

Q	Marking Instructions	AO	Marks	Typical Solution
9(a)	Shows how this particular value has been calculated As in typical solution Or $(-6.51 - (-6)) \div (3.1 - 3)$	AO1.1b	B1	$(-6.51 - (-6)) \div 0.1$
(b)	Calculates values for $(x + h)$ and $f(x + h)$ CAO	AO1.1b	B1	3.01, -6.0501
	Calculates value for gradient	AO1.1b	B1	-5.01
(c)	Infers suggested limit	AO2.2b	B1	-5
(d)	Recalls and applies formula for gradient	AO1.2	M1	$\text{Gradient} = \frac{f(3+h) - f(3)}{h}$ $= \frac{(3+h) - (3+h)^2 - (3 - 3^2)}{h}$ $= \frac{-h^2 - 5h}{h}$ $= -h - 5$ <p>As $h \rightarrow 0$, gradient $\rightarrow -5$</p> <p>When $x = 3$ gradient = -5</p>
	Substitutes correct expressions for $f(3 + h)$ and $f(3)$	AO1.1b	A1	
	Simplifies to obtain $-h - 5$	AO1.1b	A1	
	Evaluates gradient at $x = 3$ and shows that it is the required value. Constructs rigorous mathematical argument to show the required result. Only award if they have a completely correct solution, using $h \rightarrow 0$ (not =0)	AO2.1	R1	
Total			8	

(d)	Alternative Recalls and applies formula for gradient	AO1.2	M1
	Substitutes correct expressions for $f(x + h)$ and $f(x)$	AO1.1b	A1
	Simplifies to obtain $-h - (2x - 1)$	AO1.1b	A1
	Evaluates gradient at $x = 3$ and shows that it is the required value. Constructs rigorous mathematical argument to show the required result. Only award if they have a completely correct solution, which is clear, easy to follow and contains no slips.	AO2.1	R1

$$\begin{aligned} \text{Gradient} &= \frac{f(x+h) - f(x)}{h} \\ &= \frac{(x+h) - (x+h)^2 - (x-x^2)}{h} \\ &= \frac{-h^2 - (2x-1)h}{h} \\ &= -h - (2x-1) \end{aligned}$$

As $h \rightarrow 0$, gradient $\rightarrow -(2x - 1)$

When $x = 3$ gradient = -5

Total

4