

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

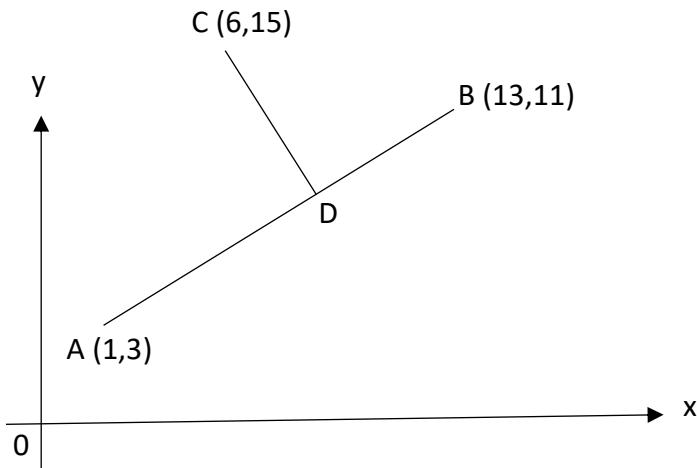
Topic 3-Coordinate Geometry

Question No (2)

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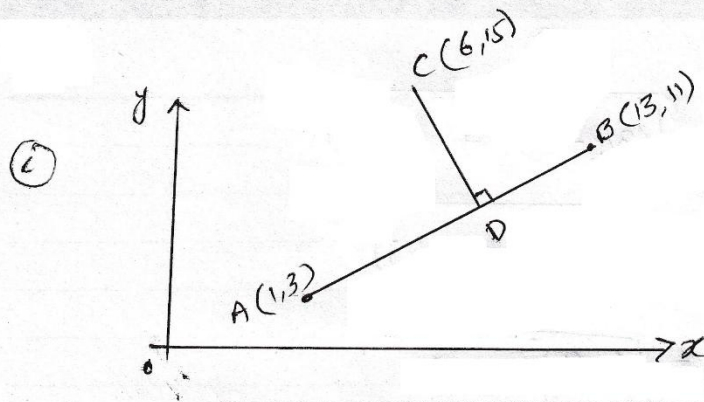
Question No (2)

The three points A (1, 3), B (13, 11) and C (6, 15) are shown in the diagram. The perpendicular from C to AB meets AB at the point D. Find

- (i) the equation of CD,
- (ii) the coordinates of D.

Solution

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How to find gradient
from two points

$A(x_1, y_1)$, $B(x_2, y_2)$

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

$$\text{gradient of } AB = \frac{11-3}{13-1}$$

$$= \frac{8}{12}$$

$$m_1 = \frac{2}{3}$$

if one line has gradient m_1
and other has m_2 , if they are
perpendicular then

$$m_1 \times m_2 = -1$$

if parallel

$$m_1 = m_2$$

if m_2 is the gradient of CD, then
 AS two lines are perpendicular then

$$m_1 \times m_2 = -1$$

$$\frac{2}{3} \times m_2 = -1$$

$$m_2 = -\frac{3}{2}$$

$$\text{gradient of CD} = -\frac{3}{2}$$

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

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

Equation of CD

$$y - 15 = -\frac{3}{2}(x - 6)$$

$$2(y - 15) = -3(x - 6)$$

$$2y - 30 = -3x + 18$$

$$3x + 2y = 18 + 30$$

$$3x + 2y = 48 \rightarrow (1)$$

(ii) Equation of line AB

$$y - y_1 = \text{gradient of AB} (x - x_1)$$

$$y - 3 = \frac{2}{3}(x - 1)$$

$$3(y-3) = 2(x-1)$$

$$3y - 9 = 2x - 2$$

$$2x - 3y + 9 - 2 = 0$$

$$2x - 3y + 7 = 0 \rightarrow (2)$$

Now we shall find the coordinates of D.

As AB and CD intersect, solving (1) and (2).

3 × Equation (1) + 2 × Equation (2), we have

$$9x + 6y - 144 = 0$$

$$4x - 6y + 14 = 0$$

$$13x - 130 = 0$$

$$13x = 130$$

$$x = \frac{130}{13} = 10$$

Put $x = 10$ in (2)

$$2(10) - 3(y) + 7 = 0$$

$$20 - 3y + 7 = 0$$

$$-3y = -27$$

$$y = \frac{27}{3} = 9$$

∴ point D is (10, 9).

