| Question | Scheme | Marks | AOs |
|---|---|---|---|
| 4 | $\dfrac{2(x+h)^2-2x^2}{h}=\ldots$ | M1 | 2.1 |
| | $\dfrac{2(x+h)^2-2x^2}{h}=\dfrac{4xh+2h^2}{h}$ | A1 | 1.1b |
| | $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\lim\limits_{h\to 0}\dfrac{4xh+2h^2}{h}=\lim\limits_{h\to 0}(4x+2h)=4x$ * | A1* | 2.5 |
| | | **(3)** | |
| | | | **(3 marks)** |

**Notes:**

Throughout the question allow the use of $\delta x$ for $h$ or any other letter e.g. $\alpha$ if used consistently.
If $\delta x$ is used then you can condone e.g. $\delta^2 x$ for $\delta x^2$ as well as condoning e.g. poorly formed $\delta$'s

**M1**: Begins the process by writing down the gradient of the chord and attempts to expand the correct bracket – you can condone "poor" squaring e.g. $(x+h)^2=x^2+h^2$.

Note that $\dfrac{2(x-h)^2-2x^2}{-h}=\ldots$ is also a possible approach.

**A1**: Reaches a correct fraction oe with the $x^2$ terms cancelled out.

E.g. $\dfrac{4xh+2h^2}{h}$, $\dfrac{\cancel{2x^2}+4xh+2h^2-\cancel{2x^2}}{h}$, $4x+2h$

**A1***: Completes the process by applying a limiting argument and deduces that $\dfrac{\mathrm{d}y}{\mathrm{d}x}=4x$ with no errors seen. The "$\dfrac{\mathrm{d}y}{\mathrm{d}x}=$" doesn't have to appear but there must be something equivalent e.g. "$\mathrm{f}'(x)=$" or "Gradient =" which can appear anywhere in their working. If $\mathrm{f}'(x)$ is used then there is no requirement to see f $(x)$ defined first. Condone e.g. $\dfrac{\mathrm{d}y}{\mathrm{d}x}\to 4x$ or $\mathrm{f}'(x)\to 4x$.

Condone missing brackets so allow e.g. $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\lim\limits_{h\to 0}\dfrac{4xh+2h^2}{h}=\lim\limits_{h\to 0}4x+2h=4x$

Do not allow $h=0$ if there is never a reference to h→0

e.g. $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\lim\limits_{h\to 0}\dfrac{4xh+2h^2}{h}=\lim\limits_{h\to 0}4x+2(0)=4x$ is acceptable

but e.g. $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{4xh+2h^2}{h}=4x+2h=4x+2(0)=4x$ is not if there is no h→0 seen.

The h→0 does not need to be present throughout the proof e.g. on every line.

They must reach $4x+2h$ at the end and not $\dfrac{4xh+2h^2}{h}$ (without the $h$'s cancelled) to complete the limiting argument.