

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)

(c)

Question Number	Scheme	Marks
1. (a)	$p^{\frac{1}{2}} = \left(\frac{1}{16}x^4\right)^{\frac{1}{2}} = \frac{1}{4}x^2$	B1
		(1)
	$(pq)^{-1} = \left(\frac{1}{16}x^4 \times \frac{40}{x^3}\right)^{-1} = \left(\frac{5}{2}x\right)^{-1} = \frac{2}{5}x^{-1}$	M1, A1
(b)		(2)
	$p q^2 = \frac{1}{16}x^4 \times \left(\frac{40}{x^3}\right)^2 = \frac{1600}{16} \times \frac{x^4}{x^6} = 100x^{-2}$	M1, A1
(c)		(2)
		(5 marks)

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}: $2^{4k} \times 2^{-3}$, $\frac{2^{4k}}{8}$, $8^{\frac{4k-3}{3}}$, $4^{\frac{4k-3}{2}}$, $(\sqrt{2})^{8k-6}$ For 8^{1-k}: 8×8^{-k}, $\frac{8}{8^k}$, $2^{3(1-k)}$, $4^{\frac{2(1-k)}{3}}$, $(\sqrt{2})^{6-6k}$ These may be seen in isolation e.g. not in an equation. But not just e.g. $8 = 2^3$	M1
	e.g. $2^{4k-3} = \frac{8^{1-k}}{4\sqrt{2}} \Rightarrow 2^{4k-3} = \frac{2^{3(1-k)}}{2^{\frac{5}{2}}} \Rightarrow 2^{4k-3} = 2^{3(1-k)-\frac{5}{2}}$ $\Rightarrow 4k-3 = 3(1-k) - \frac{5}{2} \Rightarrow k = \dots$	dM1
	$k = \frac{1}{2}$	A1
		(3)

(ii)	$\frac{x\sqrt{3}+2}{\sqrt{3}-1} = x\sqrt{3}-4 \Rightarrow x\sqrt{3}+2 = (x\sqrt{3}-4)(\sqrt{3}-1)$ $\Rightarrow x\sqrt{3}+2 = 3x+4-4\sqrt{3}-x\sqrt{3}$ $\Rightarrow 2\sqrt{3}x-3x = 2-4\sqrt{3}$	M1
	$\Rightarrow x(2\sqrt{3}-3) = 2-4\sqrt{3}$	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
	$= \frac{3-2\sqrt{2}}{3^2 - (2\sqrt{2})^2} = 3-2\sqrt{2}$	A1
	(2)	
(b) ALT	$\frac{1}{3+2\sqrt{2}} = p+q\sqrt{2} \Rightarrow 1 = (p+q\sqrt{2})(3+2\sqrt{2}) = 3p+4q+2p\sqrt{2}+3q\sqrt{2}$ $\Rightarrow 3p+4q=1$ $\Rightarrow 2p+3q=0$	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
	$= 3+2\sqrt{2} + 3-2\sqrt{2} - 2 = \dots (=4)$	dM1
	$\text{so } \sqrt{3+2\sqrt{2}} - \frac{1}{\sqrt{3+2\sqrt{2}}} = 2$	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
	$\Rightarrow (2+2\sqrt{2})^2 = 4(3+2\sqrt{2})$	dM1
	$\Rightarrow 4+8\sqrt{2}+8 = 12+8\sqrt{2} \quad \checkmark \text{ Hence true}$	A1
	(3)	
(7 marks)		

Question Number	Scheme	Marks
2.(a)	$\frac{1}{4-2\sqrt{2}} = \frac{1}{4-2\sqrt{2}} \times \frac{4+2\sqrt{2}}{4+2\sqrt{2}}$ $= \frac{4+2\sqrt{2}}{16-8} = \frac{1}{2} + \frac{1}{4}\sqrt{2} \quad \text{oe}$	M1 A1 (2)
(b)	$4x = 2\sqrt{2}x + 20\sqrt{2} \Rightarrow (4-2\sqrt{2})x = 20\sqrt{2}$ $\Rightarrow x = \frac{20\sqrt{2}}{(4-2\sqrt{2})} = 20\sqrt{2} \times (a)$ $\Rightarrow x = 20\sqrt{2} \times \left(\frac{1}{2} + \frac{1}{4}\sqrt{2}\right) = 10 + 10\sqrt{2}$	M1 dM1 A1 (3) (5 marks)

Question Number	Scheme	Marks
2. (i)	$\frac{3y^3(2x^4)^3}{4x^2y^4} = \frac{6x^{10}}{y}$	B1, B1, B1 (3)
(ii)	$\frac{16}{\sqrt{3}+1} = a\sqrt{27} + 4$ States or uses $\sqrt{27} = 3\sqrt{3}$ Correct attempt at rationalising seen e.g. $\frac{16}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1}$ Correct attempt to make "a" the subject and make progress towards the form $p\sqrt{3} + q$ e.g. $8\sqrt{3} - 8 = 3a\sqrt{3} + 4 \Rightarrow 3a\sqrt{3} = 8\sqrt{3} - 12 \Rightarrow a = \frac{8\sqrt{3}}{3\sqrt{3}} - \frac{12}{3\sqrt{3}}$ $a = -\frac{4}{3}\sqrt{3} + \frac{8}{3}$	B1 M1 M1 A1cso (4) (7 marks)

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