QUESTION 4 (25 MARKS)

Question 4 (a)

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

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

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

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

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

Question 4 (b)

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

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

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

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

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

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

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

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

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

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

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