

Question	Scheme	Marks	AOs
6	$\frac{5(x+h)^3 - 5x^3}{h} = \dots$	M1	2.1
	$(x+h)^3 = x^3 + 3x^2h + 3xh^2 + h^3$ or e.g. $(x+h)^3 = x^3 + x^2h + 2x^2h + xh^2 + 2xh^2 + h^3$	B1	1.1b
	$\frac{5(x+h)^3 - 5x^3}{h} = \frac{5(x^3 + 3x^2h + 3xh^2 + h^3) - 5x^3}{h}$ $= \frac{15x^2h + 15xh^2 + 5h^3}{h}$	A1	2.1
	$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{15x^2h + 15xh^2 + 5h^3}{h} = \lim_{h \rightarrow 0} (15x^2 + 15xh + 5h^2) = 15x^2 *$	A1*	2.5
		(4)	
	(4 marks)		

Throughout the question allow the use of δx for h or any other letter e.g. α if used consistently. If δx is used then you can condone e.g. δ^2x for $(\delta x)^2$ as well as condoning e.g. poorly formed δ's M1: Begins the process by writing down the gradient of the chord and attempts to expand $(x+h)^3$ to at least $\dots x^3 + \dots h^3$ where “...” is non-zero. Condone “poor” cubing e.g. $(x+h)^3 = x^3 + h^3$ but the $-5x^3$ must be present and correct. B1: A correct expansion of $(x+h)^3$ which can be simplified or unsimplified and may be implied by e.g. $5(x+h)^3 = 5x^3 + 15x^2h + 15xh^2 + 5h^3$ A1: Reaches a correct fraction oe with the x^3 terms cancelled out. E.g. $\frac{15x^2h + 15xh^2 + 5h^3}{h}$, $\frac{\cancel{5x^3} + 15x^2h + 15xh^2 + 5h^3 - \cancel{5x^3}}{h}$, $15x^2 + 15xh + 5h^2$ Allow unsimplified e.g. $\frac{5x^2h + 10x^2h + 5xh^2 + 10xh^2 + 5h^3}{h}$ A1*: Completes the process by applying a limiting argument and deduces that $\frac{dy}{dx} = 15x^2$ with no errors seen. The “$\frac{dy}{dx} =$” does not have to appear but there must be something equivalent e.g. “$f'(x) =$” or “Gradient =” which must appear at least once but can appear anywhere in their working. If $f'(x)$ is used then there is no requirement to see $f(x)$ defined first. Condone e.g. $\frac{dy}{dx} \rightarrow 15x^2$ or $f'(x) \rightarrow 15x^2$. Condone missing brackets so allow e.g. $\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{15x^2h + 15xh^2 + 5h^3}{h} = \lim_{h \rightarrow 0} 15x^2 + 15xh + 5h^2 = 15x^2$ Do not allow $h = 0$ if there is never a reference to $h \rightarrow 0$. The $h \rightarrow 0$ must be seen at least once but does not need to be present throughout the proof e.g. on every line.			
---	--	--	--

They must reach $15x^2 + 15xh + 5h^2$ or (e.g. with terms not collected) and not e.g.

$\frac{15x^2 \cancel{h} + 15xh^{\cancel{2}} + 5h^{\cancel{2}2}}{\cancel{h}}$ to complete the limiting argument.

Must follow all previous marks so profiles such as 1101 and 1001 are not possible

In question 6, attempts to use e.g. $\frac{5x^3 - 5(x-h)^3}{h}$ are acceptable and can be marked in a similar way.