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JC MATHEMATICS (H2) STUDY TIPS

**MASTERING TANGENT AND
NORMAL DIFFERENTIATION:
ADVANCED INSIGHTS AND
STRATEGIES**

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JC_H2Maths_036



Example 14

On the curve with equation $5x^2 + 12xy + 20y^2 = 5$, there are 2 points at which the tangents are parallel to the y-axis. Find the coordinates of these 2 points.

Differentiate w.r.t. x :

$$10x + 12\left(x \frac{dy}{dx} + y\right) + 40y \frac{dy}{dx} = 0$$

$$10x + 12x \frac{dy}{dx} + 12y + 40y \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = - \frac{10x + 12y}{12x + 40y} = - \frac{5x + 6y}{6x + 20y}$$

$$\text{Tangent } \parallel \text{ to } y\text{-axis} \Rightarrow \frac{dy}{dx} \rightarrow \infty \Rightarrow 6x + 20y = 0$$

$$\Rightarrow y = -\frac{6x}{20} = -\frac{3x}{10}$$

* Note:

This is NOT the eqⁿ of tangent.

This only tells us how x and y are related at the pt. of the curve where the tangent is $\parallel$ to the y -axis.

$$\therefore 5x^2 + 12x\left(-\frac{3x}{10}\right) + 20\left(-\frac{3x}{10}\right)^2 = 5$$

$$\Rightarrow 500x^2 - 360x^2 + 180x^2 = 500$$

$$x^2 = \frac{500}{320} = \frac{25}{16} \Rightarrow x = \pm \frac{5}{4}$$

$$\therefore x = \frac{5}{4}, y = -\frac{3}{8} \quad \text{or} \quad x = -\frac{5}{4}, y = \frac{3}{8}$$

$$\Rightarrow \text{The 2 pts. are } \left(\frac{5}{4}, -\frac{3}{8}\right) \text{ and } \left(-\frac{5}{4}, \frac{3}{8}\right)$$



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Explanation

This example outlines a worked calculus solution designed to find the coordinates on a curve where the tangents are parallel to the vertical axis.

The process involves differentiating the curve's equation to find the slope expression, then setting its denominator to zero since vertical lines have an undefined slope.

A crucial note handwritten in orange marks a key interpretive moment: it explicitly warns that the resulting simplified relationship between the two variables is not the equation of the tangent line.

Instead, as the orange text explains, it merely reveals how the coordinates are related at the specific points on the curve where the tangent runs parallel to the vertical axis. The solution concludes by using this relationship to solve for the exact coordinate points.

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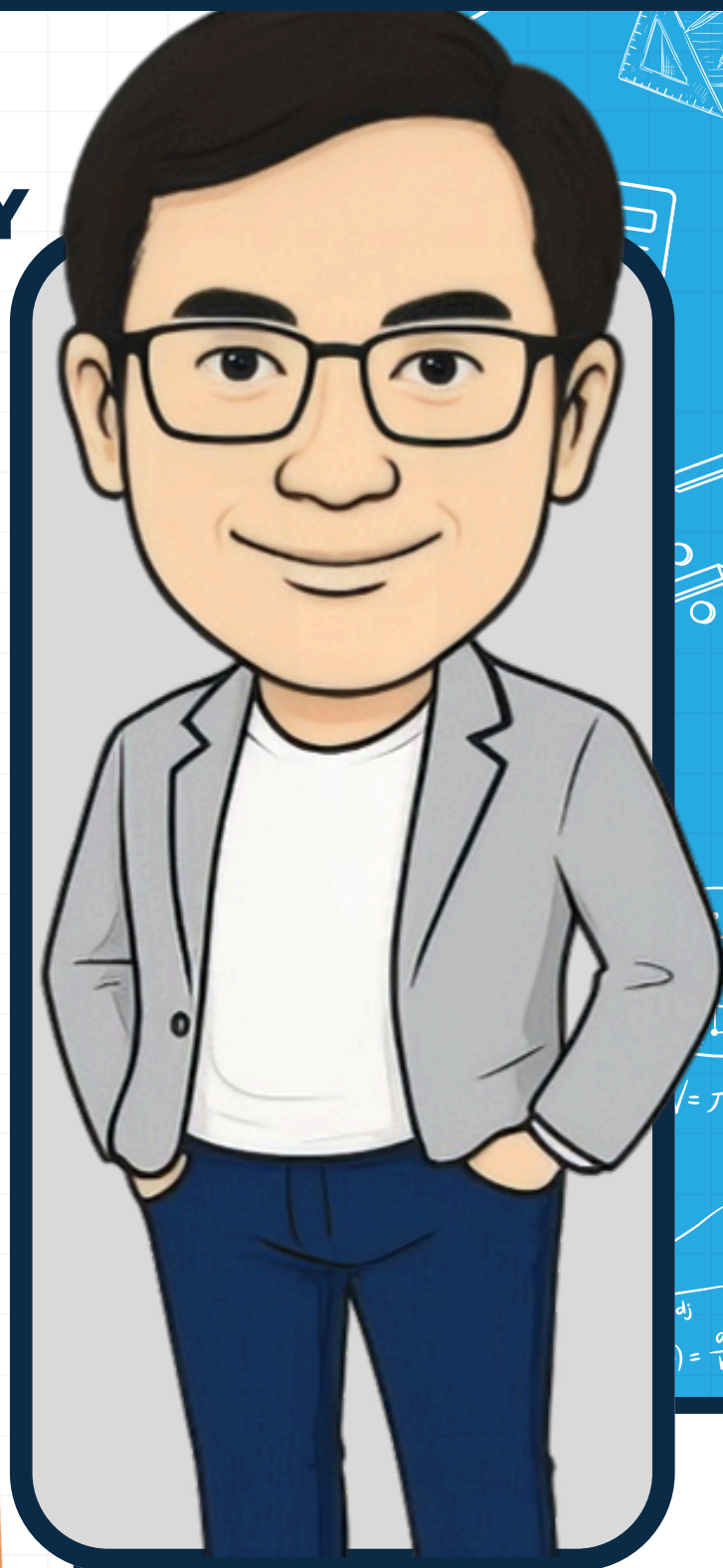
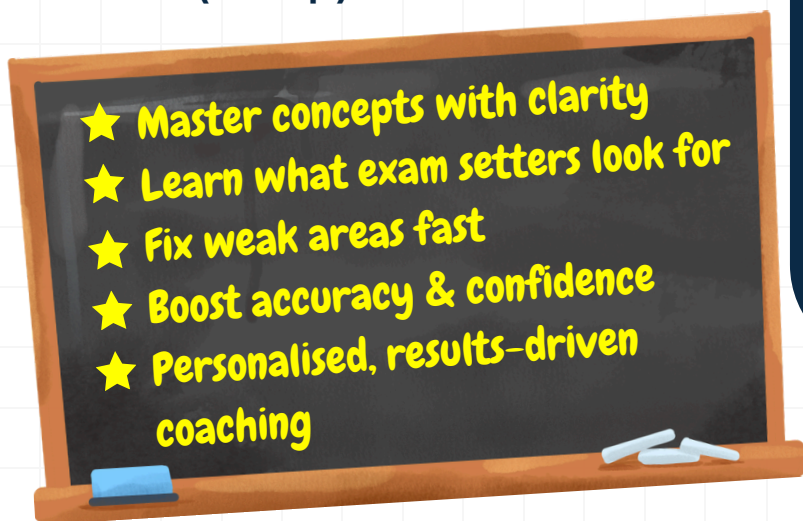
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