

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

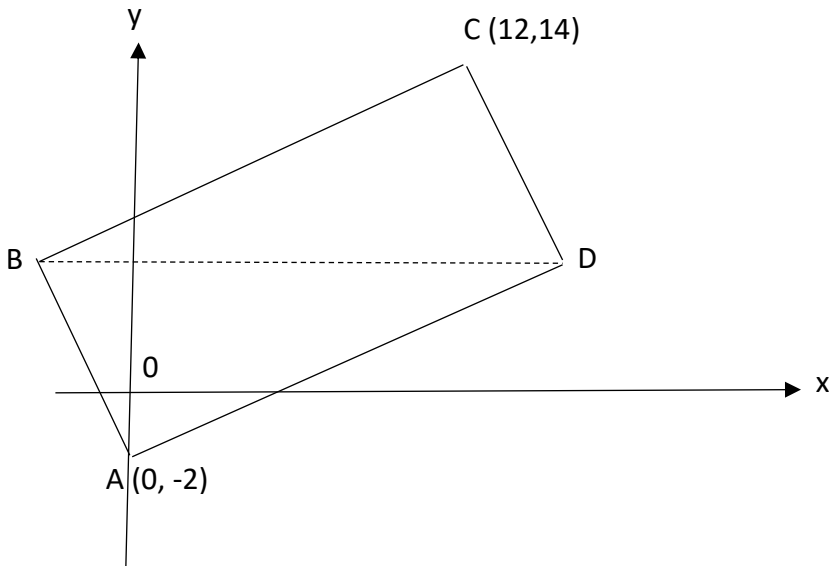
Topic 3-Coordinate Geometry

Question No (8)

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Question No (8)

The diagram shows a rectangle ABCD. The point A is $(0, -2)$ and C is $(12, 14)$. The diagonal BD is parallel to the x-axis.

(i) Explain why the y-coordinate of D is 6.

The x-coordinate of D is h .

(ii) Express the gradients of AD and CD in terms of h .

(iii) Calculate the x-coordinates of D and B.

(iv) Calculate the area of the rectangle ABCD.

Solution

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(i) AS DD is parallel to x -axis.

vertical distance from A to C is 16 units

\therefore vertical distance

between A and D is 8 units

\therefore y -coordinate of $D = 6$

$$8 - 14 = 6$$

$$8 - 2 = 6$$

(ii) AS $A(0, -2)$.

AS h The x -coordinate of D given is

$$\Rightarrow D(h, 6)$$

Gradient Formula

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

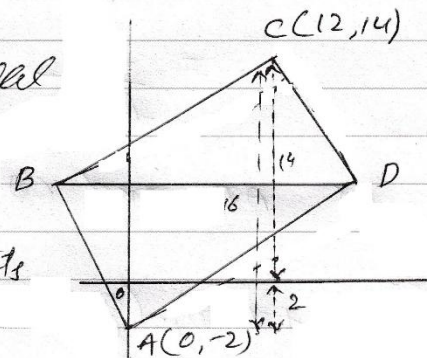
$$\text{gradient of } AB = \frac{y_2 - y_1}{x_2 - x_1}$$

\therefore gradient of

$$AD = \frac{6 - (-2)}{h - 0}$$

$$= \frac{6 + 2}{h}$$

$$= \frac{8}{h}$$



$$\begin{aligned}\text{Gradient of } CD &= \frac{6-14}{h-12} \\ &= \frac{-8}{h-12}\end{aligned}$$

(ii) AS AD and CD are perpendicular

So
(gradient of AD) \cdot (gradient of CD) = -1

$$\left(\frac{8}{h}\right) \left(\frac{-8}{h-12}\right) = -1$$

$$\begin{aligned}(8)(-8) &= (-1)(h)(h-12) \\ -64 &= -h^2 + 12h\end{aligned}$$

$$h^2 - 12h - 64 = 0$$

By Factorization

$$h^2 - 16h + 4h - 64 = 0$$

$$h(h-16) + 4(h-16) = 0$$

$$(h-16)(h+4) = 0$$

$$h-16 = 0, \quad h+4 = 0$$

$$h = 16, \quad h = -4$$

\therefore x-coordinate of B is -4 and
x-coordinate of D is 16.

(iv)

Distance formula

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

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

AS $A(0, -2), B(-4, 6)$ and $D(16, 6)$

$$|AB| = \sqrt{(-4 - 0)^2 + (6 - (-2))^2}$$

$$= \sqrt{16 + (8)^2}$$

$$= \sqrt{16 + 64}$$

$$|AB| = \sqrt{80}$$

NOW

$$AD = \sqrt{(16 - 0)^2 + (6 - (-2))^2}$$

$$= \sqrt{(16)^2 + (8)^2}$$

$$= \sqrt{256 + 64}$$

$$= \sqrt{320}$$

\therefore Area of Rectangle = width \times Length

$$= \sqrt{80} \times \sqrt{320}$$

$$= \sqrt{25600}$$

Area of rectangle ABCD = 160 square unit

