Question Number	Scheme	Marks
1(a)	$(8-3x)^{-\frac{1}{3}}=\frac{1}{2}\left(1-\frac{3}{8}x\right)^{-\frac{1}{3}}$	B1
	$\left(1-\frac{3}{8}x\right)^{-\frac{1}{3}}=1+\left(-\frac{1}{3}\right)\left(-\frac{3}{8}x\right)+\frac{-\frac{1}{3}\left(-\frac{1}{3}-1\right)}{2!}\left(-\frac{3}{8}x\right)^2+\frac{-\frac{1}{3}\left(-\frac{1}{3}-1\right)\left(-\frac{1}{3}-2\right)}{3!}\left(-\frac{3}{8}x\right)^3+...$	M1
	$(8-3x)^{-\frac{1}{3}}=\frac{1}{2}+\frac{1}{16}x+\frac{1}{64}x^2+\frac{7}{1536}x^3+...$	A1 A1
		(4)
(b)	$\frac{1}{2}+\frac{1}{16}\left(\frac{2}{3}\right)+\frac{1}{64}\left(\frac{2}{3}\right)^2+\frac{7}{1536}\left(\frac{2}{3}\right)^3+...=\frac{2851}{5184}\Rightarrow\sqrt[3]{6}=\left(\frac{2851}{5184}\right)^{-1}=...$	M1
	$=\frac{5184}{2851}$ or $1\frac{2333}{2851}$	A1
		(2)
		Total 6

Note a misread of $(8-3x)^{\frac{1}{3}}$ can score a maximum of B1M1A0A0 M0A0

(a)

B1: Obtains $\frac{1}{2}(1\pm...x)^{-\frac{1}{3}}$. $8^{-\frac{1}{3}}$ must be evaluated. May be implied by further work e.g. $\frac{1}{2}\pm...$ provided this has not come from an incorrect method.

e.g. $(8-3x)^{-\frac{1}{3}}=\frac{1}{(8-3x)^{\frac{1}{3}}}=\frac{1}{2}+\frac{1}{\frac{1}{2}\sqrt[3]{3}x}+\frac{1}{\frac{1}{2}\left(\sqrt[3]{3}x\right)^2}+...$ is B0.

M1: Attempts the binomial expansion of $(1 + kx)^n$ to get the **third** or **fourth** term **unsimplified** with an acceptable structure.

The correct binomial coefficient must be combined with x^2 or x^3 which may be unsimplified.

Look for $\frac{-\frac{1}{3}\left(-\frac{1}{3}-1\right)}{2!}...x^2$ or $\frac{-\frac{1}{3}\left(-\frac{1}{3}-1\right)\left(-\frac{1}{3}-2\right)}{3!}...x^3$ o.e. (you do not need to be concerned with their $-\frac{3}{8}$ which may be 1 or e.g. if they have a negative sign in front of the whole term)

Do not allow notation such as $\begin{pmatrix}-\frac{1}{3}\\1\end{pmatrix}$, $\begin{pmatrix}-\frac{1}{3}\\2\end{pmatrix}$ unless interpreted correctly in further work.

May be implied by correct coefficients with x^2 or x^3

A1: For 2 correct **simplified** terms of $\frac{1}{16}x$, $\frac{1}{64}x^2$, $\frac{7}{1536}x^3$ (allow x^1 for x for this mark) which may be listed.

Condone if coefficients are given as decimals i.e. $0.0625x$, $0.015625x^2$, $0.004557...x^3$

Also allow for $\left(1-\frac{3}{8}x\right)^{-\frac{1}{3}}=1+\frac{1}{8}x+\frac{1}{32}x^2+\frac{7}{768}x^3+...$ (Note B0M1A1A0 is possible)

A1: $\frac{1}{2}+\frac{1}{16}x+\frac{1}{64}x^2+\frac{7}{1536}x^3$. Isw following a correct answer.

Condone the position of x^n provided it is not clearly on the denominator. e.g. condone $\frac{1}{16}\ x$ but not $\frac{1}{16x}$. Ignore terms with higher powers of *x*. Do not accept $\frac{1}{16}x^1$

(b)

M1: Attempts to substitute $x=\frac{2}{3}$ into their expansion from part (a) to achieve a fraction and attempts to find the reciprocal of that fraction. May be implied by their fraction. You may need to check this on your calculator. They may attempt to find an additional term which is fine. Do not be concerned as to whether the fraction is correct for their binomial expansion if they have shown the substitution. Condone slips including losing one of their terms.

$"\frac{1}{2}+\frac{1}{16}\left(\frac{2}{3}\right)+\frac{1}{64}\left(\frac{2}{3}\right)^2+\frac{7}{1536}\left(\frac{2}{3}\right)^3"=\frac{A}{B}\Rightarrow\frac{B}{A}$ scores M1

$1\div\frac{2851}{5184}$ scores M1

$\frac{1}{"\frac{1}{2}+\frac{1}{16}\left(\frac{2}{3}\right)+\frac{1}{64}\left(\frac{2}{3}\right)^2+\frac{7}{1536}\left(\frac{2}{3}\right)^3"}$ on its own scores M0

A1: $\frac{5184}{2851}$ or $1\frac{2333}{2851}$. Isw once a correct answer is seen. Correct answer scores M1A1.

Question Number	Scheme	Marks
2	Assume that C_1 and C_2 do intersect so that $x^4+10x^2+8=2x^2-7$ (and has real solutions).	B1
	$x^4+8x^2+15=0\Rightarrow\left(x^2+5\right)\left(x^2+3\right)=0\Rightarrow x^2=...$ or $x^4+8x^2+15=0\Rightarrow x^2=\dfrac{-8\pm\sqrt{8^2-4\times15}}{2}$ or $x^4+8x^2+15=0\Rightarrow\left(x^2+4\right)^2-1=0\Rightarrow x^2=...$	M1
	$x^2=-5,-3$	A1
	e.g. The two values of $x^2 < 0$ (so $x^4+8x^2+15=0$ has no real roots) which is not possible so C_1 and C_2 do not intersect	A1
		(4)
		Total 4

Note that B0M1A1A1 is possible

B1: Sets up the contradiction by
- making a statement assuming that the two curves intersect e.g. let/assume/suppose C_1 and C_2 / the curves intersect/meet/cross
- equating the curves i.e. $x^4+10x^2+8=2x^2-7$ o.e. (the equation must be correct)

Condone no reference to the equation having real solutions.

M1: Attempts to solve a three-term quadratic equation in x^2 by any valid (**non-calculator**) method. Usual rules apply. **If the roots are just stated then M0A0A0 follows.**

A1: $x^2=-5,-3$. Allow e.g. $m^2=-5,-3$
Do not condone e.g. $y=-5,-3$ without reverting back to $x^2=...$ or making valid deductions about e.g. x^2 being negative

A1: **This mark can only be scored provided the previous M1A1 has been scored.**
Acceptable conclusion which
- refers to x^2 being negative which is not possible or the equation has no real roots or $x^2=-3,-5$ but $x^2\ldots0$
- refers to C_1 and C_2 not intersecting
- Correct use of inequalities throughout e.g. $x^2\ldots0$ (not just $x^2\geqslant0$)
