Question Number	Scheme	Notes	Marks
1(a)	$f(x) = x^3 - \dfrac{10\sqrt{x} - 4x}{x^2} \qquad x > 0$		
	$f(1.4) = -0.435673...$ $f(1.5) = 0.598356...$	Attempts both f(1.4) and f(1.5)	M1
	Sign change (positive, negative) (and $f(x)$ is continuous) therefore (a **root)** α is between $x = 1.4$ and $x = 1.5$	Both f(1.4) = awrt −0.4 and f(1.5) = awrt 0.6, sign change and conclusion. For 'sign change' indication that f(1.4) < 0 and f(1.5) > 0 is sufficient. Also f(1.4) f(1.5) < 0 is sufficient. 'Therefore root' (without mention of the interval) is a sufficient conclusion. Mention of 'continuous' is not required.	A1
			(2)
(b)	$\left(f(x) = x^3 - \dfrac{10\sqrt{x} - 4x}{x^2} = x^3 - 10x^{-\frac{3}{2}} + 4x^{-1} \right)$		
	$f'(x) = 3x^2 + 15x^{-\frac{5}{2}} - 4x^{-2}$ (or equivalent, see below)	$x^n \to x^{n-1}$ for one term	M1
		2 correct terms simplified or unsimplified	A1
		All correct simplified or unsimplified	A1
			(3)
(c)	$(x_1) = 1.4 - \dfrac{f(1.4)}{f'(1.4)}$ $\left(= 1.4 - \frac{-0.43567...}{10.30720...}\right) = ...$	Correct application of N-R leading to an answer. Values of f(1.4) and f '(1.4) need not be seen before their final answer.	M1
	= 1.442	cao (must be corrected to 3 d.p.) isw if x_2, etc. have been found, but the answer for 'one use of N-R' must be seen as 1.442 to score this mark.	A1
			(2)
			Total 7
(b)	Equivalent unsimplified versions are acceptable, e.g. (using quotient rule); $3x^2 - \dfrac{\left(5x^{\frac{3}{2}} - 4x^2\right) - 20x^{\frac{3}{2}} + 8x^2}{x^4}$	The 'two correct terms' still applies for the first A1. Here a 'term' would be, for example, the $x^{-\frac{5}{2}}$ terms in unsimplified form. Isw after a correct unsimplified form.	
(b)(c)	A common error in (b) is to have $+4x^{-2}$ instead of $-4x^{-2}$, giving 1.430 in (c). This, if otherwise correct, would score (b) 110 and (c) 10		