

LC 2014: PAPER 1**QUESTION 4 (25 MARKS)****Question 4 (a)**

$$f(x) = 2x^2 - 3x - 6$$

$$\begin{aligned} f(x+h) &= 2(x+h)^2 - 3(x+h) - 6 \\ &= 2(x^2 + 2hx + h^2) - 3x - 3h - 6 \\ &= 2x^2 + 4hx + 2h^2 - 3x - 3h - 6 \end{aligned}$$

$$\begin{aligned} f(x+h) - f(x) &= 2x^2 + 4hx + 2h^2 - 3x - 3h - 6 - 2x^2 + 3x + 6 \\ &= 4hx + 2h^2 - 3h \end{aligned}$$

$$\frac{f(x+h) - f(x)}{h} = \frac{4hx + 2h^2 - 3h}{h} = 4x + 2h - 3$$

$$\lim_{h \rightarrow 0} \left[\frac{f(x+h) - f(x)}{h} \right] = \lim_{h \rightarrow 0} (4x + 2h - 3) = 4x - 3$$

MARKING SCHEME NOTES**Question 4 (a) [Scale 15D (0, 5, 9, 12, 15)]**

- 5:** • Introduces $f(x+h)$
- 9:** • $f(x+h) - f(x)$ expressed (need not be simplified)
• RHS only
- 12:** • $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ (need not be simplified)

Question 4 (b)

$$f(x) = \frac{2x}{x+2}$$

$$f'(x) = \frac{(x+2)2 - 2x(1)}{(x+2)^2} = \frac{2x+4-2x}{(x+2)^2} = \frac{4}{(x+2)^2}$$

$$f'(x) = \frac{1}{4} \Rightarrow \frac{4}{(x+2)^2} = \frac{1}{4}$$

$$16 = (x+2)^2$$

$$(x+2) = \pm 4$$

$$\therefore x = -6, 2$$

$$f(x) = \frac{2x}{x+2}$$

$$x = -6: f(-6) = \frac{2(-6)}{(-6)+2} = 3$$

$$x = 2: f(2) = \frac{2(2)}{(2)+2} = 1$$

Therefore, (-6, 3) and (2, 1) are the co-ordinates of the points.

FORMULAE AND TABLES BOOK
Calculus: Quotient rule [page 25]

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

MARKING SCHEME NOTES**Question 4 (b) [Scale 10D (0, 3, 7, 8, 10)]**

3: • Either $\frac{du}{dx}$ or $\frac{dv}{dx}$ correct

• No differentiation but writes $f'(x) = \frac{1}{4}$

7: • $f'(x)$ correct but not simplified

8: • Correct values of x from students work