Question	Scheme	Marks	AOs
3(a)	$f'(x) = A\left(1-x^2\right)^{-\frac{1}{2}}$ $f''(x) = Bx\left(1-x^2\right)^{-\frac{3}{2}}$ and $f'''(x) = C\left(1-x^2\right)^{-\frac{3}{2}} + Dx^2\left(1-x^2\right)^{-\frac{5}{2}}$ or $\frac{C\left(1-x^2\right)^{\frac{3}{2}} + Dx^2\left(1-x^2\right)^{\frac{1}{2}}}{\left(1-x^2\right)^3}$	M1	2.1
	$f'(x) = \left(1-x^2\right)^{-\frac{1}{2}}$ or $\frac{1}{\sqrt{1-x^2}}$ $f''(x) = x\left(1-x^2\right)^{-\frac{3}{2}}$ or $\frac{x}{\left(1-x^2\right)^{\frac{3}{2}}}$ and $f'''(x) = \left(1-x^2\right)^{-\frac{3}{2}} + 3x^2\left(1-x^2\right)^{-\frac{5}{2}}$ or $\frac{1}{\left(1-x^2\right)^{\frac{3}{2}}} + \frac{3x^2}{\left(1-x^2\right)^{\frac{5}{2}}}$ from quotient rule $\frac{\left(1-x^2\right)^{\frac{3}{2}} + 3x^2\left(1-x^2\right)^{\frac{1}{2}}}{\left(1-x^2\right)^3}$	A1	1.1b
	Finds $f(0)$, $f'(0)$, $f''(0)$ and $f'''(0)$ and applies the formula $f(x) = f(0) + f'(0)x + f''(0)\frac{x^2}{2} + f'''(0)\frac{x^3}{6}$ $\{f(0) = 0,\ f'(0) = 1,\ f''(0) = 0,\ f'''(0) = 1\}$	M1	1.1b
	$f(x) = x + \frac{x^3}{6}$ cso	A1	1.1b
		(4)	
(b)	$\arcsin\left(\frac{1}{2}\right) = \frac{1}{2} + \frac{\left(\frac{1}{2}\right)^3}{6} = \frac{\pi}{6} \Rightarrow \pi = \ldots$	M1	1.1b
	$\pi = \frac{25}{8}$ o.e.	A1ft	2.2b
		(2)	
			(6 marks)

Notes:

(a)

M1: Finds the correct form of the first three derivatives, may be unsimplified – the third may come later.

A1: Correct first three derivatives, may be unsimplified – the third may come later.

M1: Finds $f(0)$, $f'(0)$, $f''(0)$ and $f'''(0)$ and applies to the correct formula, needs to go up to x^3.

A1: $x + \frac{x^3}{6}$ cso ignore any higher terms whether correct or not

Special case: If they think that their $f''(0) \neq 0$ then maximum score M1 A0 M1 A0

M1 for correct form of the first two derivatives

M1 Correctly uses their $f(0)$, $f'(0)$, $f''(0)$ and applies to the correct formula

Note: If candidates do not find the first three derivatives but use $f(0)=0,\ f'(0)=1,\ f''(0)=0,\ f'''(0)=1$ and use these correctly in the formula this can score M0 A0 M1 A0
(b) **M1:** Substitutes $x=\frac{1}{2}$ into both sides and rearranges to find $\pi = \ldots$ **A1ft:** Infers that $\pi=\frac{25}{8}$ o.e. Follow through their $6f\left(\frac{1}{2}\right)$