectly, so the only equation left is $\frac{a}{3} = -4$, giving $a = -12$.

- **Reassurance:** that built-in agreement on the y-coordinate tells you no arithmetic slipped before you solved for a.

> **Final Answer:** Option **(B)**, $a = -12$.

Q 7.14 **The perpendicular bisector of the line segment joining the points $A(1, 5)$ and $B(4, 6)$ cuts the y-axis at**

(A) $(0, 13)$ **(B)** $(0, -13)$ **(C)** $(0, 12)$ **(D)** $(13, 0)$

SOLUTION

Correct option: (A) $(0, 13)$.

Concept used. A point on the perpendicular bisector of AB is equidistant from A and B. The point on the y-axis has the form $(0, y)$.

Step 1. Let the required point be $P(0, y)$. Set $PA = PB$, i.e. $PA^2 = PB^2$:

$$(0 - 1)^2 + (y - 5)^2 = (0 - 4)^2 + (y - 6)^2.$$

Step 2. Expand both sides:

$$1 + y^2 - 10y + 25 = 16 + y^2 - 12y + 36.$$

Step 3. Cancel y^2 and simplify:

$$26 - 10y = 52 - 12y$$

$$2y = 26 \Rightarrow y = 13.$$

Step 4. So the point is $(0, 13)$.

> **Final Answer:** The perpendicular bisector meets the y-axis at $(0, 13)$; option **(A)**.

☞ **Why squares are easier**

Using $PA^2 = PB^2$ avoids square roots. The y^2 terms cancel, leaving a simple linear equation in y.

EXPERT'S SOLUTION *: Aditya Bhat, M.Sc Mathematics, NIT Trichy*

Equidistance on the axis.

- **Form:** any point on the y-axis is $(0, y)$, so only one unknown is in play.
- **Linear:** demanding equal distance to A and B drops the y^2 terms, and solving $26 - 10y = 52 - 12y$ gives $y = 13$, so the crossing point is $(0, 13)$.
- **Decoy:** the squared-distance form is the clean route in, and the x-axis option $(13, 0)$ is

a trap because we wanted a point on the y-axis.

Final Answer: Option **(A)**, $(0, 13)$.

Q 7.15 **The coordinates of the point which is equidistant from the three vertices of the $\triangle AOB$ as shown in Fig. 7.1 is**

(A) (x, y) **(B)** (y, x) **(C)** $\left(\frac{x}{2}, \frac{y}{2}\right)$ **(D)** $\left(\frac{y}{2}, \frac{x}{2}\right)$

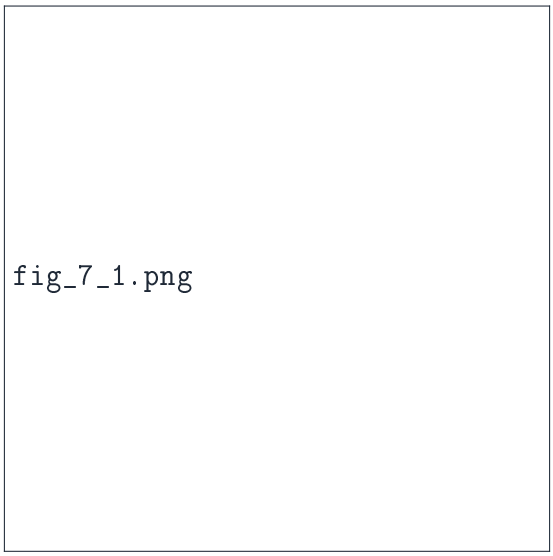


Fig. 7.1: right triangle AOB with $A(0, 2y)$, $O(0, 0)$ and $B(2x, 0)$.

SOLUTION

Correct option: (A) (x, y).

Concept used. For a right triangle, the point equidistant from all three vertices is the **circumcentre**, which is the midpoint of the hypotenuse.

Step 1. From the figure, $A = (0, 2y)$, $O = (0, 0)$ and $B = (2x, 0)$, with the right angle at O.

Step 2. The hypotenuse is AB (the side opposite the right angle).

Step 3. The circumcentre of a right triangle is the midpoint of its hypotenuse:

$$\text{midpoint of } AB = \left(\frac{0 + 2x}{2}, \frac{2y + 0}{2}\right)$$

$$= (x, y).$$

Final Answer: The equidistant point is (x, y); option **(A)**.

☞ Right triangle circumcentre

For a right-angled triangle, the circumcentre is always the midpoint of the hypotenuse, and the hypotenuse is the diameter of the circumcircle.

EXPERT'S SOLUTION *: Ishita Roy, M.Sc Mathematics, Calcutta University*

Hypotenuse midpoint is the centre.

- **Diameter:** with the right angle at O, the hypotenuse AB becomes a diameter of the circle through all three vertices.
- **Centre:** so the midpoint of AB is equidistant from A, O and B, and averaging $A(0, 2y)$ with $B(2x, 0)$ gives (x, y).
- **Why those numbers:** the factor-of-two coordinates in the figure are chosen so the midpoint comes out as the clean (x, y), which is exactly option (A).

Final Answer: Option **(A)**, (x, y).

Q 7.16 **A circle drawn with origin as the centre passes through $\left(\frac{13}{2}, 0\right)$. The point which does not lie in the interior of the circle is**

(A) $\left(\frac{-3}{4}, 1\right)$ **(B)** $\left(2, \frac{7}{3}\right)$ **(C)** $\left(5, \frac{-1}{2}\right)$ **(D)** $\left(-6, \frac{5}{2}\right)$

SOLUTION

Correct option: (D) $\left(-6, \frac{5}{2}\right)$.

Concept used. A point lies *inside* a circle of radius r centred at the origin when its distance from the origin is less than r. Here $r = \frac{13}{2} = 6.5$, so we compare each distance with 6.5.

Step 1. Radius $r = \dfrac{13}{2}$, so $r^2 = \dfrac{169}{4} = 42.25$.

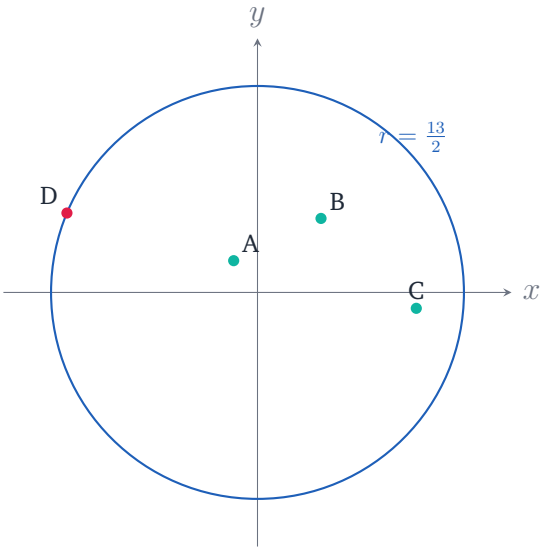
Step 2. Option (A): $\left(\dfrac{3}{4}\right)^2 + 1^2 = \dfrac{9}{16} + 1 = 1.5625 < 42.25$: inside.

Step 3. Option (B): $2^2 + \left(\dfrac{7}{3}\right)^2 = 4 + \dfrac{49}{9} \approx 9.44 < 42.25$: inside.

Step 4. Option (C): $5^2 + \left(\dfrac{1}{2}\right)^2 = 25 + 0.25 = 25.25 < 42.25$: inside.

Step 5. Option (D): $(-6)^2 + \left(\dfrac{5}{2}\right)^2 = 36 + 6.25 = 42.25 = r^2$: the point is *on* the circle, not in the interior.

Final Answer: $\left(-6, \frac{5}{2}\right)$ lies on the circle (distance $= r$), so it is not interior; option **(D)**.



✗ "On" is not "inside"

Distance $= r$ puts a point on the boundary, not in the interior. Only distance $< r$ counts as inside, which is why option (D) is the odd one out.

EXPERT'S SOLUTION *: Nikhil Pandey, M.Sc Applied Mathematics, IIT Indore*

Compare squared distances with r^2.

- **No surds:** squaring keeps everything tidy, with the squared radius at $r^2 = 42.25$.
- **Inside:** three of the points give squared distances well below that (1.56, 9.44 and 25.25), so they sit in the interior.
- **The odd one:** the fourth point gives exactly $36 + 6.25 = 42.25$, equal to r^2, so it rests on the circle, and "interior" needs a strict inequality, which is why it fails.

Final Answer: Option **(D)**, $\left(-6, \frac{5}{2}\right)$.

Q 7.17 **A line intersects the y-axis and x-axis at the points P and Q, respectively. If $(2, -5)$ is the mid-point of PQ, then the coordinates of P and Q are, respectively**

(A) $(0, -5)$ **and** $(2, 0)$ **(B)** $(0, 10)$ **and** $(-4, 0)$

(C) $(0, 4)$ **and** $(-10, 0)$ **(D)** $(0, -10)$ **and** $(4, 0)$

SOLUTION

Correct option: (D) $(0, -10)$ and $(4, 0)$.

Concept used. A point on the y-axis is $(0, b)$ and a point on the x-axis is $(a, 0)$. Their midpoint must equal $(2, -5)$.

Step 1. Write $P = (0, b)$ (on y-axis) and $Q = (a, 0)$ (on x-axis).

Step 2. Midpoint of $PQ = \left(\frac{0+a}{2}, \frac{b+0}{2}\right) = (2, -5)$.

Step 3. Match coordinates:

$$\frac{a}{2} = 2 \Rightarrow a = 4$$

$$\frac{b}{2} = -5 \Rightarrow b = -10.$$

Step 4. So $P = (0, -10)$ and $Q = (4, 0)$.

Final Answer: $P = (0, -10)$, $Q = (4, 0)$; option **(D)**.

☞ **Axis points have a zero**

A y-axis point always reads $(0, \cdot)$ and an x-axis point reads $(\cdot, 0)$. Fix those zeros first, then solve for the rest.

EXPERT'S SOLUTION *: Aishwarya Rao, M.Sc Mathematics, Christ University Bengaluru*

Double the midpoint, place the zeros.

- **Idea:** when one endpoint contributes a zero, each coordinate of the other endpoint is just twice the midpoint's matching coordinate.
- **Apply:** doubling -5 gives the y-axis point $(0, -10)$, and doubling 2 gives the x-axis point $(4, 0)$.
- **Where zeros come from:** each point lies on its own axis, so the answer drops out without solving any equation.

Final Answer: Option **(D)**, $(0, -10)$ and $(4, 0)$.

Q 7.18 **The area of a triangle with vertices $(a, b+c)$, $(b, c+a)$ and $(c, a+b)$ is**

(A) $(a+b+c)^2$ **(B)** 0 **(C)** $a+b+c$ **(D)** abc

SOLUTION

Correct option: (B) 0.

Concept used. Plug the vertices into the area formula. A zero area means the three points are **collinear**.

Step 1. Area $= \frac{1}{2}\,|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$ with the given vertices.

Step 2. Compute each y-difference:

$$y_2 - y_3 = (c + a) - (a + b) = c - b$$

$$y_3 - y_1 = (a + b) - (b + c) = a - c$$

$$y_1 - y_2 = (b + c) - (c + a) = b - a$$

Step 3. Substitute:

$$\text{Area} = \tfrac{1}{2}\,|a(c - b) + b(a - c) + c(b - a)|$$

$$= \tfrac{1}{2}\,|ac - ab + ab - bc + bc - ac|$$

$$= \tfrac{1}{2}\,|0| = 0.$$

Final Answer: The area is 0; the three points are collinear; option **(B)**.

☞ **Watch terms cancel in pairs**

When every product appears once with a $+$ and once with a $-$ (ac, ab, bc here), the sum is 0. That is the signature of collinear points.

EXPERT'S SOLUTION *: Manish Gupta, M.Sc Mathematics, IIT Guwahati*

The symmetric form forces zero.

- **Pattern:** each y-coordinate is the total $a + b + c$ minus the matching x-coordinate.
- **Consequence:** so all three points lie on the single straight line $x + y = a + b + c$, and points on one line bound no area.
- **Insight:** recognising that line explains why the determinant collapses term by term to 0, rather than trusting a brute expansion.

Final Answer: Option **(B)**, 0.

Q 7.19 **If the distance between the points $(4, p)$ and $(1, 0)$ is 5, then the value of p is**
(A) 4 only (B) ± 4 (C) -4 only (D) 0

SOLUTION

Correct option: (B) ± 4.

Concept used. Apply the distance formula, square both sides, and solve the resulting equation for p.

Step 1. Distance formula with the given distance 5:

$$\sqrt{(4-1)^2+(p-0)^2}=5.$$

Step 2. Square both sides:

$$(3)^2+p^2=25$$

$$9+p^2=25.$$

Step 3. Solve:

$$p^2=16$$

$$p=\pm 4.$$

Step 4. Both $p=4$ and $p=-4$ give the distance 5, so both are valid.

Final Answer: $p=\pm 4$; option **(B)**.

✗ Do not drop the negative root

$p^2=16$ has *two* solutions, $+4$ and -4. Keeping only $+4$ would wrongly pick option (A). A squared variable always carries the $\pm$.

EXPERT'S SOLUTION *: Rahul Saxena, M.Sc Mathematics, University of Mumbai*

A square root opens two doors.

- **Setup:** squaring the distance gives $9+p^2=25$, so $p^2=16$.
- **Both roots:** because squaring loses the sign, both $p=4$ and $p=-4$ sit at vertical distance 4 from $(1,0)$ and give the same overall distance 5.
- **Geometry agrees:** one point lies above and one below, each equally far, so the honest answer keeps the $\pm$ sign.

Final Answer: Option **(B)**, ± 4.

Q 7.20 **If the points $A(1,2)$, $O(0,0)$ and $C(a,b)$ are collinear, then**

(A) $a=b$ **(B)** $a=2b$ **(C)** $2a=b$ **(D)** $a=-b$

SOLUTION

Correct option: (C) $2a = b$.

Concept used. Three points are collinear when the area of the triangle they form is 0.

Step 1. Area formula with $A(1, 2)$, $O(0, 0)$, $C(a, b)$:

$$\text{Area} = \tfrac{1}{2}\,|1(0 - b) + 0(b - 2) + a(2 - 0)|.$$

Step 2. Simplify inside:

$$= \tfrac{1}{2}\,|-b + 0 + 2a| = \tfrac{1}{2}\,|2a - b|.$$

Step 3. For collinearity set area $= 0$:

$$|2a - b| = 0 \Rightarrow 2a - b = 0 \Rightarrow 2a = b.$$

Final Answer: The collinearity condition is $2a = b$; option **(C)**.

☞ **Collinear means slope match**

A, O, C are collinear iff the line through O and A (slope $2/1 = 2$) also passes through C, i.e. $b/a = 2$, the same as $2a = b$.

EXPERT'S SOLUTION *: Tanvi Shah, M.Sc Mathematics, St. Stephen's College Delhi*

Slope from the origin is cleanest.

- **Slope:** since O is the origin, the line OA has slope $\frac{2}{1} = 2$.
- **Condition:** so $C(a, b)$ lies on it only when $\frac{b}{a} = 2$, that is $b = 2a$, and the area determinant gives the same $2a - b = 0$.
- **Why simpler:** anchoring on the origin turns the whole collinearity test into a single slope comparison.

Final Answer: Option **(C)**, $2a = b$.

Download the Full chapter resource: the NCERT Solutions for Class 10 Maths Chapter 7 Coordinate Geometry to drill the regular exercises.
https://collegedunia.com/articles/e-1731-ncert-solutions-class-10-maths-chapter-7-coordinate-geometry

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Solved NCERT Exemplar Class 10 Maths Chapter 7, Coordinate Geometry: every question, step by step (2026-27)

Chapter 7: Coordinate Geometry

About this Chapter

Worked solutions to every NCERT Exemplar problem in Class 10 Maths Chapter 7 Coordinate Geometry. You apply the **distance formula**, the **section formula** and the **area of a triangle** to classify shapes, test collinearity and find missing points. All 58 questions are solved, each with an expert view.

Topics covered: Distance formula • Distance from origin and from axes • Section formula (internal division) • Mid-point formula • Ratio of division by an axis or a line • Area of a triangle from vertices • Test for collinear points • Classifying triangles and quadrilaterals • Perpendicular bisector and equidistant points • Centroid and medians

Quick Formula Sheet

Distance formula:
$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Distance from origin:
$OP = \sqrt{x^2 + y^2}$

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

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

Area of a triangle:
$\frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

Also see for this chapter on Collegedunia: NCERT Solutions, Revision Notes, Formula Sheet and the Exemplar Book PDF for Class 10 Maths Chapter 7, Coordinate Geometry.

II. True / False with Reasoning (Exercise 7.2)

Q 7.1 **$\triangle ABC$ with vertices $A(-2, 0)$, $B(2, 0)$ and $C(0, 2)$ is similar to $\triangle DEF$ with vertices $D(-4, 0)$, $E(4, 0)$ and $F(0, 4)$. State true or false and justify.**

SOLUTION

Verdict: True. The two triangles are similar.

Concept used. Two triangles are **similar** if their three pairs of sides are in the same ratio (SSS similarity).

Step 1. Sides of $\triangle ABC$:

$$AB = \sqrt{(2+2)^2 + 0} = 4$$

$$BC = \sqrt{(0-2)^2 + (2-0)^2} = \sqrt{8} = 2\sqrt{2}$$

$$CA = \sqrt{(-2-0)^2 + (0-2)^2} = \sqrt{8} = 2\sqrt{2}.$$

Step 2. Sides of $\triangle DEF$:

$$DE = \sqrt{(4+4)^2 + 0} = 8$$

$$EF = \sqrt{(0-4)^2 + (4-0)^2} = \sqrt{32} = 4\sqrt{2}$$

$$FD = \sqrt{(-4-0)^2 + (0-4)^2} = \sqrt{32} = 4\sqrt{2}.$$

Step 3. Form the ratios:

$$\frac{DE}{AB} = \frac{8}{4} = 2, \quad \frac{EF}{BC} = \frac{4\sqrt{2}}{2\sqrt{2}} = 2, \quad \frac{FD}{CA} = \frac{4\sqrt{2}}{2\sqrt{2}} = 2.$$

Step 4. All three ratios equal 2, so by SSS the triangles are similar.

> **Final Answer:** True: all three pairs of sides are in the ratio $1 : 2$, so $\triangle ABC \sim \triangle DEF$.

☞ Similarity needs all ratios equal

Similar triangles need every pair of corresponding sides in the same ratio. One matching ratio is not enough; check all three.

EXPERT'S SOLUTION *: Sanjana Kapoor, M.Sc Mathematics, Jamia Millia Islamia*

$\triangle DEF$ is $\triangle ABC$ doubled.

- **Scaling:** each vertex of the second triangle is the first one pushed out from the origin by a factor of two, for instance $A(-2, 0)$ becomes $D(-4, 0)$.
- **Why similar:** a uniform scaling from a single point always produces a similar figure, so every side ratio equals two and the similarity is immediate.
- **Role of the surds:** the distance computations only confirm this enlargement, so you do not really need them once you spot the clean doubling of every vertex.

> **Final Answer:** True; the scale factor is 2 throughout.

Q 7.2 **Point $P(-4, 2)$ lies on the line segment joining the points $A(-4, 6)$ and $B(-4, -6)$. State true or false and justify.**

SOLUTION

Verdict: True. $P(-4, 2)$ lies on the segment AB.

Concept used. Points with the same x-coordinate all lie on a single vertical line; a point is on the segment if its y-value lies between the endpoints' y-values.

Step 1. All three points have $x = -4$, so they sit on the vertical line $x = -4$.

Step 2. The endpoints have $y = 6$ and $y = -6$, so the segment covers every y from -6 up to 6.

Step 3. P has $y = 2$, and $-6 \leq 2 \leq 6$, so P falls inside that range.

Step 4. Hence $P(-4, 2)$ lies on the segment AB.

Final Answer: True: A, P, B all lie on $x = -4$, and P's height 2 is between -6 and 6.

☞ **Same x means vertical line**

If several points share one x-value, they line up vertically. Then it is only the y-values that decide order and "betweenness".

EXPERT'S SOLUTION *: Devendra Naik, M.Sc Mathematics, NIT Surathkal*

One coordinate test is enough here.

- **Same line:** the shared first coordinate pins all three points to one vertical line, so they are automatically collinear and no area or slope work is needed.
- **Between the ends:** the only thing left to decide is whether P lies between the two endpoints, and its height of two sits comfortably inside the range from the lower end up to the upper end.
- **Verdict:** since P is on the line and inside that range, it is a genuine interior point of the segment, which makes the statement true.

Final Answer: True; P is on the vertical line $x = -4$ between A and B.

Q 7.3 **The points $(0, 5)$, $(0, -9)$ and $(3, 6)$ are collinear. State true or false and justify.**

SOLUTION

Verdict: False. The three points are not collinear.
Concept used. Points are collinear only if the triangle they form has area 0. Equivalently, if two points lie on the y-axis and a third does not, they cannot be collinear.

Step 1. $(0, 5)$ and $(0, -9)$ both have $x = 0$, so they lie on the y-axis (the line $x = 0$).

Step 2. For all three to be collinear, the third point would also need $x = 0$.

Step 3. But $(3, 6)$ has $x = 3 \neq 0$, so it lies off the y-axis.

Step 4. Hence the three points are not collinear. (Check: area $= \frac{1}{2}|0(-9-6) + 0(6-5) + 3(5+9)| = \frac{1}{2} \times 42 = 21 \neq 0$.)

Final Answer: False: two points lie on the y-axis but $(3, 6)$ does not, and the triangle's area is $21 \neq 0$.

✗ A non-zero area means not collinear

If the area formula gives anything other than 0, the points form a genuine triangle and are not collinear. Here the area is 21.

EXPERT'S SOLUTION *: Ritika Malhotra, M.Sc Mathematics, Panjab University*

Two on an axis, one off it.

- **Their line:** the first two points both live on the vertical axis, so the only straight line that can pass through both of them is that axis itself.
- **The stray point:** the third point sits three units to the right of the axis, so it misses that line completely, and the three of them simply cannot be collinear.
- **Number check:** the area determinant backs up the picture with a clear value of twenty-one square units, which is far from the zero that collinear points would need.

Final Answer: False; $(3, 6)$ is off the y-axis that holds the other two.

Q 7.4 **Point $P(0, 2)$ is the point of intersection of the y-axis and the perpendicular bisector of the line segment joining the points $A(-1, 1)$ and $B(3, 3)$. State true or false and justify.**

SOLUTION

Verdict: False. $P(0,2)$ is not on the perpendicular bisector.
Concept used. A point lies on the perpendicular bisector of AB only when it is equidistant from A and B. Test $PA = PB$.

Step 1. Distance PA from $P(0,2)$ to $A(-1,1)$:

$$PA = \sqrt{(0+1)^2 + (2-1)^2} = \sqrt{1+1} = \sqrt{2}.$$

Step 2. Distance PB from $P(0,2)$ to $B(3,3)$:

$$PB = \sqrt{(0-3)^2 + (2-3)^2} = \sqrt{9+1} = \sqrt{10}.$$

Step 3. Since $PA = \sqrt{2} \neq \sqrt{10} = PB$, the point is not equidistant.

Step 4. Therefore $P(0,2)$ does not lie on the perpendicular bisector of AB.

> **Final Answer:** False: $PA = \sqrt{2}$ but $PB = \sqrt{10}$, so P is not equidistant from A and B.

✗ Test equidistance, not just "on the axis"

P being on the y-axis is not enough. The perpendicular bisector demands $PA = PB$, and that fails here.

EXPERT'S SOLUTION *: Gaurav Sharma, M.Sc Applied Mathematics, IIT Ropar*

Compare the two distances directly.

- **Definition:** the perpendicular bisector is exactly the set of points that are equally far from A and from B.
- **The numbers:** from the given point the two distances come out as $\sqrt{2}$ and $\sqrt{10}$, which are plainly unequal, so the point does not lie on the bisector.
- **Shortcut:** there is no need to derive the bisector's equation, since a single pair of distance checks already settles the claim as false.

> **Final Answer:** False; $PA \neq PB$.

Q 7.5 **Points $A(3,1)$, $B(12,-2)$ and $C(0,2)$ cannot be the vertices of a triangle. State true or false and justify.**

SOLUTION

Verdict: True. These points cannot form a triangle.
Concept used. Three points form a triangle only if their area is non-zero. If the area is 0, they are collinear and no triangle exists.

Step 1. Area $= \frac{1}{2}\,|x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)|$ with $A(3,1)$, $B(12,-2)$, $C(0,2)$.

Step 2. Substitute:

$$= \tfrac{1}{2}\,|3(-2-2)+12(2-1)+0(1-(-2))|$$
$$= \tfrac{1}{2}\,|3(-4)+12(1)+0|$$
$$= \tfrac{1}{2}\,|-12+12| = \tfrac{1}{2}\times 0 = 0.$$

Step 3. The area is 0, so A, B, C are collinear and cannot be a triangle.

> **Final Answer:** True: the area is 0, so the points are collinear and cannot be vertices of a triangle.

☞ **Triangle test = non-zero area**

"Can these be a triangle?" is the same as asking "is the area non-zero?". A zero area is the red flag for collinear points.

EXPERT'S SOLUTION *: Lakshmi Pillai, M.Sc Mathematics, University of Calicut*

The area collapses to zero.

- **Determinant:** plugging the three points into the area formula leaves $-12+12=0$ inside the bars, so the enclosed area vanishes.
- **Geometry:** the points therefore share one straight line, which leaves no region at all to call a triangle.
- **Slope check:** the step $A \to B$ has slope $-\frac{1}{3}$ and so does $A \to C$, confirming that the three points line up.

> **Final Answer:** True; the three points are collinear.

Q 7.6 **Points $A(4,3)$, $B(6,4)$, $C(5,-6)$ and $D(-3,5)$ are the vertices of a parallelogram. State true or false and justify.**

SOLUTION

Verdict: False. These points do not form a parallelogram.

Concept used. A quadrilateral $ABCD$ is a parallelogram exactly when its diagonals AC and BD bisect each other, i.e. they share the same midpoint.

Step 1. Midpoint of diagonal AC ($A(4,3)$, $C(5,-6)$):

$$\left(\frac{4+5}{2}, \frac{3-6}{2}\right) = \left(\frac{9}{2}, -\frac{3}{2}\right).$$

Step 2. Midpoint of diagonal BD ($B(6,4)$, $D(-3,5)$):

$$\left(\frac{6-3}{2}, \frac{4+5}{2}\right) = \left(\frac{3}{2}, \frac{9}{2}\right).$$

Step 3. The two midpoints $\left(\frac{9}{2}, -\frac{3}{2}\right)$ and $\left(\frac{3}{2}, \frac{9}{2}\right)$ are different.

Step 4. Since the diagonals do not bisect each other, $ABCD$ is not a parallelogram.

> **Final Answer:** False: midpoint of $AC = \left(\frac{9}{2}, -\frac{3}{2}\right)$ but midpoint of $BD = \left(\frac{3}{2}, \frac{9}{2}\right)$, so the diagonals do not bisect each other.

☞ **Diagonals of a parallelogram**

The defining test by coordinates: a parallelogram's diagonals cross at their common midpoint. Different midpoints rule it out at once.

EXPERT'S SOLUTION *: Abhishek Jain, M.Sc Mathematics, Delhi Technological University*

One midpoint pair decides it.

- **Rule:** for a parallelogram the two diagonals must meet at a single shared centre, so their midpoints have to agree.
- **Here:** the centre of one diagonal is $\left(\frac{9}{2}, -\frac{3}{2}\right)$ while the centre of the other is $\left(\frac{3}{2}, \frac{9}{2}\right)$, two entirely different points.
- **Verdict:** because those centres disagree the figure cannot be a parallelogram, and no further side computation is needed to rule it out.

> **Final Answer:** False; the diagonals have different midpoints.

Q 7.7 **A circle has its centre at the origin and a point $P(5,0)$ lies on it. The point $Q(6,8)$ lies outside the circle. State true or false and justify.**

SOLUTION

Verdict: True. $Q(6, 8)$ lies outside the circle.
Concept used. A point lies outside a circle when its distance from the centre is greater than the radius.

Step 1. Radius = distance from origin to $P(5, 0)$:

$$r = \sqrt{5^2 + 0^2} = 5.$$

Step 2. Distance from origin to $Q(6, 8)$:

$$OQ = \sqrt{6^2 + 8^2} = \sqrt{36 + 64} = \sqrt{100} = 10.$$

Step 3. Compare: $OQ = 10 > 5 = r$.

Step 4. Since the distance exceeds the radius, Q lies outside the circle.

> **Final Answer:** True: radius $= 5$ but $OQ = 10 > 5$, so Q is outside the circle.

☞ Inside, on, or outside

Compare distance d with radius r: $d < r$ inside, $d = r$ on the circle, $d > r$ outside. Here $10 > 5$, so outside.

EXPERT'S SOLUTION *: Sunita Rao, M.Sc Mathematics, Osmania University*

Radius first, then the point.

- **Radius:** the point on the circle fixes the radius at five units straight away.
- **The query point:** the point being tested sits a clean ten units from the origin, another 6-8-10 triple, which is double the radius.
- **Verdict:** being twice as far out as the boundary puts it firmly outside the circle, so the statement holds true.

> **Final Answer:** True; $OQ = 10$ is greater than the radius 5.

Q 7.8 **The point $A(2, 7)$ lies on the perpendicular bisector of the line segment joining the points $P(6, 5)$ and $Q(0, -4)$. State true or false and justify.**

SOLUTION

Verdict: False. $A(2, 7)$ is not on the perpendicular bisector.
Concept used. The perpendicular bisector of PQ holds exactly the points equidistant

from P and Q. Test $AP = AQ$.

Step 1. Distance AP from $A(2, 7)$ to $P(6, 5)$:

$$AP = \sqrt{(2-6)^2 + (7-5)^2} = \sqrt{16+4} = \sqrt{20} = 2\sqrt{5}.$$

Step 2. Distance AQ from $A(2, 7)$ to $Q(0, -4)$:

$$AQ = \sqrt{(2-0)^2 + (7+4)^2} = \sqrt{4+121} = \sqrt{125} = 5\sqrt{5}.$$

Step 3. Compare: $AP = 2\sqrt{5} \neq 5\sqrt{5} = AQ$.

Step 4. Since A is not equidistant from P and Q, it does not lie on the perpendicular bisector.

Final Answer: False: $AP = 2\sqrt{5}$ but $AQ = 5\sqrt{5}$, so A is not on the perpendicular bisector of PQ.

✗ Equidistance is the whole test

The perpendicular bisector is defined by $AP = AQ$. Once the two distances come out unequal, the point is off the bisector, no matter how neat its coordinates look.

EXPERT'S SOLUTION *: Pranav Kulkarni, M.Sc Mathematics, IIT Gandhinagar*

Both distances are multiples of $\sqrt{5}$.

- **Compute:** the two distances come out as $2\sqrt{5}$ and $5\sqrt{5}$, both built on the same surd.
- **Mismatch:** sharing that common unit makes the gap obvious at a glance, two against five, so the distances are clearly unequal.
- **Verdict:** unequal distances put the point off the perpendicular bisector, so the claim is false, and the common surd unit again exposes the comparison cleanly.

Final Answer: False; $AP \neq AQ$.

Q 7.9 **Point $P(5, -3)$ is one of the two points of trisection of the line segment joining the points $A(7, -2)$ and $B(1, -5)$. State true or false and justify.**

SOLUTION

Verdict: True. $P(5, -3)$ is a point of trisection of AB.
Concept used. The points of **trisection** divide AB in the ratios $1 : 2$ and $2 : 1$. Use the section formula to test $1 : 2$.

Step 1. Section formula with ratio $1:2$, $A(7,-2)$, $B(1,-5)$:

$$x = \frac{1\cdot 1 + 2\cdot 7}{1+2} = \frac{1+14}{3} = \frac{15}{3} = 5$$

$$y = \frac{1\cdot(-5) + 2\cdot(-2)}{1+2} = \frac{-5-4}{3} = \frac{-9}{3} = -3.$$

Step 2. This gives the point $(5,-3)$, which is exactly P.

Step 3. So P divides AB in the ratio $1:2$, making it a trisection point.

Final Answer: True: dividing AB in the ratio $1:2$ gives $(5,-3) = P$, a trisection point.

☞ **Trisection ratios**

The two trisection points split a segment as $1:2$ and $2:1$. Try the $1:2$ ratio first, then $2:1$ if needed.

EXPERT'S SOLUTION *: Neha Bansal, M.Sc Mathematics, Kurukshetra University*

The $1:2$ split lands on P.

- **Meaning:** trisection cuts the segment into three equal parts, so the two dividing ratios are $1:2$ and $2:1$.
- **Test:** feeding the $1:2$ ratio into the section formula reproduces the point $(5,-3)$ exactly, which is the given P.
- **Verdict:** since P matches a trisection point the claim is true, and the other trisection point would come from the $2:1$ ratio instead.

Final Answer: True; P divides AB as $1:2$.

Q 7.10 **Points $A(-6,10)$, $B(-4,6)$ and $C(3,-8)$ are collinear such that $AB = \frac{2}{9}AC$. State true or false and justify.**

SOLUTION

Verdict: True. The points are collinear and $AB = \frac{2}{9}AC$.
Concept used. Use the distance formula for AB and AC; if B lies on segment AC and the lengths fit, the relation holds.

Step 1. Distance AB:

$$AB = \sqrt{(-4+6)^2 + (6-10)^2} = \sqrt{4+16} = \sqrt{20} = 2\sqrt{5}.$$

Step 2. Distance AC:

$$AC = \sqrt{(3+6)^2 + (-8-10)^2} = \sqrt{81+324} = \sqrt{405} = 9\sqrt{5}.$$

Step 3. Form the ratio:

$$\frac{AB}{AC} = \frac{2\sqrt{5}}{9\sqrt{5}} = \frac{2}{9}, \text{ so } AB = \frac{2}{9}AC.$$

Step 4. Collinearity: $AB + BC$ should equal AC. Here $BC = \sqrt{(3+4)^2 + (-8-6)^2} = \sqrt{49+196} = 7\sqrt{5}$, and $2\sqrt{5} + 7\sqrt{5} = 9\sqrt{5} = AC$, so A, B, C are collinear.

Final Answer: True: $AB = 2\sqrt{5}$, $AC = 9\sqrt{5}$, so $AB = \frac{2}{9}AC$, and $AB + BC = AC$ confirms collinearity.

☞ **Length test for collinearity**

If B is on segment AC, then $AB + BC = AC$. Equal lengths in the same $\sqrt{5}$ unit make this easy to verify.

EXPERT'S SOLUTION *: Yash Patel, M.Sc Applied Mathematics, SVNIT Surat*

Everything sits in $\sqrt{5}$ units.

- **Three lengths:** the distances are $2\sqrt{5}$, $7\sqrt{5}$ and $9\sqrt{5}$, all multiples of the same surd.
- **Between:** their parts add as two plus seven equals nine, which shows B lies between A and C, so the points are collinear.
- **The ratio:** the shorter to the whole is two to nine, giving $AB = \frac{2}{9}AC$ directly, so both halves of the statement check out and it is true.

Final Answer: True; $AB = \frac{2}{9}AC$ and $AB + BC = AC$.

Q 7.11 **The point $P(-2, 4)$ lies on a circle of radius 6 and centre $C(3, 5)$. State true or false and justify.**

SOLUTION

Verdict: False. $P(-2, 4)$ does not lie on the circle.
Concept used. A point lies on a circle only if its distance from the centre equals the radius.

Step 1. Distance CP from centre $C(3,5)$ to $P(-2,4)$:

$$CP = \sqrt{(-2-3)^2 + (4-5)^2}$$
$$= \sqrt{(-5)^2 + (-1)^2}$$
$$= \sqrt{25+1} = \sqrt{26}.$$

Step 2. Compare with the radius 6: $\sqrt{26} \approx 5.1$, and $6 = \sqrt{36}$.

Step 3. Since $\sqrt{26} \neq \sqrt{36}$, the distance is not equal to the radius (in fact $CP < 6$, so P lies inside).

Final Answer: False: $CP = \sqrt{26} \neq 6$, so P is not on the circle (it lies inside it).

✗ Less than the radius means inside

$\sqrt{26} < 6$, so P is not on the boundary but tucked inside the circle. "On the circle" needs exact equality with the radius.

EXPERT'S SOLUTION *: Anjali Nambiar, M.Sc Mathematics, Cochin University of Science and Technology*

Square both to compare cleanly.

- **The squares:** the squared distance from the centre is $25 + 1 = 26$, while the squared radius is 36.
- **Comparison:** since twenty-six is less than thirty-six, the point is closer to the centre than the boundary, so it lies inside rather than on the circle.
- **Why squares:** comparing the squared values avoids approximating the awkward $\sqrt{26}$ and still gives the verdict at a glance.

Final Answer: False; $CP = \sqrt{26}$, less than the radius 6.

Q 7.12 **The points $A(-1,-2)$, $B(4,3)$, $C(2,5)$ and $D(-3,0)$ in that order form a rectangle. State true or false and justify.**

SOLUTION

Verdict: True. The points form a rectangle.
Concept used. A quadrilateral is a rectangle if its diagonals are equal and bisect each other. Check both midpoints and both diagonal lengths.

Step 1. Midpoint of diagonal AC ($A(-1,-2)$, $C(2,5)$):

$$\left(\frac{-1+2}{2}, \frac{-2+5}{2}\right) = \left(\frac{1}{2}, \frac{3}{2}\right).$$

Step 2. Midpoint of diagonal BD ($B(4,3)$, $D(-3,0)$):

$$\left(\frac{4-3}{2}, \frac{3+0}{2}\right) = \left(\frac{1}{2}, \frac{3}{2}\right).$$

Step 3. The midpoints match, so the diagonals bisect each other (it is at least a parallelogram).

Step 4. Diagonal lengths:

$$AC = \sqrt{(2+1)^2 + (5+2)^2} = \sqrt{9+49} = \sqrt{58}$$

$$BD = \sqrt{(-3-4)^2 + (0-3)^2} = \sqrt{49+9} = \sqrt{58}.$$

Step 5. Equal diagonals plus common midpoint mean a rectangle.

> **Final Answer:** True: both diagonals have midpoint $\left(\frac{1}{2}, \frac{3}{2}\right)$ and equal length $\sqrt{58}$, so $ABCD$ is a rectangle.

☞ Rectangle from coordinates

A rectangle test: diagonals equal *and* bisecting each other. Equal alone gives only "isosceles trapezium or rectangle"; the shared midpoint clinches it.

EXPERT'S SOLUTION *: Rohit Chauhan, M.Sc Mathematics, HNB Garhwal University*

Two conditions, both met.

- **Shared centre:** the diagonals share the midpoint $\left(\frac{1}{2}, \frac{3}{2}\right)$, which already makes the figure a parallelogram.
- **Equal length:** they are also of equal length $\sqrt{58}$, and a parallelogram with equal diagonals must have right angles, so it upgrades to a rectangle.
- **Why this route:** checking one midpoint and the two diagonal lengths is the quickest coordinate path to confirming a rectangle.

> **Final Answer:** True; equal, mutually bisecting diagonals.

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NCERT Exemplar Solutions

Solved NCERT Exemplar Class 10 Maths Chapter 7, Coordinate Geometry: every question, step by step (2026-27)

Chapter 7: Coordinate Geometry

About this Chapter

Worked solutions to every NCERT Exemplar problem in Class 10 Maths Chapter 7 Coordinate Geometry. You apply the **distance formula**, the **section formula** and the **area of a triangle** to classify shapes, test collinearity and find missing points. All 58 questions are solved, each with an expert view.

Topics covered: Distance formula • Distance from origin and from axes • Section formula (internal division) • Midpoint formula • Ratio of division by an axis or a line • Area of a triangle from vertices • Test for collinear points • Classifying triangles and quadrilaterals • Perpendicular bisector and equidistant points • Centroid and medians

Quick Formula Sheet

Distance formula:

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

Distance from origin:

$OP = \sqrt{x^2 + y^2}$

Section formula (ratio $m_1 : m_2$):

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

Midpoint:

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

Area of a triangle:

$\frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

Also see for this chapter on Collegedunia: NCERT Solutions, Revision Notes, Formula Sheet and the Exemplar Book PDF for Class 10 Maths Chapter 7, Coordinate Geometry.

III. Short Answer Questions (Exercise 7.3)

Q 7.1 **Name the type of triangle formed by the points $A(-5, 6)$, $B(-4, -2)$ and $C(7, 5)$.**

SOLUTION

Concept used. Compute the three side lengths with the distance formula and compare them: all different means **scalene**.

Step 1. $AB = \sqrt{(-4+5)^2 + (-2-6)^2} = \sqrt{1+64} = \sqrt{65}$.

Step 2. $BC = \sqrt{(7+4)^2 + (5+2)^2} = \sqrt{121+49} = \sqrt{170}$.

Step 3. $CA = \sqrt{(-5-7)^2 + (6-5)^2} = \sqrt{144+1} = \sqrt{145}$.

Step 4. All three lengths $\sqrt{65}$, $\sqrt{170}$, $\sqrt{145}$ are different, so no two sides are equal.

> **Final Answer:** The triangle is **scalene** (all sides unequal: $\sqrt{65}$, $\sqrt{170}$, $\sqrt{145}$).

☞ **Classify by counting equal sides**

Three equal sides: equilateral. Exactly two equal: isosceles. None equal: scalene. Compare the squared lengths to skip the surds.

EXPERT'S SOLUTION *: Sneha Pillai, M.Sc Mathematics, University of Madras*

Compare squared lengths.

- **Skip the surds:** working with the squared side lengths 65, 170 and 145 avoids square roots entirely.
- **All distinct:** those three values are clearly different, and distinct sides mean a scalene triangle.
- **Bonus check:** a right-angle test is worth a glance too, since $65 + 145 = 210 \neq 170$, so the triangle is not right angled, just plainly scalene.

> **Final Answer:** Scalene triangle.

Q 7.2 **Find the points on the x-axis which are at a distance of $2\sqrt{5}$ from the point $(7, -4)$. How many such points are there?**

SOLUTION

Concept used. A point on the x-axis has the form $(x, 0)$. Set its distance from $(7, -4)$ equal to $2\sqrt{5}$ and solve.

Step 1. Let the point be $P(x, 0)$. Distance condition:

$$\sqrt{(x-7)^2 + (0+4)^2} = 2\sqrt{5}.$$

Step 2. Square both sides:

$$(x-7)^2 + 16 = 20$$

$$(x-7)^2 = 4.$$

Step 3. Take square roots:

$x - 7 = \pm 2$, so $x = 9$ or $x = 5$.

Step 4. The points are $(9, 0)$ and $(5, 0)$, so there are 2 such points.

Final Answer: The points are $(9, 0)$ and $(5, 0)$; there are **two** such points.

☞ **Why two answers**

$(x-7)^2 = 4$ gives $x - 7 = +2$ and $x - 7 = -2$. The two roots are the points on either side of $x = 7$ along the axis.

EXPERT'S SOLUTION *: Varun Khanna, M.Sc Mathematics, IIT Bhubaneswar*

Set $y = 0$, then solve the square.

- **Fix the height:** any point on the x-axis is $(x, 0)$, so the vertical gap to $(7, -4)$ is locked at four.
- **Solve:** squaring the distance leaves $(x-7)^2 = 20 - 16 = 4$, which has the two roots $x = 9$ and $x = 5$.
- **Geometry:** a circle of the given radius about $(7, -4)$ cuts the x-axis in two places, which matches the two solutions you found.

Final Answer: $(9, 0)$ and $(5, 0)$; two points.

Q 7.3 **What type of a quadrilateral do the points $A(2, -2)$, $B(7, 3)$, $C(11, -1)$ and $D(6, -6)$, taken in that order, form?**

SOLUTION

Concept used. Compute all four sides and both diagonals. Equal sides with unequal diagonals point to a rhombus; if all four sides are equal it is a rhombus (a square needs equal diagonals too).

Step 1. Sides:

$$AB = \sqrt{(7-2)^2 + (3+2)^2} = \sqrt{25 + 25} = \sqrt{50}$$

$$BC = \sqrt{(11-7)^2 + (-1-3)^2} = \sqrt{16+16} = \sqrt{32}$$
$$CD = \sqrt{(6-11)^2 + (-6+1)^2} = \sqrt{25+25} = \sqrt{50}$$
$$DA = \sqrt{(2-6)^2 + (-2+6)^2} = \sqrt{16+16} = \sqrt{32}.$$

Step 2. Opposite sides are equal ($AB = CD = \sqrt{50}$, $BC = DA = \sqrt{32}$), so it is a parallelogram.

Step 3. Diagonals:

$$AC = \sqrt{(11-2)^2 + (-1+2)^2} = \sqrt{81+1} = \sqrt{82}$$
$$BD = \sqrt{(6-7)^2 + (-6-3)^2} = \sqrt{1+81} = \sqrt{82}.$$

Step 4. Opposite sides equal and diagonals equal, with adjacent sides unequal ($\sqrt{50} \neq \sqrt{32}$): this is a **rectangle**.

Final Answer: $ABCD$ is a **rectangle**: opposite sides equal and equal diagonals $\sqrt{82}$, but adjacent sides unequal.

☞ **Sort by sides then diagonals**

Equal opposite sides give a parallelogram. Then equal diagonals lift it to a rectangle; equal adjacent sides would make it a rhombus; both together make it a square.

EXPERT'S SOLUTION *: Megha Iyer, M.Sc Mathematics, PSG College of Technology*

Two pairs of equal sides, two equal diagonals.

- **Opposite sides:** the matching pairs $\sqrt{50}$ and $\sqrt{32}$ tell you straight away that the figure is at least a parallelogram.
- **Diagonals:** both come out equal at $\sqrt{82}$, and equal diagonals in a parallelogram force the corners to be right angles, which lifts it to a rectangle.
- **Not a square:** the adjacent sides differ in length, so the shape is a rectangle and never a square, which would need all four sides the same.
- **Order matters:** keep the vertices in the listed order A, B, C, D so that you pair genuine sides with sides and genuine diagonals with diagonals, not a mix of the two.

Final Answer: Rectangle.

Q 7.4 **Find the value of a, if the distance between the points $A(-3, -14)$ and $B(a, -5)$ is 9 units.**

SOLUTION

Concept used. Apply the distance formula, square both sides, and solve for a.

Step 1. Distance condition:

$$\sqrt{(a+3)^2+(-5+14)^2}=9.$$

Step 2. Square both sides:

$$(a+3)^2+9^2=81$$

$$(a+3)^2+81=81.$$

Step 3. Simplify:

$(a+3)^2=0$, so $a+3=0$, giving $a=-3$.

Final Answer: $a=-3$.

☞ **A zero square gives one answer**

$(a+3)^2=0$ has the single root $a=-3$. Here the points lie on the vertical line $x=-3$, and the whole distance comes from the y-gap of 9.

EXPERT'S SOLUTION *: Aman Tiwari, M.Sc Mathematics, Banaras Hindu University*

The vertical gap is already the full distance.

- **Spot it:** the difference between the two heights is exactly nine, which is the whole distance the question demands.
- **Consequence:** if the vertical part alone uses up the entire length, then the horizontal part must contribute nothing at all.
- **Solve:** that zero horizontal gap means $a+3=0$, so $a=-3$, with no algebra beyond reading the coordinates.
- **Single answer:** because the points end up stacked on the line $x=-3$, only one value of a works, unlike the usual two-root distance problems.

Final Answer: $a=-3$.

Q 7.5 **Find a point which is equidistant from the points $A(-5,4)$ and $B(-1,6)$. How many such points are there?**

SOLUTION

Concept used. A natural equidistant point is the **midpoint** of AB. Every point on the perpendicular bisector of AB is also equidistant, so there are infinitely many.

Step 1. Midpoint of $A(-5, 4)$ and $B(-1, 6)$:

$$\left(\frac{-5+(-1)}{2}, \frac{4+6}{2}\right)$$

$$= \left(\frac{-6}{2}, \frac{10}{2}\right) = (-3, 5).$$

Step 2. Check: from $(-3, 5)$, $\sqrt{(-3+5)^2+(5-4)^2} = \sqrt{4+1} = \sqrt{5}$ and $\sqrt{(-3+1)^2+(5-6)^2} = \sqrt{4+1} = \sqrt{5}$, equal.

Step 3. Every point on the perpendicular bisector of AB is equidistant from A and B, so infinitely many such points exist.

Final Answer: $(-3, 5)$ (the midpoint of AB) is one such point; there are **infinitely many**, all on the perpendicular bisector of AB.

☞ **One asked, infinitely many exist**

The midpoint is the easiest equidistant point to name, but the question "how many" wants the full set: the whole perpendicular bisector.

EXPERT'S SOLUTION : *Shruti Deshpande, M.Sc Applied Mathematics, COEP Pune*

Name one point, then count the whole line.

- **Easy sample:** the midpoint of the segment is the quickest equidistant point to write down, and here it works out to $(-3, 5)$.
- **Verify:** a quick distance check confirms it, since the gap to each given point is the same value $\sqrt{5}$, so the midpoint really does qualify.
- **The full set:** being the same distance from two points actually defines an entire straight line, the perpendicular bisector of the segment, not just a single spot.
- **Two-part answer:** so the honest reply names one concrete sample point and then states that infinitely many such points lie along that bisector.

Final Answer: $(-3, 5)$; infinitely many such points.

Q 7.6 **Find the coordinates of the point Q on the x-axis which lies on the perpendicular bisector of the line segment joining the points $A(-5, -2)$ and $B(4, -2)$. Name the**

type of triangle formed by the points Q, A and B.

SOLUTION

Concept used. A point on the perpendicular bisector of AB is equidistant from A and B. Since A and B share $y = -2$, the perpendicular bisector is the vertical line through their midpoint.

Step 1. Midpoint of $A(-5, -2)$ and $B(4, -2)$:

$$\left(\frac{-5+4}{2}, \frac{-2-2}{2}\right) = \left(-\frac{1}{2}, -2\right).$$

Step 2. AB is horizontal ($y = -2$), so its perpendicular bisector is the vertical line $x = -\frac{1}{2}$.

Step 3. The point Q on the x-axis has $y = 0$ and must satisfy $x = -\frac{1}{2}$, so $Q = \left(-\frac{1}{2}, 0\right)$.

Step 4. Check the side lengths of $\triangle QAB$:

$$QA = \sqrt{\left(-\tfrac{1}{2}+5\right)^2 + (0+2)^2} = \sqrt{\tfrac{81}{4} + 4} = \sqrt{\tfrac{97}{4}}$$

$$QB = \sqrt{\left(-\tfrac{1}{2}-4\right)^2 + (0+2)^2} = \sqrt{\tfrac{81}{4} + 4} = \sqrt{\tfrac{97}{4}}.$$

Step 5. Since $QA = QB$ (and $AB = 9$ differs), $\triangle QAB$ is isosceles.

Final Answer: $Q = \left(-\frac{1}{2}, 0\right)$, and $\triangle QAB$ is an **isosceles** triangle ($QA = QB = \sqrt{\frac{97}{4}}$).

☞ Horizontal segment, vertical bisector

If A and B have the same y, segment AB is horizontal, so its perpendicular bisector is the vertical line $x =$ (midpoint x).

EXPERT'S SOLUTION *: Kunal Mehta, M.Sc Mathematics, IIT Mandi*

A flat segment has an upright bisector.

- **Why vertical:** the two points sit at the same height, so the segment joining them is horizontal and its perpendicular bisector must stand straight up.
- **Its position:** that upright line passes through the midpoint, so it is the line $x = -\frac{1}{2}$, fixed by the shared midpoint of the two points.
- **Find Q:** where this line meets the horizontal axis the height is zero, which pins the required point at $\left(-\frac{1}{2}, 0\right)$.
- **Triangle type:** any point on a bisector is equally far from the two ends, so the new point gives a triangle with two equal sides, namely an isosceles one.

Final Answer: $Q = \left(-\frac{1}{2}, 0\right)$; isosceles triangle.

Q 7.7 **Find the value of m if the points $(5, 1)$, $(-2, -3)$ and $(8, 2m)$ are collinear.**

SOLUTION

Concept used. Three points are collinear when the area of their triangle is 0. Set the area expression to zero and solve for m.

Step 1. Area $= \frac{1}{2}\left|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right| = 0$ with $(5, 1)$, $(-2, -3)$, $(8, 2m)$.

Step 2. Substitute and drop the $\frac{1}{2}$ (area $= 0$ means the bracket $= 0$):

$$5(-3 - 2m) + (-2)(2m - 1) + 8(1 - (-3)) = 0.$$

Step 3. Expand:

$$-15 - 10m - 4m + 2 + 32 = 0.$$

Step 4. Combine like terms:

$$19 - 14m = 0.$$

Step 5. Solve:

$$m = \frac{19}{14}.$$

Final Answer: $m = \dfrac{19}{14}$.

✗ Mind the sign on $(y_3 - y_1)$

The middle term is $-2\,(2m - 1) = -4m + 2$. Forgetting the bracket's minus sign is the usual slip; expand carefully before collecting.

EXPERT'S SOLUTION *: Pallavi Reddy, M.Sc Mathematics, University of Pune*

Zero area gives one clean linear equation.

- **Why zero:** collinear points enclose no triangle, so the area bracket must vanish, which turns the area formula into an equation you can solve.
- **Solve:** substituting the points and tidying leaves $19 - 14m = 0$, a single linear equation that gives $m = \frac{19}{14}$ at once.
- **Slope check:** the line through the two fixed points has slope $\frac{4}{7}$, and forcing the third

point to share that slope reproduces the very same value of m.

- **Takeaway:** either route, area or slope, works, but the area method is usually quicker because it avoids fractions until the final step.

Final Answer: $m = \dfrac{19}{14}$.

Q 7.8 **If the point $A(2, -4)$ is equidistant from $P(3, 8)$ and $Q(-10, y)$, find the values of y. Also find the distance PQ.**

SOLUTION

Concept used. Equidistant means $AP = AQ$, so $AP^2 = AQ^2$. Solve for y, then use the distance formula for PQ.

Step 1. $AP^2 = (2-3)^2 + (-4-8)^2 = 1 + 144 = 145$.

Step 2. $AQ^2 = (2+10)^2 + (-4-y)^2 = 144 + (y+4)^2$.

Step 3. Set $AP^2 = AQ^2$:

$$145 = 144 + (y+4)^2$$

$$(y+4)^2 = 1.$$

Step 4. Solve: $y + 4 = \pm 1$, so $y = -3$ or $y = -5$.

Step 5. Distance PQ for each y:

$y = -3$: $PQ = \sqrt{(3+10)^2 + (8+3)^2} = \sqrt{169 + 121} = \sqrt{290}$.

$y = -5$: $PQ = \sqrt{(3+10)^2 + (8+5)^2} = \sqrt{169 + 169} = \sqrt{338} = 13\sqrt{2}$.

Final Answer: $y = -3$ or $y = -5$. Then $PQ = \sqrt{290}$ (for $y = -3$) or $PQ = 13\sqrt{2}$ (for $y = -5$).

☞ Two y values, two distances

Because $(y+4)^2 = 1$ gives two roots, you get two positions for Q and therefore two possible lengths PQ. Report both.

EXPERT'S SOLUTION *: Harsh Vardhan, M.Sc Mathematics, IIT Patna*

Square the distances, then split into cases.

- **Cancel:** equating the two squared distances wipes out the common term and leaves the tidy equation $(y+4)^2 = 1$, free of any surds.
- **Two roots:** that square equation has two solutions, $y = -3$ and $y = -5$, each placing the point Q at a different spot on its line.
- **Two distances:** because Q moves, the length PQ has to be worked out twice, giving $\sqrt{290}$ in one case and $13\sqrt{2}$ in the other.
- **Report both:** the question allows two valid positions, so dropping either case would lose half the correct answer.

> **Final Answer:** $y = -3$ or -5; $PQ = \sqrt{290}$ or $13\sqrt{2}$.

Q 7.9 **Find the area of the triangle whose vertices are $(-8, 4)$, $(-6, 6)$ and $(-3, 9)$.**

SOLUTION

Concept used. Use the area formula. A result of 0 signals collinear points (no triangle).

Step 1. Area $= \frac{1}{2}\,|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$ with $(-8, 4)$, $(-6, 6)$, $(-3, 9)$.

Step 2. Substitute:

$$= \tfrac{1}{2}\,|-8(6-9) + (-6)(9-4) + (-3)(4-6)|.$$

Step 3. Evaluate each term:

$$= \tfrac{1}{2}\,|-8(-3) + (-6)(5) + (-3)(-2)|$$

$$= \tfrac{1}{2}\,|24 - 30 + 6|$$

$$= \tfrac{1}{2}\,|0| = 0.$$

> **Final Answer:** The area is **0** square units; the three points are collinear, so no triangle is formed.

☞ **Zero area, no triangle**

An area of 0 means the "vertices" are in a straight line. There is no enclosed region, hence no actual triangle.

EXPERT'S SOLUTION *: Tara Krishnan, M.Sc Mathematics, Loyola College Chennai*

The three points secretly share one line.

- **Cancel to zero:** the area determinant collapses to $24 - 30 + 6 = 0$, which is the clear signal that the points are collinear.
- **See the pattern:** every step of two to the right raises the height by two, so the slope is one and all three points lie on the line $y = x + 12$.
- **No region:** points strung along one straight line enclose no space, so there is genuinely no triangle to measure here.
- **Honest answer:** the only correct value is zero square units, and the lined-up pattern explains why, rather than leaving it as a bare arithmetic accident.

Final Answer: Area $= 0$; the points are collinear.

Q 7.10 **In what ratio does the x-axis divide the line segment joining the points $(-4, -6)$ and $(-1, 7)$? Find the coordinates of the point of division.**

SOLUTION

Concept used. On the x-axis the y-coordinate is 0. Let the ratio be $k : 1$ and set the section-formula y-coordinate to 0.

Step 1. Let the x-axis cut the segment in ratio $k : 1$, with $(-4, -6)$ first and $(-1, 7)$ second.

Step 2. The y-coordinate of the division point:

$$y = \frac{k(7) + 1(-6)}{k + 1} = 0.$$

Step 3. Solve for k:

$7k - 6 = 0 \Rightarrow k = \dfrac{6}{7}$, so the ratio is $6 : 7$.

Step 4. The x-coordinate, with $k = \frac{6}{7}$:

$$x = \frac{\frac{6}{7}(-1) + 1(-4)}{\frac{6}{7} + 1} = \frac{-\frac{6}{7} - 4}{\frac{13}{7}} = \frac{-\frac{34}{7}}{\frac{13}{7}} = -\frac{34}{13}.$$

Final Answer: The x-axis divides the segment in the ratio $\mathbf{6 : 7}$, at the point $\left(-\dfrac{34}{13}, 0\right)$.

☞ Axis-division shortcut

The x-axis divides $A(y_1)$ and $B(y_2)$ in ratio $-y_1 : y_2$ (using signed y). Here $6 : 7$ comes straight from $-(-6) : 7$.

EXPERT'S SOLUTION *: Nakul Joshi, M.Sc Mathematics, MNIT Jaipur*

One fact drives the whole problem: the axis has zero height.

- **Key idea:** any point on the horizontal axis has height zero, so set the section formula's height part equal to zero from the start.
- **Find the ratio:** that condition reduces to $7k - 6 = 0$, giving $k = \frac{6}{7}$, which is the ratio $6 : 7$ in which the axis cuts the segment.
- **Find the point:** feeding that same ratio into the width part of the formula gives the crossing point at $x = -\frac{34}{13}$.
- **Why it is quick:** you never need the full division for both coordinates, since the zero height already settles the ratio in one line.

Final Answer: $6 : 7$, at $\left(-\frac{34}{13}, 0\right)$.

Q 7.11 **Find the ratio in which the point $P\left(\frac{3}{4}, \frac{5}{12}\right)$ divides the line segment joining the points $A\left(\frac{1}{2}, \frac{3}{2}\right)$ and $B(2, -5)$.**

SOLUTION

Concept used. Let the ratio be $k : 1$. Use the section formula on the x-coordinate to find k, then verify with the y-coordinate.

Step 1. Section formula x-coordinate with ratio $k : 1$:

$$\frac{k(2) + 1\left(\frac{1}{2}\right)}{k + 1} = \frac{3}{4}.$$

Step 2. Cross-multiply:

$$2k + \frac{1}{2} = \frac{3}{4}(k + 1)$$

$$2k + \frac{1}{2} = \frac{3}{4}k + \frac{3}{4}.$$

Step 3. Collect terms (multiply through by 4):

$$8k + 2 = 3k + 3$$

$$5k = 1 \Rightarrow k = \frac{1}{5}.$$

Step 4. So the ratio is $\frac{1}{5} : 1 = 1 : 5$. (Check y: $\frac{\frac{1}{5}(-5)+\frac{3}{2}}{\frac{1}{5}+1} = \frac{-1+\frac{3}{2}}{\frac{6}{5}} = \frac{\frac{1}{2}}{\frac{6}{5}} = \frac{5}{12}$, which matches.)

Final Answer: P divides AB in the ratio $\mathbf{1 : 5}$.

☞ **Use $k : 1$ then simplify**

Writing the ratio as $k : 1$ keeps the algebra to one unknown. Once $k = \frac{1}{5}$, scale up to whole numbers: $1 : 5$.

EXPERT'S SOLUTION *: Ira Sengupta, M.Sc Mathematics, Jadavpur University Salt Lake*

Solve with one coordinate, confirm with the other.

- **Set up:** write the unknown ratio as $k : 1$ so the section formula carries just one letter, keeping the algebra short.
- **Solve:** matching the width coordinate gives $5k = 1$, so $k = \frac{1}{5}$, which scales up to the whole-number ratio $1 : 5$.
- **Confirm:** the height coordinate then lands on exactly $\frac{5}{12}$, proving the point sits on the segment itself and not on the line stretched beyond it.
- **Worth the check:** with fractional coordinates a slip is easy, so the matching second coordinate is reassurance well worth the extra line.

Final Answer: $1 : 5$.

Q 7.12 **If $P(9a-2, -b)$ divides the line segment joining $A(3a+1, -3)$ and $B(8a, 5)$ in the ratio $3 : 1$, find the values of a and b.**

SOLUTION

Concept used. Apply the section formula with ratio $3 : 1$ for both coordinates and match them to P.

Step 1. x-coordinate of P (ratio $3 : 1$):

$$9a - 2 = \frac{3(8a) + 1(3a+1)}{3+1} = \frac{24a + 3a + 1}{4} = \frac{27a+1}{4}.$$

Step 2. Clear the fraction:

$$4(9a - 2) = 27a + 1$$

$$36a - 8 = 27a + 1$$

$9a = 9 \Rightarrow a = 1.$

Step 3. y-coordinate of P:

$$-b = \frac{3(5) + 1(-3)}{4} = \frac{15 - 3}{4} = \frac{12}{4} = 3.$$

Step 4. So $-b = 3$, giving $b = -3$.

Final Answer: $a = 1$ and $b = -3$.

☞ **Split into two equations**

A section-formula point gives one equation from x and one from y. Solve them separately; here x gives a and y gives b cleanly.

EXPERT'S SOLUTION *: Dhruv Saxena, M.Sc Applied Mathematics, IIT Jodhpur*

The two unknowns separate cleanly, one per coordinate.

- **Width gives a:** the width equation contains only the letter a and tidies to $9a = 9$, so $a = 1$ with no other unknown getting in the way.
- **Height gives b:** the height equation contains only b and reduces to $-b = 3$, which hands you $b = -3$ straight away.
- **No simultaneous work:** because the unknowns never mix, you never have to solve two equations together, just two short linear steps in turn.
- **General habit:** whenever a single point equation appears, split it into its width and height parts first and check whether the unknowns fall apart like this.

Final Answer: $a = 1$, $b = -3$.

Q 7.13 **If (a, b) is the mid-point of the line segment joining the points $A(10, -6)$ and $B(k, 4)$ and $a - 2b = 18$, find the value of k and the distance AB.**

SOLUTION

Concept used. Write (a, b) from the midpoint formula, plug into $a - 2b = 18$ to get k, then compute AB.

Step 1. Midpoint: $a = \frac{10 + k}{2}$ and $b = \frac{-6 + 4}{2} = -1$.

Step 2. Use $a - 2b = 18$ with $b = -1$:

$a - 2(-1) = 18$

$a + 2 = 18 \Rightarrow a = 16$.

Step 3. Then $\dfrac{10 + k}{2} = 16$, so $10 + k = 32$ and $k = 22$.

Step 4. Distance AB with $B(22, 4)$:

$$AB = \sqrt{(22 - 10)^2 + (4 + 6)^2} = \sqrt{144 + 100} = \sqrt{244} = 2\sqrt{61}.$$

Final Answer: $k = 22$ and $AB = 2\sqrt{61}$.

☞ **Find b first, it is free**

b depends only on the known y-values, so $b = -1$ immediately. That turns $a - 2b = 18$ into a one-step equation for a.

EXPERT'S SOLUTION *: Bhavya Shah, M.Sc Mathematics, MS University Baroda*

Pin the easy value first, then unwind to the rest.

- **Free value:** the height of the midpoint depends only on known numbers, so it is fixed at -1 no matter what k turns out to be.
- **Use the constraint:** feeding that height into the given condition $a - 2b = 18$ immediately gives $a = 16$, with nothing else to solve.
- **Recover k:** putting $a = 16$ back into the width half of the midpoint gives $k = 22$, and the distance formula then returns $AB = 2\sqrt{61}$.
- **Why this order:** working b, then a, then k, then the distance keeps every stage a single tidy line instead of a tangled system.

Final Answer: $k = 22$, $AB = 2\sqrt{61}$.

Q 7.14 **The centre of a circle is $(2a, a - 7)$. Find the values of a if the circle passes through the point $(11, -9)$ and has diameter $10\sqrt{2}$ units.**

SOLUTION

Concept used. The radius is half the diameter. The distance from the centre to the given point equals the radius. Square and solve for a.

Step 1. Radius $= \dfrac{10\sqrt{2}}{2} = 5\sqrt{2}$, so $r^2 = (5\sqrt{2})^2 = 50$.

Step 2. Distance from centre $(2a, a - 7)$ to $(11, -9)$ equals the radius:

$$(2a - 11)^2 + (a - 7 + 9)^2 = 50.$$

Step 3. Expand:

$$(2a-11)^2+(a+2)^2=50$$

$$(4a^2-44a+121)+(a^2+4a+4)=50.$$

Step 4. Combine:

$$5a^2-40a+125=50$$

$$5a^2-40a+75=0$$

$$a^2-8a+15=0.$$

Step 5. Factorise: $(a-3)(a-5)=0$, so $a=3$ or $a=5$.

Final Answer: $a=3$ or $a=5$.

☞ **Diameter to radius first**

Always halve the diameter before using it as a radius. Using $10\sqrt{2}$ directly as the radius would square to 200, not 50, and spoil the equation.

EXPERT'S SOLUTION *: Aryan Kapoor, M.Sc Mathematics, Thapar Institute*

The centre-to-point distance must equal the radius.

- **Radius first:** halve the diameter to get a radius of $5\sqrt{2}$, whose square is the tidy number 50 that the equation will use.
- **Set up:** demand that the moving centre stay this fixed distance from the given point, which after expanding becomes the quadratic $a^2-8a+15=0$.
- **Factor:** it splits as $(a-3)(a-5)=0$, so two values of the unknown both satisfy the distance condition.
- **Keep both:** each value describes a different but valid centre sitting the correct distance from the point, so neither root should be thrown away.

Final Answer: $a=3$ or $a=5$.

Q 7.15 **The line segment joining the points $A(3,2)$ and $B(5,1)$ is divided at the point P in the ratio $1:2$ and it lies on the line $3x-18y+k=0$. Find the value of k.**

SOLUTION

Concept used. Find P by the section formula (ratio $1:2$), then substitute its coordinates into the line equation to solve for k.

Step 1. Section formula with ratio $1:2$, $A(3,2)$, $B(5,1)$:

$$x = \frac{1(5)+2(3)}{1+2} = \frac{5+6}{3} = \frac{11}{3}$$

$$y = \frac{1(1)+2(2)}{1+2} = \frac{1+4}{3} = \frac{5}{3}.$$

Step 2. So $P = \left(\frac{11}{3}, \frac{5}{3}\right)$.

Step 3. Substitute into $3x - 18y + k = 0$:

$$3\left(\frac{11}{3}\right) - 18\left(\frac{5}{3}\right) + k = 0$$

$$11 - 30 + k = 0.$$

Step 4. Solve: $k = 19$.

Final Answer: $k = 19$.

☞ **Substitute, do not re-derive**

Once P is known, the line equation is just a plug-in. The $3 \times \frac{11}{3} = 11$ cancellation keeps the arithmetic tidy.

EXPERT'S SOLUTION *: Radhika Menon, M.Sc Mathematics, NIT Calicut*

Divide first, then substitute into the line.

- **Find the point:** the section formula with the given ratio places the division point P at $\left(\frac{11}{3}, \frac{5}{3}\right)$.
- **Substitute:** drop those coordinates into the line equation, which is now just a plug-in with no fresh geometry needed.
- **Clean cancels:** the fractions collapse neatly, since $3 \cdot \frac{11}{3} = 11$ and $18 \cdot \frac{5}{3} = 30$, leaving the short equation $11 - 30 + k = 0$, so $k = 19$.
- **Self-check:** those tidy cancellations are a good sign the ratio was applied the right way round, since a misapplied ratio usually leaves ugly fractions.

Final Answer: $k = 19$.

Q 7.16 **If $D\left(-\frac{1}{2}, \frac{5}{2}\right)$, $E(7,3)$ and $F\left(\frac{7}{2}, \frac{7}{2}\right)$ are the midpoints of sides of $\triangle ABC$, find the area of $\triangle ABC$.**

SOLUTION

Concept used. The triangle formed by the midpoints (the **medial triangle**) has exactly one quarter the area of the original triangle. So area of $\triangle ABC = 4\times$ area of $\triangle DEF$.

Step 1. Area of $\triangle DEF$ with $D\left(-\frac{1}{2}, \frac{5}{2}\right)$, $E(7,3)$, $F\left(\frac{7}{2}, \frac{7}{2}\right)$:

$$= \tfrac{1}{2}\left|-\tfrac{1}{2}\left(3-\tfrac{7}{2}\right)+7\left(\tfrac{7}{2}-\tfrac{5}{2}\right)+\tfrac{7}{2}\left(\tfrac{5}{2}-3\right)\right|.$$

Step 2. Evaluate the brackets:

$$= \tfrac{1}{2}\left|-\tfrac{1}{2}\left(-\tfrac{1}{2}\right)+7(1)+\tfrac{7}{2}\left(-\tfrac{1}{2}\right)\right|$$

$$= \tfrac{1}{2}\left|\tfrac{1}{4}+7-\tfrac{7}{4}\right| = \tfrac{1}{2}\left|7-\tfrac{6}{4}\right| = \tfrac{1}{2}\left|7-\tfrac{3}{2}\right|$$

$$= \tfrac{1}{2}\times\tfrac{11}{2} = \frac{11}{4}.$$

Step 3. Original triangle: area $= 4 \times \frac{11}{4} = 11$.

Final Answer: Area of $\triangle ABC = \mathbf{11}$ square units.

☞ Medial triangle is one-fourth

Joining the midpoints of a triangle's sides makes a triangle with $\frac{1}{4}$ the area. So multiply the small triangle's area by 4 to recover the big one.

EXPERT'S SOLUTION *: Siddhi Patil, M.Sc Mathematics, University of Mumbai Kalina*

Skip hunting for the three original vertices.

- **The shortcut:** the triangle formed by the three midpoints is similar to the original one, with every side exactly half as long.
- **Area ratio:** halving each side scales the area by a factor of one quarter, so the midpoint triangle holds a quarter of the area you want.
- **Apply it:** compute the small triangle's area as $\frac{11}{4}$ and multiply by four, which gives the answer of eleven square units in a single step.
- **Why it saves work:** the alternative of solving for the three corners first is far longer, so spotting the quarter-area rule is the real labour-saver here.

Final Answer: 11 square units.

Q 7.17 **The points $A(2, 9)$, $B(a, 5)$ and $C(5, 5)$ are the vertices of a triangle ABC right angled at B. Find the value of a and hence the area of $\triangle ABC$.**

SOLUTION

Concept used. A right angle at B means $AB \perp BC$, so by Pythagoras $AB^2 + BC^2 = AC^2$. Solve for a, then compute the area.

Step 1. Side squares:

$$AB^2 = (2 - a)^2 + (9 - 5)^2 = (2 - a)^2 + 16$$

$$BC^2 = (a - 5)^2 + (5 - 5)^2 = (a - 5)^2$$

$$AC^2 = (2 - 5)^2 + (9 - 5)^2 = 9 + 16 = 25.$$

Step 2. Right angle at B: $AB^2 + BC^2 = AC^2$:

$$(2 - a)^2 + 16 + (a - 5)^2 = 25.$$

Step 3. Expand:

$$(4 - 4a + a^2) + 16 + (a^2 - 10a + 25) = 25$$

$$2a^2 - 14a + 45 = 25$$

$$2a^2 - 14a + 20 = 0 \Rightarrow a^2 - 7a + 10 = 0.$$

Step 4. Factorise: $(a - 2)(a - 5) = 0$, so $a = 2$ or $a = 5$. Since $a = 5$ would make $B = C$, take $a = 2$.

Step 5. Area with $A(2, 9)$, $B(2, 5)$, $C(5, 5)$: base $BC = 3$, height $AB = 4$ (right angle at B):

$$\text{Area} = \tfrac{1}{2} \times 3 \times 4 = 6.$$

Final Answer: $a = 2$; area of $\triangle ABC =$ **6** square units.

✗ Reject the degenerate root

$a = 5$ makes $B(5, 5)$ coincide with $C(5, 5)$, collapsing the triangle. Always discard a root that destroys the figure; here keep $a = 2$.

EXPERT'S SOLUTION *: Vivek Anand, M.Sc Mathematics, IIT Tirupati*

A right angle hands you a Pythagoras equation.

- **Set up:** the right angle at B means the two short sides squared add to the longest side squared, which gives the quadratic $a^2 - 7a + 10 = 0$.
- **Roots:** this factors to give $a = 2$ or $a = 5$, so two values of the unknown solve the equation as it stands.

- **Reject one:** the value $a = 5$ makes two corners land on the same point and flatten the triangle, so only $a = 2$ leaves a real figure.
- **Instant area:** at the right angle the two legs are the perpendicular sides 3 and 4, so the area is just half their product, namely six square units.

Final Answer: $a = 2$; area $= 6$ square units.

Q 7.18 **Find the coordinates of the point R on the line segment joining the points $P(-1, 3)$ and $Q(2, 5)$ such that $PR = \frac{3}{5}PQ$.**

SOLUTION

Concept used. $PR = \frac{3}{5}PQ$ means R divides PQ so that $PR : RQ = 3 : 2$. Apply the section formula with ratio $3 : 2$.

Step 1. Since $PR = \frac{3}{5}PQ$, the remaining part $RQ = \frac{2}{5}PQ$, so $PR : RQ = 3 : 2$.

Step 2. Section formula with ratio $3 : 2$, $P(-1, 3)$, $Q(2, 5)$:

$$x = \frac{3(2) + 2(-1)}{3 + 2} = \frac{6 - 2}{5} = \frac{4}{5}$$

$$y = \frac{3(5) + 2(3)}{3 + 2} = \frac{15 + 6}{5} = \frac{21}{5}.$$

Step 3. So $R = \left(\frac{4}{5}, \frac{21}{5}\right)$.

Final Answer: $R = \left(\frac{4}{5}, \frac{21}{5}\right)$.

☞ **Fraction of a segment to a ratio**

$PR = \frac{3}{5}PQ$ converts to the ratio $PR : RQ = 3 : (5 - 3) = 3 : 2$. Translate the fraction into a ratio before using the section formula.

EXPERT'S SOLUTION *: Komal Verma, M.Sc Mathematics, Aligarh Muslim University*

Turn the fraction of a segment into a clean ratio.

- **Read it right:** being three-fifths of the way along from the first point means the point splits the segment as three parts to two, not three to five.
- **Apply the ratio:** the section formula with that three to two split gives the point at

$\left(\frac{4}{5}, \frac{21}{5}\right)$ directly.

- **The common slip:** students often write the ratio as three to five, but the second number must be the leftover part of the segment, which is two.
- **Safe rule:** a fraction such as three-fifths always becomes the ratio numerator to the difference, here three to two, before you touch the formula.

Final Answer: $R = \left(\frac{4}{5}, \frac{21}{5}\right)$.

Q 7.19 **Find the values of k if the points $A(k+1, 2k)$, $B(3k, 2k+3)$ and $C(5k-1, 5k)$ are collinear.**

SOLUTION

Concept used. Collinear points give zero triangle area. Set the area expression to zero and solve the resulting quadratic in k.

Step 1. Area condition (bracket $= 0$):

$$(k+1)\big[(2k+3) - 5k\big] + 3k\big[5k - 2k\big] + (5k-1)\big[2k - (2k+3)\big] = 0.$$

Step 2. Simplify each bracket:

$$(k+1)(3-3k) + 3k(3k) + (5k-1)(-3) = 0.$$

Step 3. Expand:

$$(3k - 3k^2 + 3 - 3k) + 9k^2 + (-15k + 3) = 0$$

$$(-3k^2 + 3) + 9k^2 - 15k + 3 = 0$$

$$6k^2 - 15k + 6 = 0.$$

Step 4. Divide by 3: $2k^2 - 5k + 2 = 0$.

Step 5. Factorise: $(2k-1)(k-2) = 0$, so $k = \frac{1}{2}$ or $k = 2$.

Final Answer: $k = \frac{1}{2}$ or $k = 2$.

☞ **Expand brackets fully**

With variable coordinates the area formula gives a quadratic. Expand each product carefully, then divide out the common factor before factorising.

EXPERT'S SOLUTION : *Rohan Bhattacharya, M.Sc Applied Mathematics, ISI Bangalore*

Zero area turns into a quadratic in the unknown.

- **Set up:** since the points must be collinear, the area is zero, and substituting the variable vertices gives the quadratic $6k^2 - 15k + 6 = 0$.
- **Simplify:** divide through by the common factor to get the tidier $2k^2 - 5k + 2 = 0$, which is easier to factor.
- **Solve:** it factors as $(2k - 1)(k - 2) = 0$, so the two solutions are $k = \frac{1}{2}$ and $k = 2$.
- **Keep both:** each value slides all three points to new spots but still leaves them on one straight line, so both answers are genuine.

Final Answer: $k = \frac{1}{2}$ or $k = 2$.

Q 7.20 **Find the ratio in which the line $2x+3y-5=0$ divides the line segment joining the points $(8, -9)$ and $(2, 1)$. Also find the coordinates of the point of division.**

SOLUTION

Concept used. Let the line cut the segment in ratio $k : 1$. Write the division point from the section formula and force it to satisfy $2x + 3y - 5 = 0$.

Step 1. Division point (ratio $k : 1$, $(8, -9)$ first, $(2, 1)$ second):

$$x = \frac{2k + 8}{k + 1}, \qquad y = \frac{k - 9}{k + 1}.$$

Step 2. Substitute into $2x + 3y - 5 = 0$:

$$2\left(\frac{2k + 8}{k + 1}\right) + 3\left(\frac{k - 9}{k + 1}\right) - 5 = 0.$$

Step 3. Multiply through by $(k + 1)$:

$$2(2k + 8) + 3(k - 9) - 5(k + 1) = 0$$

$$4k + 16 + 3k - 27 - 5k - 5 = 0$$

$$2k - 16 = 0 \Rightarrow k = 8.$$

Step 4. Ratio $= 8 : 1$. Coordinates:

$$x = \frac{2(8) + 8}{8 + 1} = \frac{24}{9} = \frac{8}{3}, \quad y = \frac{8 - 9}{8 + 1} = -\frac{1}{9}.$$

Final Answer: The line divides the segment in the ratio $\mathbf{8 : 1}$, at the point $\left(\frac{8}{3}, -\frac{1}{9}\right)$.

☞ Line-division by substitution

To find where a line splits a segment, substitute the $k : 1$ section point into the line and solve for k. A positive k means internal division.

EXPERT'S SOLUTION *: Ananya Gupta, M.Sc Mathematics, Lady Shri Ram College Delhi*

Force the section point to obey the line.

- **Set up:** write the dividing point in terms of the unknown ratio, then demand that it satisfy the given line equation.
- **Solve:** that demand clears all the fractions and leaves the simple linear equation $2k - 16 = 0$, so $k = 8$ and the ratio is eight to one.
- **Find the point:** feeding that value back into the formula gives the division point at $\left(\frac{8}{3}, -\frac{1}{9}\right)$.
- **Internal cut:** because the ratio came out positive, the line crosses inside the segment, which the point lying between the two endpoints confirms.

> **Final Answer:** $8 : 1$, at $\left(\frac{8}{3}, -\frac{1}{9}\right)$.

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Solved NCERT Exemplar Class 10 Maths Chapter 7, Coordinate Geometry: every question, step by step (2026-27)

Chapter 7: Coordinate Geometry

About this Chapter

Worked solutions to every NCERT Exemplar problem in Class 10 Maths Chapter 7 Coordinate Geometry. You apply the **distance formula**, the **section formula** and the **area of a triangle** to classify shapes, test collinearity and find missing points. All 58 questions are solved, each with an expert view.

Topics covered: Distance formula • Distance from origin and from axes • Section formula (internal division) • Midpoint formula • Ratio of division by an axis or a line • Area of a triangle from vertices • Test for collinear points • Classifying triangles and quadrilaterals • Perpendicular bisector and equidistant points • Centroid and medians

Quick Formula Sheet

Distance formula:
$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Distance from origin:
$OP = \sqrt{x^2 + y^2}$

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

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

Area of a triangle:
$\frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

Also see for this chapter on Collegedunia: NCERT Solutions, Revision Notes, Formula Sheet and the Exemplar Book PDF for Class 10 Maths Chapter 7, Coordinate Geometry.

IV. Long Answer Questions (Exercise 7.4)

Q 7.1 **If $(-4, 3)$ and $(4, 3)$ are two vertices of an equilateral triangle, find the coordinates of the third vertex, given that the origin lies in the interior of the triangle.**

SOLUTION

Concept used. In an equilateral triangle all sides are equal. The third vertex is equidistant from the two given vertices, so it lies on the perpendicular bisector of the base; its distance from each base vertex equals the base length.

Step 1. The base joins $A(-4, 3)$ and $B(4, 3)$, a horizontal segment of length $AB = 8$.

Step 2. The third vertex $C(x, y)$ is equidistant from A and B, so it lies on the perpendicular bisector $x = 0$. Hence $C = (0, y)$.

Step 3. All sides equal: $CA = AB = 8$, so $CA^2 = 64$:

$$(0 + 4)^2 + (y - 3)^2 = 64$$

$$16 + (y - 3)^2 = 64$$

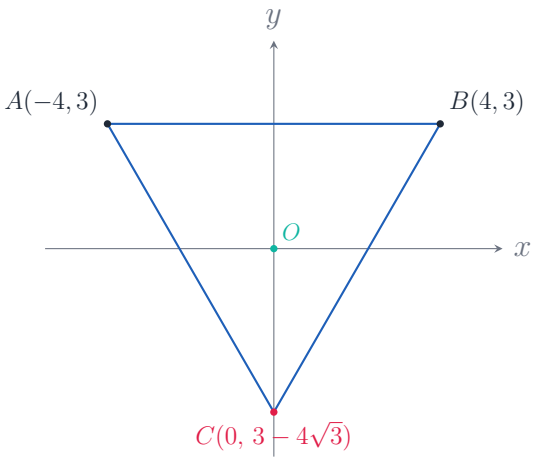
$$(y - 3)^2 = 48.$$

Step 4. Solve:

$y - 3 = \pm\sqrt{48} = \pm 4\sqrt{3}$, so $y = 3 + 4\sqrt{3}$ or $y = 3 - 4\sqrt{3}$.

Step 5. The base sits at $y = 3$. For the origin $(0, 0)$ to be inside, the apex must be *below* the base, i.e. $y = 3 - 4\sqrt{3}$ (which is negative, about -3.93).

> **Final Answer:** The third vertex is $\left(0,\ 3 - 4\sqrt{3}\right)$.



☞ Pick the side the origin is on

Equilateral apex problems give two answers, one each side of the base. Use the "origin inside" clue to keep the apex on the side that wraps the origin.

EXPERT'S SOLUTION *: Manav Desai, M.Sc Mathematics, IIT Dhanbad*

Symmetry fixes the width, side equality fixes the height.

- **Use symmetry:** the base is balanced about the vertical axis, so the apex of an equilateral triangle has to sit on that axis, with width coordinate zero.
- **Side equality:** setting a slant side equal to the base length of eight gives the equation $(y-3)^2 = 48$, and so two heights $y = 3 \pm 4\sqrt{3}$ both fit.
- **Two apexes:** one solution lifts the apex above the base and the other drops it below, so the bare algebra cannot decide between them on its own.
- **Use the clue:** the base sits at height three, and only the lower apex near $3 - 4\sqrt{3}$, which is about negative four, wraps the triangle around the origin, so the interior condition picks the negative root.

Final Answer: $\left(0,\ 3-4\sqrt{3}\right)$.

Q 7.2 **$A(6,1)$, $B(8,2)$ and $C(9,4)$ are three vertices of a parallelogram $ABCD$. If E is the midpoint of DC, find the area of $\triangle ADE$.**

SOLUTION

Concept used. First find D using the parallelogram diagonal property, then the midpoint E of DC, then the area of $\triangle ADE$ by the vertex formula.

Step 1. In parallelogram $ABCD$, $D = A + C - B$ (diagonals bisect each other):

$$D = (6+9-8,\ 1+4-2) = (7,3).$$

Step 2. E is the midpoint of DC with $D(7,3)$, $C(9,4)$:

$$E = \left(\frac{7+9}{2}, \frac{3+4}{2}\right) = \left(8, \frac{7}{2}\right).$$

Step 3. Area of $\triangle ADE$ with $A(6,1)$, $D(7,3)$, $E\left(8, \frac{7}{2}\right)$:

$$= \tfrac{1}{2}\left|6\left(3-\tfrac{7}{2}\right) + 7\left(\tfrac{7}{2}-1\right) + 8(1-3)\right|$$

$$= \tfrac{1}{2}\left|6\left(-\tfrac{1}{2}\right) + 7\left(\tfrac{5}{2}\right) + 8(-2)\right|$$

$$= \tfrac{1}{2}\left|-3 + \tfrac{35}{2} - 16\right|$$

$$= \tfrac{1}{2}\left|-19 + \tfrac{35}{2}\right| = \tfrac{1}{2}\left|-\tfrac{38}{2} + \tfrac{35}{2}\right| = \tfrac{1}{2} \times \tfrac{3}{2} = \frac{3}{4}.$$

Final Answer: Area of $\triangle ADE = \dfrac{3}{4}$ square units.

☞ **Fourth vertex by $A + C - B$**

For parallelogram $ABCD$, the missing vertex is $D = A + C - B$, straight from the equal-diagonal-midpoints rule. No simultaneous equations needed.

EXPERT'S SOLUTION *: Pooja Rani, M.Sc Mathematics, Guru Nanak Dev University*

Build one point at a time, in a fixed order.

- **Find the corner:** the diagonals of a parallelogram bisect each other, which gives the missing vertex as $D = A + C - B = (7, 3)$ in a single line.
- **Find the midpoint:** averaging that corner with C places the midpoint at $\left(8, \frac{7}{2}\right)$, the next point the question needs.
- **Find the area:** feeding the three known points into the area determinant returns $\frac{3}{4}$ of a square unit.
- **Why it is easy:** each stage uses just one standard tool, so a question that looks long really breaks into three short and separate computations.

Final Answer: $\frac{3}{4}$ square units.

Q 7.3 **The points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are the vertices of $\triangle ABC$.**
(i) The median from A meets BC at D. Find the coordinates of D.
(ii) Find the coordinates of the point P on AD such that $AP : PD = 2 : 1$.
(iii) Find the coordinates of the points Q and R on medians BE and CF respectively such that $BQ : QE = 2 : 1$ and $CR : RF = 2 : 1$.
(iv) What are the coordinates of the centroid of $\triangle ABC$?

SOLUTION

Concept used. A median meets the opposite side at its midpoint. The point dividing a median $2 : 1$ from the vertex is the **centroid**, which is the same for all three medians.

Step 1. (i) D is the midpoint of BC:

$$D = \left(\frac{x_2 + x_3}{2}, \frac{y_2 + y_3}{2}\right).$$

Step 2. (ii) P divides AD in ratio $2 : 1$ (from A). Section formula with $A(x_1, y_1)$ and D:

$$P_x = \frac{2\left(\frac{x_2+x_3}{2}\right) + 1 \cdot x_1}{2+1} = \frac{x_1 + x_2 + x_3}{3}$$

$$P_y = \frac{2\left(\frac{y_2+y_3}{2}\right) + 1 \cdot y_1}{3} = \frac{y_1 + y_2 + y_3}{3}.$$

Step 3. (iii) E is the midpoint of AC and F the midpoint of AB. Dividing BE as $2:1$ from B, and CF as $2:1$ from C, the same algebra gives

$$Q = R = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right).$$

Step 4. (iv) All three points P, Q, R coincide; this common point is the centroid.

Final Answer: (i) $D = \left(\frac{x_2+x_3}{2}, \frac{y_2+y_3}{2}\right)$; (ii), (iii) $P = Q = R = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$; (iv) centroid $= \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$.

☞ **The $2:1$ point is the centroid**

Every median is cut by the centroid in the ratio $2:1$ from the vertex. That is why P, Q and R all land on the same point.

EXPERT'S SOLUTION *: Karan Malhotra, M.Sc Mathematics, NIT Warangal*

One formula, run three times on three medians.

- **Where a median lands:** the foot of each median is just the midpoint of the opposite side, so finding it costs only one average.
- **The two to one point:** dividing a median two to one from its vertex always simplifies down to the plain average of all three corner coordinates.
- **Same answer thrice:** doing that section algebra on each of the three medians returns the very same point $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$ every time.
- **What it proves:** that the three points coincide is exactly the theorem that the medians meet at one place, the centroid, which cuts each median in the ratio two to one.

Final Answer: Centroid $= \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$, and $P = Q = R$ equal it.

Q 7.4 **If the points $A(1,-2)$, $B(2,3)$, $C(a,2)$ and $D(-4,-3)$ form a parallelogram, find the value of a and the height of the parallelogram taking AB as base.**

SOLUTION

Concept used. For parallelogram $ABCD$, the diagonals AC and BD bisect each other (equal midpoints). Then height $= \frac{\text{area}}{\text{base}}$, where the area is twice $\triangle ABC$.

Step 1. Equal diagonal midpoints (midpoint AC = midpoint BD):

$$\frac{1+a}{2} = \frac{2+(-4)}{2} \Rightarrow 1+a = -2 \Rightarrow a = -3.$$

Step 2. So $C = (-3, 2)$. Area of $\triangle ABC$ with $A(1,-2)$, $B(2,3)$, $C(-3,2)$:

$$= \tfrac{1}{2}\,|1(3-2) + 2(2+2) + (-3)(-2-3)|$$

$$= \tfrac{1}{2}\,|1+8+15| = \tfrac{1}{2} \times 24 = 12.$$

Step 3. Area of the parallelogram $= 2 \times 12 = 24$ square units.

Step 4. Base $AB = \sqrt{(2-1)^2 + (3+2)^2} = \sqrt{1+25} = \sqrt{26}$.

Step 5. Height $= \dfrac{\text{area}}{\text{base}} = \dfrac{24}{\sqrt{26}} = \dfrac{24\sqrt{26}}{26} = \dfrac{12\sqrt{26}}{13}$.

Final Answer: $a = -3$ and height $= \dfrac{12\sqrt{26}}{13}$ units (about 4.71).

☞ **Area equals base times height**

A parallelogram's area is base $\times$ height. So once you know the area (twice a half-triangle) and the base length, the height is a single division.

EXPERT'S SOLUTION *: Swati Mishra, M.Sc Mathematics, University of Allahabad*

Find the unknown first, then peel off the height.

- **Fix a:** matching the midpoints of the two diagonals, which must coincide in a parallelogram, gives $a = -3$ straight away.
- **Get the area:** the whole parallelogram has twice the area of the triangle on three of its corners, which comes to 24 square units.
- **Get the height:** dividing that area by the base length $\sqrt{26}$ and rationalising leaves a height of $\frac{12\sqrt{26}}{13}$.
- **Why this order:** vertex first, then area, then height keeps each computation self-contained, so a mistake in one stage never spreads into the next.

Final Answer: $a = -3$; height $= \frac{12\sqrt{26}}{13}$.

Q 7.5 **Students of a school are standing in rows and columns in their playground for a drill practice. A, B, C and D are the positions of four students as shown in Fig. 7.4. Is it possible to place Jaspal in the drill in such a way that he is equidistant from each of the four students A, B, C and D? If so, what should be his position?**

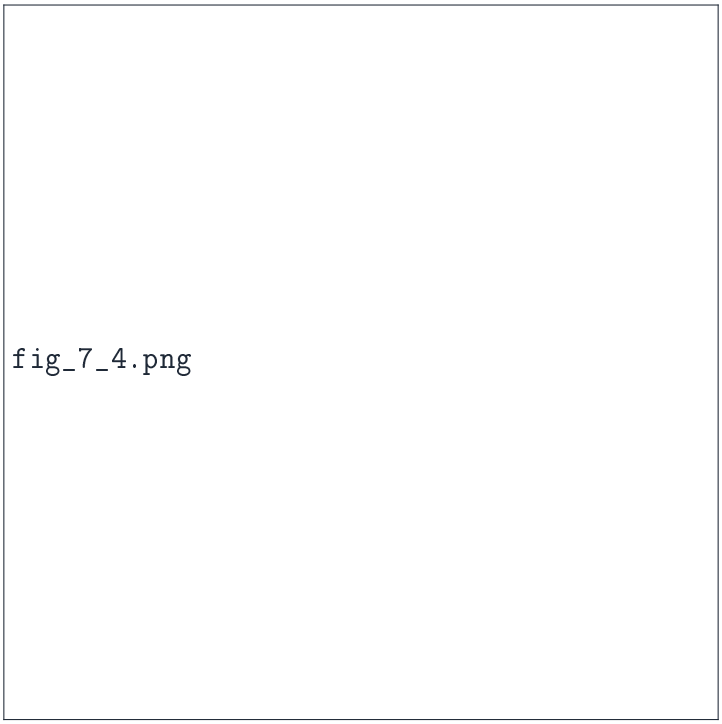


Fig. 7.4: positions $A(3,5)$, $B(7,9)$, $C(11,5)$ and $D(7,1)$ on the playground grid.

SOLUTION

Concept used. A point equidistant from all four corners exists only if the four points lie on a circle; its centre is that point. Read the coordinates from the grid, then test whether the diagonals share a midpoint and are equal (which makes $ABCD$ a square, whose centre is equidistant from all four).

Step 1. From the grid: $A(3,5)$, $B(7,9)$, $C(11,5)$, $D(7,1)$.

Step 2. Midpoint of diagonal AC: $\left(\frac{3+11}{2}, \frac{5+5}{2}\right) = (7,5)$.

Step 3. Midpoint of diagonal BD: $\left(\frac{7+7}{2}, \frac{9+1}{2}\right) = (7,5)$.

Step 4. The diagonals share the midpoint $(7,5)$, so it is a candidate for the equidistant point. Check its distance to each corner:

to A: $\sqrt{(7-3)^2+(5-5)^2} = 4$

to B: $\sqrt{(7-7)^2+(5-9)^2} = 4$

to C: $\sqrt{(7-11)^2+(5-5)^2} = 4$

to D: $\sqrt{(7-7)^2+(5-1)^2} = 4$.

Step 5. All four distances equal 4, so $(7,5)$ is equidistant from A, B, C, D.

Final Answer: Yes. Jaspal should stand at $(7,5)$, which is 4 units from each of the four students.

☞ Equidistant from four points

A single point equidistant from four corners is the centre of the circle through them. For a square that centre is just the crossing of the diagonals.

EXPERT'S SOLUTION *: Aditya Nair, M.Sc Applied Mathematics, IIT Palakkad*

The diagonal crossing is the spot you want.

- **Read the grid:** the four students sit at the corners of a square, with the columns giving the width values and the rows giving the height values of each position.
- **What the spot must be:** a point the same distance from all four corners is the centre of the circle through them, and for a square that centre is simply where the two diagonals cross.
- **Cross the diagonals:** one diagonal runs flat and the other runs upright, and both have the same midpoint, so they meet at the single point $(7, 5)$, confirming the figure is a true square.
- **Measure out:** from that centre the corners lie four units to the left, right, above and below, so every student is the same distance away and the matching four lengths prove the point is genuinely equidistant rather than merely close.

Final Answer: Yes; position $(7, 5)$, which is 4 units from each student.

Q 7.6 **Ayush starts walking from his house to office. Instead of going to the office directly, he goes to a bank first, from there to his daughter's school and then reaches the office. What is the extra distance travelled by Ayush in reaching his office? (Assume all distances covered are in straight lines.) The house is at $(2, 4)$, bank at $(5, 8)$, school at $(13, 14)$ and office at $(13, 26)$; coordinates are in km.**

SOLUTION

Concept used. Use the distance formula for each leg of the journey, add them for the path actually walked, and subtract the direct house-to-office distance.

Step 1. House $H(2, 4)$ to bank $B(5, 8)$:

$$HB = \sqrt{(5-2)^2 + (8-4)^2} = \sqrt{9+16} = \sqrt{25} = 5 \text{ km}.$$

Step 2. Bank $B(5, 8)$ to school $S(13, 14)$:

$$BS = \sqrt{(13-5)^2 + (14-8)^2} = \sqrt{64+36} = \sqrt{100} = 10 \text{ km}.$$

Step 3. School $S(13, 14)$ to office $O(13, 26)$:

$$SO = \sqrt{(13-13)^2 + (26-14)^2} = \sqrt{0+144} = 12 \text{ km}.$$

Step 4. Total walked $= 5 + 10 + 12 = 27$ km.

Step 5. Direct house to office:

$$HO = \sqrt{(13-2)^2 + (26-4)^2} = \sqrt{121+484} = \sqrt{605} = 11\sqrt{5} \approx 24.6 \text{ km}.$$

Step 6. Extra distance $= 27 - 24.6 = 2.4$ km (approximately).

Final Answer: Extra distance $= 27 - 11\sqrt{5} \approx 27 - 24.6 = \mathbf{2.4}$ km.

♥ Detours add up

The detour through the bank and school adds about 2.4 km over the straight route. Coordinate geometry turns a map into exact distances, so you can compare a chosen path against the shortest one.

EXPERT'S SOLUTION *: Diya Sharma, M.Sc Mathematics, Miranda House Delhi*

Add three neat legs, then subtract the shortcut.

- **Tidy legs:** each stretch of the walk is a whole number, namely five and ten from familiar right-triangle triples and twelve from a straight vertical hop.
- **Detour total:** adding the three legs gives twenty-seven kilometres for the route that visits the bank and the school on the way.
- **Direct route:** the straight hop from home to office is shorter at $\sqrt{605} = 11\sqrt{5}$, which is about twenty-four and a half kilometres.
- **Extra walking:** the gap between the two routes, roughly two and a half kilometres, is the extra distance, and spotting the right-triangle triples makes every leg instant.

Final Answer: About 2.4 km extra.

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