

Cambridge International AS & A Level

Mathematics

9709

Paper 1 Pure Mathematics 1

Topic 3-Coordinate Geometry

Question No (1)

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Question No (1)

The curve $y^2 = 12x$ intersects the line $3y = 4x + 6$ at two points. Find the distance between the two points.

Solution

Equation of curve

$$y^2 = 12x \rightarrow \textcircled{1}$$

Equation of line

$$3y = 4x + 6 \rightarrow \textcircled{2}$$

From $\textcircled{2}$

$$y = \frac{4x+6}{3} \rightarrow \textcircled{3}$$

put equation $\textcircled{3}$ in Equation $\textcircled{1}$

$$\left(\frac{4x+6}{3}\right)^2 = 12x$$

$$\frac{(4x+6)^2}{3^2} = 12x$$

$$\frac{(4x)^2 + 2(4x)(6) + 6^2}{9} = 12x$$

$$16x^2 + 48x + 36 = 108x$$

$$16x^2 + 48x - 108x + 36 = 0$$

$$16x^2 - 60x + 36 = 0$$

$$4(4x^2 - 15x + 9) = 0$$

$$\Rightarrow 4x^2 - 15x + 9 = 0$$

factorize

$$4x^2 - 12x - 3x + 9 = 0$$

$$4x(x-3) - 3(x-3) = 0$$

$$(x-3)(4x-3) = 0$$

$$x-3=0, \quad 4x-3=0$$

$$x=3, \quad x=3/4$$

when $x=3$

from Equation ③

$$y = \frac{4x+6}{3}$$

$$y = \frac{4(3)+6}{3}$$

$$= \frac{12+6}{3}$$

$$= \frac{18}{3}$$

$$y = 6$$

$$P(3, 6)$$

when $x=3/4$

from equation ③

$$y = \frac{4x+6}{3}$$

$$= \frac{4(3/4)+6}{3}$$

$$= \frac{3+6}{3}$$

$$= 3$$

$$y = 3$$

$$Q(3/4, 3)$$

distance between two
points $P(x_1, y_1), Q(x_2, y_2)$

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

$$\text{distance} = \sqrt{\left(3\frac{1}{4} - 3\right)^2 + (3 - 6)^2}$$

$$= \sqrt{\left(\frac{3-12}{4}\right)^2 + (-3)^2}$$

$$= \sqrt{\left(\frac{-9}{4}\right)^2 + 9}$$

$$= \sqrt{\frac{81}{16} + 9}$$

$$= \sqrt{\frac{21 + 144}{4}}$$

$$\text{distance} = \frac{15}{4}$$