Question Number	Scheme	Notes	Marks
7(a)	$f(x)=x^{\frac{3}{2}}+x-3$ $f(1)=1+1-3=-1 \quad f(2)=\sqrt{8}+2-3=1.828...$	Calculates values for both f(1) and f(2) with one correct. Allow e.g., f(2) = $2\sqrt{2}-1$ or awrt 2	M1
	f is **continuous** and **changes sign**, so **root** or α in [1, 2]. Correct interval [1, 2] if given. Sign change can be implied by "negative, positive", "f(1) < 0, f(2) > 0" or "f(1)f(2) < 0"	**Correct values** and sight of **continuous**, **sign change** and e.g., **root/shown/QED/true/proven/✓**	A1
			(2)
(b) **Work may be seen in a table**	$f(1.5)=1.5^{\frac{3}{2}}+1.5-3 \quad \{=...0.3371...\}$	Obtains a numerical expression or value for f (1.5)	M1
	$f(1.25)=1.25^{\frac{3}{2}}+1.25-3=... \quad \{-0.3524...\}$	Obtains a value for f(1.25). **Requires previous M mark.**	**d**M1
	$\Rightarrow$ root/α /x/it's in/on/$\in$ [1.25, 1.5] or "**in** [1.25, 1.5]" or $1.25 \leqslant$ root/α /$x \leqslant 1.5$	Correct values (awrt 0.3 and –0.3 or –0.4) and suitable conclusion. Allow "between $\frac{5}{4}$ and $\frac{3}{2}$ **inclusive**"	A1
	Do not accept [1.5, 1.25]. Just "f(1.25) = ... **followed by** f(1.5) = ... so..." is 100 if no evidence of interval bisection. There are no marks if it is a clear attempt at interpolation.		**(3)**
(c)(i)	$f'(x)=\frac{3}{2}x^{\frac{1}{2}}+1$	Correct differentiation. Any correct equivalent e.g., $1.5\sqrt{x}+1$	B1
(ii)	$\alpha \approx 1.375-\frac{1.375^{\frac{3}{2}}+1.375-3}{"\frac{3}{2}\times 1.375^{\frac{1}{2}}+1"}=...$ $\left\{\begin{array}{c}=1.375-\frac{-0.01266958256...}{2.75890591...}=1.375+0.004592248875...\\=1.379592249...\end{array}\right\}$ $\left\{\text{exact values}: \frac{11}{8}-\frac{11\sqrt{22}-52}{32}\div\frac{8+3\sqrt{22}}{8}\right\}$	Correctly applies the Newton-Raphson formula with 1.375 & their $f'(x)$ **and** obtains a value. Some working must be seen unless approx. root is seen correct to 6 d.p. accuracy (1.379592) or better. Allow "$...=1.375-\frac{f(1.375)}{f'(1.375)}$" followed by value but formula must be **fully** substituted if just followed by value unless "x_0" defined	M1
	awrt 1.380 or "1.38" (Ignore further iterations)	No clearly incorrect work.	A1
	NB Actual root is 1.379589808. Answer only is no marks.		**(3)**
(d)	e.g., $\frac{\alpha-1.25}{1.5-\alpha}=\frac{0.3524575141...}{0.3371173071...}$ or e.g., $\frac{1.5-\alpha}{0.337...}=\frac{1.5-1.25}{0.337...+0.352...}$	Forms an equation in e.g., α with their f(1.25) and f(1.5) allowing for sign errors only but must be using differences. Allow use of "f(1.25)" and "f(1.5)"- could recover sign error	M1
	$\alpha=1.377780737...=1.378$	**d**M1: Solves $\Rightarrow$ value **Requires previous M mark.** A1: awrt 1.378	**d**M1 A1
	May use a formula. Allow work in, e.g., x for all marks. No working required for 2nd M		**(3)**
Alt (Equation of line methods)	or $y-(-0.3524...[\text{or } 0.3371...])=\frac{0.3371...-(-0.3524...)}{1.5-1.25}(x-1.25[\text{or}1.5])$ or $-0.3524...[\text{or } 0.3371...]=\frac{0.3371...-(-0.3524...)}{1.5-1.25}(1.25[\text{or}1.5])+c \Rightarrow c=...$ A full method to determine the equation of the line using their f(1.25) and f(1.5) allowing for sign errors only (but allow subsequent errors finding c if $y = mx + c$ used)		M1
	$\{\Rightarrow y=2.758...x-3.800...\}$ $\alpha=1.377780737...=1.378$	**d**M1: Puts $y = 0$ and solves $\Rightarrow$ value **Requires previous M mark.** A1: awrt 1.378	**d**M1 A1 **(3)**
	May use a formula. Allow work in, e.g., x for all marks. No working required for 2nd M		**Total 11**