Question	Scheme	Marks	AOs
2 (a)	$(4+5x)^{\frac{1}{2}} = (4)^{\frac{1}{2}}\left(1+\frac{5x}{4}\right)^{\frac{1}{2}} = 2\left(1+\frac{5x}{4}\right)^{\frac{1}{2}}$	B1	1.1b
	$=\{2\}\left[1+\left(\frac{1}{2}\right)\left(\frac{5x}{4}\right)+\frac{\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)}{2!}\left(\frac{5x}{4}\right)^2+\ldots\right]$	M1	1.1b
		A1ft	1.1b
	$= 2+\frac{5}{4}x-\frac{25}{64}x^2+\ldots$	A1	2.1
		(4)	
(b)(i)	$\left\{x=\frac{1}{10}\Rightarrow\right\}(4+5(0.1))^{\frac{1}{2}}$	M1	1.1b
	$=\sqrt{4.5} = \frac{3}{2}\sqrt{2}$ or $\frac{3}{\sqrt{2}}$		
	$\frac{3}{2}\sqrt{2}$ or $1.5\sqrt{2}$ or $\frac{3}{\sqrt{2}} = 2+\frac{5}{4}\left(\frac{1}{10}\right)-\frac{25}{64}\left(\frac{1}{10}\right)^2+\ldots\ \{=2.121\ldots\}$ $\Rightarrow \frac{3}{2}\sqrt{2}=\frac{543}{256}$ or $\frac{3}{\sqrt{2}}=\frac{543}{256} \Rightarrow \sqrt{2}=\ldots$	M1	3.1a
	So, $\sqrt{2}=\frac{181}{128}$ or $\sqrt{2}=\frac{256}{181}$	A1	1.1b
(b)(ii)	$x=\frac{1}{10}$ satisfies $\lvert x\rvert<\frac{4}{5}$ (o.e.), so the approximation is valid.	B1	2.3
		(4)	
			(8 marks)

Question 2 Notes:	
(a)	
B1:	Manipulates $(4+5x)^{\frac{1}{2}}$ by taking out a factor of $(4)^{\frac{1}{2}}$ or 2
M1:	Expands $(...+\lambda x)^{\frac{1}{2}}$ to give at least 2 terms which can be simplified or un-simplified, E.g. $1+\left(\frac{1}{2}\right)(\lambda x)$ or $\left(\frac{1}{2}\right)(\lambda x)+\frac{(\frac{1}{2})(-\frac{1}{2})}{2!}(\lambda x)^2$ or $1+...+\frac{(\frac{1}{2})(-\frac{1}{2})}{2!}(\lambda x)^2$ where λ is a numerical value and **where** $\lambda \neq 1$.
A1ft:	A correct simplified or un-simplified $1+\left(\frac{1}{2}\right)(\lambda x)+\frac{(\frac{1}{2})(-\frac{1}{2})}{2!}(\lambda x)^2$ expansion with **consistent** (λx)
A1:	Fully correct solution leading to $2+\frac{5}{4}x+kx^2$, where $k=-\frac{25}{64}$
(b)(i)	
M1:	Attempts to substitute $x=\frac{1}{10}$ or 0.1 into $(4+5x)^{\frac{1}{2}}$
M1:	A complete method of finding an approximate value for $\sqrt{2}$. E.g. • substituting $x=\frac{1}{10}$ or 0.1 into their part (a) binomial expansion and equating the result to an expression of the form $\alpha\sqrt{2}$ or $\frac{\beta}{\sqrt{2}}$; $\alpha, \beta \neq 0$ • followed by re-arranging to give $\sqrt{2}=...$
A1:	$\frac{181}{128}$ **or any equivalent fraction**, e.g. $\frac{362}{256}$ or $\frac{543}{384}$ Also allow $\frac{256}{181}$ **or any equivalent fraction**
(b)(ii)	
B1:	Explains that the approximation is valid because $x=\frac{1}{10}$ satisfies $\lvert x\rvert<\frac{4}{5}$