

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 1-Quadratics

Question No (11)

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The straight line $y = mx + 14$ is a tangent to the curve $y = \frac{12}{x} + 2$ at the point P. Find the value of the constant m and the coordinates of P.

Solution

Equation of line

$$y = mx + 14 \rightarrow \textcircled{1}$$

Equation of curve

$$y = \frac{12}{x} + 2 \rightarrow \textcircled{2}$$

solving $\textcircled{1}$ & $\textcircled{2}$ simultaneously

$$mx + 14 = \frac{12}{x} + 2$$

$$x(mx + 14) = 12 + 2x$$

$$mx^2 + 14x = 12 + 2x$$

$$mx^2 + 14x - 2x - 12 = 0$$

$$mx^2 + 12x - 12 = 0 \rightarrow \textcircled{3}$$

As line is tangent to curve
discriminant $b^2 - 4ac = 0$

$$(12)^2 - 4(m)(-12) = 0$$

$$144 + 48m = 0$$

$$48m = -144$$

$$m = \frac{-144}{48}$$

$$m = -3$$

Now we find the point P

put $m = -3$ in $\textcircled{3}$

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

$$-3(x^2 - 4x + 4) = 0$$

$$x^2 - 4x + 4 = 0$$

$$(x-2)^2 = 0$$

$$\Rightarrow x-2 = 0$$

$$x = 2$$

put $x = 2$ in

$$y = \frac{12}{x} + 2$$

$$= \frac{12}{2} + 2$$

$$= 6 + 2$$

$$y = 8$$

$$\therefore P(2, 8)$$