Question Number	Scheme	Notes	Marks
2	$\mathrm{f}(x)=10-2x-\frac{1}{2\sqrt{x}}-\frac{1}{x^3} \qquad x>0$		
(a)	$\mathrm{f}(0.4)=-7.21..., \ \mathrm{f}(0.5)=0.292...$	Attempts both f(0.4) and f(0.5)	M1
	Sign change (positive, negative) and $\mathrm{f}(x)$ is **continuous** therefore (a root) α is between $x=0.4$ and $x=0.5$	Both f(0.4) = awrt -7 and f(0.5) = awrt 0.3, sign change and conclusion. **Must mention continuity**. Can have $\mathrm{f}(0.4)\times\mathrm{f}(0.5)<0$ instead of "sign change"	A1
			(2)
(b)	$\mathrm{f}'(x)=-2+\frac{1}{4}x^{-\frac{3}{2}}+3x^{-4}$	$x^n \to x^{n-1}$ in at least 1 term other than 10	M1
		2 of the 3 terms shown correct	A1
		All correct	A1
			(3)
(c)	$x_1=0.5-\frac{\mathrm{f}(0.5)}{\mathrm{f}'(0.5)}=0.5-\frac{0.29289321...}{46.70710678...}$	Correct application of Newton-Raphson	M1
	= 0.494	Correct value 3dp. A correct derivative must have been used	A1
			(2)
(d)	$\frac{4.9-\beta}{\lvert\mathrm{f}(4.9)\rvert}=\frac{\beta-4.8}{\mathrm{f}(4.8)}\Rightarrow\beta=...$	Uses a correct interpolation method (Signs to be correct)	M1
	$\beta=4.883$	Correct value 3dp unless penalised in (c)	A1
			(2)
ALT 1	$\beta=\frac{a\lvert\mathrm{f}(b)\rvert+b\lvert\mathrm{f}(a)\rvert}{\lvert\mathrm{f}(a)\rvert+\lvert\mathrm{f}(b)\rvert}$ $\beta=\frac{4.8\times0.0344+4.9\times0.1627}{0.0344+0.1627}=...$	Uses a correct interpolation method (Signs to be correct)	M1
	$\beta=4.883$	Correct value 3dp unless penalised in (c)	A1
			(2)
ALT 2	Gradient $=\frac{-0.0344-0.1627}{4.9-4.8}=-1.971$ Equation of line: $y-0.1627=-1.971(x-4.8)$ or $y=-1.971+9.6235$ Substitute $y=0$ $x=...$	Complete method for line equation followed by substitution to obtain a value for x	M1
	$\beta=4.883$	Correct value 3dp unless penalised in (c)	A1
			(2)
			Total 9