Question Number	Scheme	Marks
4(i)(a)	ay^3	B1
		(1)
(i)(b)	$\dfrac{5}{\left(3a^{1-x}\right)^{-2}}=\dfrac{45}{\ldots}$	B1
	$\left(\ldots a^{1-x}\right)^{-2}=a^{-2}\times a^{2x}$	M1
	$=\dfrac{45a^2}{y^2}$	A1
		(3)
(ii)(a)	e.g. $3^{4t+2}=\left(3^{2t}\right)^2\times 9=9p^2$ (see notes)	M1
	$\Rightarrow 27\times p^2+3=82\times p\Rightarrow 27p^2-82p+3=0$ *	A1*
		(2)
(ii)(b)	Solves the quadratic $\Rightarrow 3,\ \dfrac{1}{27}$	B1
	$\left(3^t\right)^2=3$ or $9^t=3\Rightarrow t=\dfrac{1}{2}$ or $\left(3^t\right)^2=\dfrac{1}{27}\Rightarrow 3^t=\dfrac{1}{3\sqrt{3}}\Rightarrow t=-\dfrac{3}{2}$ or $9^t=\dfrac{1}{27}\Rightarrow t=-\dfrac{3}{2}$	M1
	$(t=)\ \dfrac{1}{2},\ -\dfrac{3}{2}$	A1
		(3)
		(9 marks)

Question Number	Scheme	Marks
2.	Attempts both sides as powers of 3 $\quad \dfrac{3^x}{3^{4y}}=3^3\times 3^{0.5}\Rightarrow 3^{x-4y}=3^{"3.5"}$	M1
	Sets powers equal and attempts to makes y the subject : $x-4y="3.5"\Rightarrow y=\ldots$	dM1
	$y=\dfrac{1}{4}x-\dfrac{7}{8}$	A1
		(3) **(3 marks)**

Question Number	Scheme	Marks
2a	$\frac{1}{8}x$	B1
		(1)
b	$\frac{1}{256}x^{\frac{3}{2}}$	B1
		(1)
c	$\left(\frac{1}{2}\left(\frac{1}{64}x^2\times\frac{16}{\sqrt{x}}\right)\right)^{-\frac{4}{3}}=\left(\frac{1}{8}x^{\frac{3}{2}}\right)^{-\frac{4}{3}}=16x^{-2}$	M1A1
		(2)
		(4 marks)

(a)

Question	**Scheme**	**Marks**
2(i)(a)	$2^{n+3}=2^n\times2^3=8m$	B1
		(1)
(b)	$16^{3n}=\left(2^4\right)^{3n}$	M1
	$=2^{12n}=\left(2^n\right)^{12}=m^{12}$	A1
		(2)
(ii)	$x\sqrt{3}-3=x+\sqrt{3}\Rightarrow x\sqrt{3}-x=3+\sqrt{3}\Rightarrow x\left(\sqrt{3}-1\right)=3+\sqrt{3}\Rightarrow x=...$	M1
	$=\frac{3+\sqrt{3}}{\sqrt{3}-1}\times\frac{\pm\left(\sqrt{3}+1\right)}{\pm\left(\sqrt{3}+1\right)}$	M1
	$=\frac{\pm\left(4\sqrt{3}+6\right)}{\pm(3-1)}=3+2\sqrt{3}$	A1
		(3)

Question Number	Scheme	Marks
4(i)	Uses a correct law of indices on 2^{4k-3} or 8^{1-k} The possibilities are endless but some more common examples are: For 2^{4k-3}: $2^{4k}\times2^{-3}$, $\frac{2^{4k}}{8}$, $8^{\frac{4k-3}{3}}$, $4^{\frac{4k-3}{2}}$, $\left(\sqrt{2}\right)^{8k-6}$ For 8^{1-k}: 8×8^{-k}, $\frac{8}{8^k}$, $2^{3(1-k)}$, $4^{\frac{2(1-k)}{3}}$, $\left(\sqrt{2}\right)^{6-6k}$ These may be seen in isolation e.g. not in an equation. But not just e.g. $8=2^3$	M1
	e.g. $2^{4k-3}=\frac{8^{1-k}}{4\sqrt{2}}\Rightarrow2^{4k-3}=\frac{2^{3(1-k)}}{2^{\frac{5}{2}}}\Rightarrow2^{4k-3}=2^{3(1-k)-\frac{5}{2}}$ $\Rightarrow4k-3=3(1-k)-\frac{5}{2}\Rightarrow k=...$	dM1
	$k=\frac{1}{2}$	A1
		(3)

(ii)		
	$\frac{x\sqrt{3}+2}{\sqrt{3}-1}=x\sqrt{3}-4 \Rightarrow x\sqrt{3}+2=\left(x\sqrt{3}-4\right)\left(\sqrt{3}-1\right)$ $\Rightarrow x\sqrt{3}+2=3x+4-4\sqrt{3}-x\sqrt{3}$ $\Rightarrow 2\sqrt{3}x-3x=2-4\sqrt{3}$	M1
	$\Rightarrow x\left(2\sqrt{3}-3\right)=2-4\sqrt{3}$	A1
	$\Rightarrow x=\frac{2-4\sqrt{3}}{2\sqrt{3}-3}\times\frac{2\sqrt{3}+3}{2\sqrt{3}+3}$	dM1
	$=-6-\frac{8}{3}\sqrt{3}$	A1
		(4)

Question	Scheme	Marks
6(a)	$\left(r-\frac{1}{r}\right)^2=r^2-r\times\frac{1}{r}-r\times\frac{1}{r}+\frac{1}{r^2}$	**M1**
	$=r^2+\frac{1}{r^2}-2$	**A1**
		(2)
(b)	$\frac{1}{3+2\sqrt{2}}=\frac{1}{3+2\sqrt{2}}\times\frac{3-2\sqrt{2}}{3-2\sqrt{2}}$	**M1**
	$=\frac{3-2\sqrt{2}}{3^2-\left(2\sqrt{2}\right)^2}=3-2\sqrt{2}$	**A1**
		(2)
(b) ALT	$\frac{1}{3+2\sqrt{2}}=p+q\sqrt{2}\Rightarrow 1=\left(p+q\sqrt{2}\right)\left(3+2\sqrt{2}\right)=3p+4q+2p\sqrt{2}+3q\sqrt{2}$ $\Rightarrow \begin{matrix}3p+4q=1\\2p+3q=0\end{matrix}$	**M1**
	$\Rightarrow \begin{matrix}3p+4q=1\\2p+3q=0\end{matrix}\Rightarrow\begin{matrix}6p+8q=2\\6p+9q=0\end{matrix}\Rightarrow q=-2\Rightarrow 3p-8=1\Rightarrow p=3$ $\frac{1}{3+2\sqrt{2}}=3-2\sqrt{2}$	**A1**
		(2)
(c)	$\left(\sqrt{3+2\sqrt{2}}-\frac{1}{\sqrt{3+2\sqrt{2}}}\right)^2=3+2\sqrt{2}+\frac{1}{3+2\sqrt{2}}-2$	**M1**
	$=3+2\sqrt{2}+3-2\sqrt{2}-2=\ldots(=4)$	**dM1**
	so $\sqrt{3+2\sqrt{2}}-\frac{1}{\sqrt{3+2\sqrt{2}}}=2$	**A1**
		(3)
(c) Alt	$\sqrt{3+2\sqrt{2}}-\frac{1}{\sqrt{3+2\sqrt{2}}}=2\Rightarrow 3+2\sqrt{2}-1=2\sqrt{3+2\sqrt{2}}$	**M1**
	$\Rightarrow\left(2+2\sqrt{2}\right)^2=4\left(3+2\sqrt{2}\right)$	**dM1**
	$\Rightarrow 4+8\sqrt{2}+8=12+8\sqrt{2}$ ✓ Hence true	**A1**
		(3)
		(7 marks)

Question Number	Scheme	Marks
2 (a)	$3^{3x}=\left(3^x\right)^3=y^3$	B1
		(1)
(b)	$\dfrac{1}{3^{x-2}}=\dfrac{1}{3^x\times3^{-2}}=\dfrac{9}{y}$	M1 A1
		(2)
(c)	$\dfrac{81}{9^{2-3x}}=\dfrac{9^2}{9^{2-3x}}=9^{2-(2-3x)}=9^{3x}=3^{6x}=y^6$	M1 A1
		(2)
		(5 marks)