Question Number	Scheme	Notes	Marks
4	$f(x)=\frac{3}{2}x^3-6\sqrt{x}+\frac{1}{x}$		
(a)	$f'(x)=\frac{9}{2}x^2-3x^{-\frac{1}{2}}-\frac{1}{x^2}$	M1: One term differentiated correctly A1: Fully correct differentiation (any form). Condone $-1x^{-2}$ for final term.	**M1** **A1**
			(2)
(b)	$x_1=0.25-\frac{f(0.25)}{f'(0.25)}$ $=0.25-\frac{\frac{3}{2}(0.25)^3-6\sqrt{0.25}+\frac{1}{0.25}}{\frac{9}{2}(0.25)^2-3(0.25)^{-\frac{1}{2}}-\frac{1}{(0.25)^2}}$ $=0.25-\frac{1.0234375}{-21.71875}$ or $0.25-\frac{\frac{131}{128}}{-\frac{695}{32}}$ or $\frac{1}{4}+\frac{131}{2780}\left\{=\frac{413}{1390}\right\}$ $=0.25-(-0.04712230216...)$ $=0.2971223022...=0.297$ (3 d.p.)	M1: Attempts to apply the Newton-Raphson formula with their $f'(x)$ and obtains a value. Condone a copying/sign error in $f(x)$ and/or their $f'(x)$ if intention clear. Implied by awrt 0.297. Must be working if value or $f'(x)$ incorrect. Allow as minimum $x_0=0.25, x_1=x_0-\frac{f(x_0)}{f'(x_0)}\Rightarrow x_1=...$ A1: awrt 0.297. Must be decimal. Note: actual root is 0.305 or 0.3054852282... isw if x_2 is attempted, etc.	**M1** **A1**
			(2)
(c)	$f(1.65)=-0.3628914411...$ $f(1.7)=0.1346924079...$	Attempts both $f(1.65)$ and $f(1.7)$ with at least one correct to 2 d.p.	**M1**
	e.g., $\frac{\beta-1.65}{1.7-\beta}=\frac{0.3628914411...}{0.1346924079...}\Rightarrow\beta=...$ Maysee $\frac{1.7-\beta}{0.134...}$ or $\frac{\beta-1.65}{0.362...}=\frac{1.7-1.65}{0.362...+0.134...}$ Forms a correct equation in β/x with their $f(1.65)$ and $f(1.7)$ values and solves. If e.g., A is used for $\beta-1.65$ then $1.65+A$ must be seen later Implied by awrt 1.686. If value incorrect must see an equation but allow $\frac{1.65(0.134...)-1.7(-0.362...)}{0.134...-(-0.362...)}$ from use of $\frac{af(b)-bf(a)}{f(b)-f(a)}$. If a correct interpolation formula is quoted, allow slips in the substitution if the intention is clear.		**M1**
	SC for M1M1: Some candidates are not evaluating $f(1.65)$ and $f(1.7)$. Award M1M1 if $f(1.65)$ and $f(1.7)$ are used correctly within a correct interpolation formula. For example:		

	1) $\dfrac{1.7-\beta}{\beta-1.65}=\dfrac{\frac{3}{2}(1.7)^3-6(1.7)^{1/2}+(1.7)^{-1}}{-\left[\frac{3}{2}(1.65)^3-6(1.65)^{1/2}+(1.65)^{-1}\right]}=0.3711...\Rightarrow\beta=1.686$. This scores M1M1A1. 2) $\dfrac{1.7-\beta}{\beta-1.65}=0.3711...\Rightarrow\beta=...$ This scores M1M1, and if their solution β is correct, also scores A1. 3) As a minimal solution: $\dfrac{x-1.65}{\lvert f(1.65)\rvert}=\dfrac{1.7-x}{\lvert f(1.7)\rvert}\Rightarrow x=1.686$ This scores M1M1A1. The correct answer implies that correct values have been used for $f(1.65)$ and $f(1.7)$.		
	$\beta=1.686465356...=1.686\,(3\text{ d.p.})$	Awrt 1.686. Allow "x=" (Actual root is 1.687 or 1.686860129...)	**A1**
Alt	$y-(-0.362...[\text{or } 0.134...])=\dfrac{0.134...-(-0.362...)}{1.7-1.65}(x-(1.65[\text{or } 1.7]))\Rightarrow y=0,\ x=...$ M1: As main scheme M1: Forms correct straight line equation, sets $y = 0$ and solves		**M1** **M1**
	$\beta=1.686465356...=1.686\,(3\text{ d.p.})$	Awrt 1.686	**A1**
			(3)
			Total 7