

Cambridge International AS & A Level

Mathematics

9709

Paper 1 Pure Mathematics 1

Topic 3-Coordinate Geometry

Question No (20)

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Question No (20)

The point C lies on the perpendicular bisector of the line joining the points A (4, 6) and B (10, 2). C also lies on the line parallel to AB through (3, 11).

- (i) Find the equation of the perpendicular bisector of AB.
- (ii) Calculate the coordinates of C.

Solution

mid-point of AB

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

mid-point of AB = $\left(\frac{4+10}{2}, \frac{6+2}{2} \right)$

$$= \left(\frac{14}{2}, \frac{8}{2} \right)$$

$$= (7, 4)$$

How to find gradient from two points

A(x₁, y₁), B(x₂, y₂)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

gradient of AB = $\frac{2-6}{10-4}$

$$= -\frac{4}{6}$$

$$= -\frac{2}{3}$$

if m₁ is the gradient of one line and m₂ is the gradient of second line
if these are perpendicular to each other then
(m₁)(m₂) = -1

gradient of perpendicular bisector of AB = $\frac{3}{2}$

Equation of line from one point $P(x_1, y_1)$ and gradient m is

$$y - y_1 = m(x - x_1)$$

Equation of perpendicular bisector of AB passing through $(7, 4)$ and gradient $\frac{3}{2}$

$$y - 4 = \frac{3}{2}(x - 7)$$

$$2(y - 4) = 3(x - 7)$$

$$2y - 8 = 3x - 21$$

$$2y = 3x - 21 + 8$$

$$2y = 3x - 13 \rightarrow \textcircled{1}$$

(ii)

if m_1 is the gradient of one line and m_2 is the gradient to second line, if these lines are parallel then
 $m_1 = m_2$

Gradient of line parallel to AB $= -\frac{2}{3}$

Equation of line parallel to AB and passing through $(3, 11)$ is

$$y - 11 = -\frac{2}{3}(x - 3)$$

$$3(y - 11) = -2(x - 3)$$

$$3y - 33 = -2x + 6$$

$$2x + 3y = 33 + 6$$

$$2x + 3y = 39 \rightarrow \textcircled{2}$$

from ①

$$2y = 3x - 13$$

$$y = \frac{3x-13}{2}$$

put this value, $y = \frac{3x-13}{2}$ in ②

$$2x + 3\left(\frac{3x-13}{2}\right) = 39$$

$$2(2x) + 3(3x-13) = 2(39)$$

$$4x + 9x - 39 = 78$$

$$13x = 78 + 39$$

$$13x = 117$$

$$x = \frac{117}{13}$$

$$x = 9$$

put $x = 9$ in $y = \frac{3x-13}{2}$

$$y = \frac{3(9)-13}{2}$$

$$= \frac{27-13}{2}$$

$$y = 7$$

$\therefore$ coordinates of C are (9, 7).

