Question	Scheme	Marks	AOs
2(a)	$f'(x) = \alpha(1+x)^{-1}$ $f''(x) = \beta(1+x)^{-2}$ $f'''(x) = \gamma(1+x)^{-3}$ $f^{iv}(x) = \delta(1+x)^{-4}$	M1	2.1
	$f'(x) = (1+x)^{-1}$ $f''(x) = -1(1+x)^{-2}$ $f'''(x) = 2(1+x)^{-3}$ $f^{iv}(x) = -6(1+x)^{-4}$	A1	1.1b
	$f'(0) = (1+0)^{-1} = 1$ $f''(0) = -1(1+0)^{-2} = -1$ $f'''(0) = 2(1+0)^{-3} = 2$ $f^{iv}(0) = -6(1+0)^{-4} = -6$	M1	1.1b
	$f(x) = f(0) + f'(0)x + \frac{f''(0)x^2}{2} + \frac{f'''(0)x^3}{6} + \frac{f^{iv}(0)x^4}{24}$	M1	2.5
	$f(x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4}$ *	A1*	1.1b
		(5)	
(b)	$g(x) = \ln\left(\frac{1+2x}{(1-2x)^2}\right) = \ln(1+2x) - 2\ln(1-2x)$	B1	3.1a
	$\ln(1-2x) = (-2x) - \frac{(-2x)^2}{2} + \frac{(-2x)^3}{3} - \frac{(-2x)^4}{4}$ $\ln(1+2x) = (2x) - \frac{(2x)^2}{2} + \frac{(2x)^3}{3} - \frac{(2x)^4}{4}$	M1	2.2a
	$g(x) = \left[2x - 2x^2 + \frac{8}{3}x^3 - 4x^4\right] - 2\left[-2x - 2x^2 - \frac{8}{3}x^3 - 4x^4\right]$ $= 6x + 2x^2 + 8x^3 + 4x^4$	A1	1.1b
		(3)	

(8 marks)

Notes:

(a)

M1: Differentiates four times to achieve the required form

A1: All four derivatives correct

M1: Evaluates $f'(0)$, $f''(0)$, $f'''(0)$ and $f^{iv}(0)$

M1: Correct use of Maclaurin series up to the term in x^4

A1*: Correct solution, with no errors seen

(b)

B1: Writes $g(x)$ as linear ln terms

M1: Deduces the series expansions for $\ln(1+2x)$ and $\ln(1-2x)$. Do NOT allow a restart, they must use the expansion in part (a).

A1: Correct series expansion.