

LC 2013 (SET D): PAPER 1

QUESTION 5 (25 MARKS)

Question 5 (a)

$$y = 2x^3 - 3x^2 - 1$$

$$\frac{dy}{dx} = 6x^2 - 6x$$

FORMULAE AND TABLES BOOK
Calculus: Derivatives [page 25]

$$y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$$

Question 5 (b)

METHOD 1: Multiply out the brackets and differentiate term by term.

$$\begin{aligned} y &= (2x^2 + 3x + 1)(x^3 - x + 2) \\ &= 2x^5 - 2x^3 + 4x^2 + 3x^4 - 3x^2 + 6x + x^3 - x + 2 \\ &= 2x^5 + 3x^4 - x^3 + x^2 + 5x + 2 \end{aligned}$$

$$\frac{dy}{dx} = 10x^4 + 12x^3 - 3x^2 + 2x + 5$$

METHOD 2: Use the product rule (this is not on the new course)

$$\begin{aligned} \frac{dy}{dx} &= (2x^2 + 3x + 1)(3x^2 - 1) + (x^3 - x + 2)(4x + 3) \\ &= 6x^4 - 2x^2 + 9x^3 - 3x + 3x^2 - 1 + 4x^4 + 3x^3 - 4x^2 - 3x + 8x + 6 \\ &= 10x^4 + 12x^3 - 3x^2 + 2x + 5 \end{aligned}$$

$$y = uv \Rightarrow \frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$u = (2x^2 + 3x + 1) \Rightarrow \frac{du}{dx} = 4x + 3$$

$$v = (x^3 - x + 2) \Rightarrow \frac{dv}{dx} = 3x^2 - 1$$

Question 5 (c)

This is done using the quotient rule which is not on the new course.

$$\begin{aligned} \frac{dy}{dx} &= \frac{(2x+5)3 - 3x(2)}{(2x+5)^2} = \frac{6x+15-6x}{(2x+5)^2} = \frac{15}{(2x+5)^2} \\ \left(\frac{dy}{dx}\right)_{x=0} &= \frac{15}{(2(0)+5)^2} = \frac{15}{5^2} = \frac{15}{25} = \frac{3}{5} \end{aligned}$$

$$y = \frac{u}{v} \Rightarrow \frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$u = 3x \Rightarrow \frac{du}{dx} = 3$$

$$v = 2x + 5 \Rightarrow \frac{dv}{dx} = 2$$

MARKING SCHEME NOTES

Question 5 [Scale 25C (0, 8, 17, 25)]

This question required a range of skills, only some of which are on the syllabus for these candidates. Marking focuses only on the syllabus-related skills

8: • Displays syllabus related skills, e.g. correct differentiation of one term only

17: • Correct differentiation of two terms only

• Correct coefficient for each term but error(s) in indices

• Correct indices for each term but error(s) in coefficients

Note: Consistently displays syllabus-related skills, e.g. three terms correctly differentiated, award full credit

AUTHOR'S NOTE: This question was a serious error by the SEC, including material from the old syllabus which is no longer on the new syllabus.