

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 3-Coordinate Geometry

Question No (22)

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Question No (22)

Three points have coordinates A (0, 7), B (8, 3) and C (3k, k). Find the value of the constant k for which

- (i) C lies on the line that passes through A and B,
- (ii) C lies on the perpendicular bisector of AB.

Solution

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Given three points

(i) $A(0,7)$, $B(8,3)$, $C(3K,K)$

Formula for two parallel lines.

If m_1 is the gradient of one line
and m_2 is the gradient of second line
if they are parallel then

$$m_1 = m_2$$

Formula for gradient from
two points $A(x_1, y_1)$, $B(x_2, y_2)$

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

As C lies on the line passing through
A and B, so AB and AC are parallel,

$$\Rightarrow \text{gradient of AB} = \text{gradient of AC}$$

$$\frac{3-7}{8-0} = \frac{K-7}{3K-0}$$

$$\frac{-4}{8} = \frac{K-7}{3K}$$

$$-\frac{1}{2} = \frac{K-7}{3K}$$

$$-3K = 2(K-7)$$

$$-3K = 2K - 14$$

$$-3K - 2K = -14$$

$$-5K = -14$$

$$5K = 14$$

$$K = \frac{14}{5}$$

$$K = 2.8$$

(ii)

mid-point Formula

for two points $A(x_1, y_1)$, $B(x_2, y_2)$

$$\text{mid-point of } AB = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

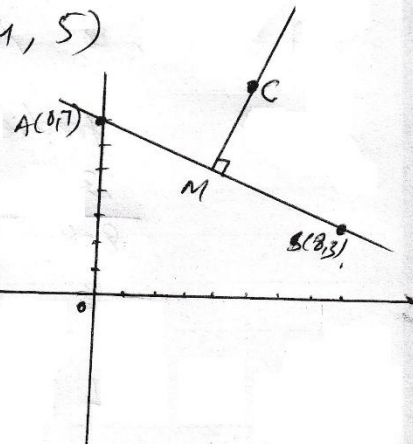
$$\text{now mid-point of } AB = \left(\frac{0+8}{2}, \frac{7+3}{2} \right)$$

$$= \left(4, 5 \right)$$

$$M = (4, 5)$$

Formula

when two lines
are perpendicular
then product of their
gradient is -1 i.e.
 $m_1 \times m_2 = -1$



$$(\text{Gradient of AB}) \times (\text{gradient of CM}) = -1$$

$$\left(\frac{3-7}{8-0}\right) \times \left(\frac{5-k}{4-3k}\right) = -1$$

$$\left(-\frac{4}{8}\right) \left(\frac{5-k}{4-3k}\right) = -1$$

$$\left(-\frac{1}{2}\right) \left(\frac{5-k}{4-3k}\right) = -1$$

$$\frac{5-k}{4-3k} = 2$$

$$5-k = 2(4-3k)$$

$$5-k = 8-6k$$

$$6k-k = 8-5$$

$$5k = 3$$

$$k = \frac{3}{5}$$