Question	Scheme	Marks	AOs
<b>2</b> (a)	$f'(x) = 12x^3 + 4x - 12$	B1	1.1b
	Sets $f'(x) = 0 \Rightarrow x^3 = \frac{12 - 4x}{12}$	M1	1.1b
	$x = \sqrt[3]{1 - \frac{x}{3}} *$	A1*	2.1
		(3)	
(b)	$x_2 = \sqrt[3]{1 - \frac{1}{3}}$	M1	1.1b
	$x_2 = 0.8736$	A1	1.1b
	$x_5 = 0.8894$	A1	1.1b
		(3)	
	Attempts $f'(0.8885) = -0.029$ and $f'(0.8895) = 0.003$	M1	3.1a
(c)	States that (1) there is a change of sign and (2) $f'(x)$ is continuous	Δ 1	2.4
	with the conclusion that $\alpha = 0.889$ to 3 dp	Al	∠.4
		(2)	
			(8 marks)

## Notes:

**(a)** 

**B1:** Differentiates correctly  $f'(x) = 12x^3 + 4x - 12$  Allow this when unsimplified.

**M1:** Attempts to set their f'(x) = 0 and proceeds to make  $x^3$  the subject

A1\*: Achieves 
$$x = \sqrt[3]{1 - \frac{x}{3}}$$
 with no errors (b)

M1: Attempts to use the iterative formula with  $x_1 = 1$ . This is implied by sight of  $x_2 = \sqrt[3]{\frac{2}{3}}$  or awrt 0.87

**A1:** 
$$x_2 = 0.8736$$

**A1:** 
$$x_5 = 0.8894$$

(c)

M1: Attempts to substitute x = 0.8885 and x = 0.8895 into a suitable function and gets one value correct (rounded or truncated to 1 sf)

Suitable functions are e.g;  $f'(x) = 12x^3 + 4x^2 - 12$ ,  $g(x) = \pm \left(3x^3 + x^2 - 3\right)$   $h(x) = \pm \left(x - \sqrt[3]{1 - \frac{x}{3}}\right)$ 

## A1: Requires

- both calculations to be correct (rounded or truncated to 1sf)
- a statement that the function is continuous (within the given interval)
- a correct conclusion, eg hence  $\alpha = 0.889$  to 3 dp