Conclusion: So if n^3 is even then n must be even

Note that B0 M1 A1 A1 is possible

Question Number	Scheme	Marks
2(a)	$4^{-\frac{1}{2}}$ or $\frac{1}{4^{\frac{1}{2}}}$ or $\frac{1}{2}$	B1
	$(4-5x)^{-\frac{1}{2}} = \frac{1}{2}\left(1-\frac{5x}{4}\right)^{-\frac{1}{2}}$ $= \ldots\left(1+\left(-\frac{1}{2}\right)\times\left(-\frac{5x}{4}\right)+\frac{\left(-\frac{1}{2}\right)\times\left(-\frac{3}{2}\right)}{2!}\times\left(-\frac{5x}{4}\right)^2+\ldots\right)$	M1A1
	$= \frac{1}{2}+\frac{5}{16}x+\frac{75}{256}x^2+\ldots$	A1
		(4)
	$\frac{2+kx}{(2-3x)^3} = (2+kx)\left(\frac{1}{2}+\frac{5}{16}x+\frac{75}{256}x^2+\ldots\right)$	
(b)	Compares x terms leading to k = ... E.g. $\frac{10}{16}+\frac{k}{2}=\frac{3}{10} \Rightarrow k=-\frac{13}{20}$	M1 A1
		(2)
(c)	Compares x^2 terms leading to m = ... E.g. $m=\frac{75}{128}+\frac{5}{16}\times'-\frac{13}{20}' \Rightarrow m=\frac{49}{128}$	M1 A1
		(2)
		(8 marks)
Alt (a)	$4^{-\frac{1}{2}}$ or $\frac{1}{4^{\frac{1}{2}}}$	B1
	$(4-5x)^{-\frac{1}{2}} = 4^{-\frac{1}{2}}+\left(-\frac{1}{2}\right)4^{-\frac{3}{2}}(-5x)+\frac{-\frac{1}{2}\times-\frac{3}{2}}{2}4^{-\frac{5}{2}}(-5x)^2$	M1A1
	$= \frac{1}{2}+\frac{5}{16}x+\frac{75}{256}x^2+\ldots$	A1
		(4)

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(a)

B1: For taking out a factor of $4^{-\frac{1}{2}}$ or $\frac{1}{2}$

For a direct expansion look for $4^{-\frac{1}{2}}+....$ or equivalent.

M1: For the form of the binomial expansion $(1+ax)^{-\frac{1}{2}}$ where $a \neq 1$ or -5

To score M1 it is sufficient to see either term two or term three. Allow a slip on the sign.

So allow for either $\left(-\frac{1}{2}\right)(\pm ax)$ or $\frac{\left(-\frac{1}{2}\right)\times\left(-\frac{3}{2}\right)}{2}(\pm ax)^2$

In the alternative version look for $\left(-\frac{1}{2}\right)4^{-\frac{3}{2}}(-5x)$ or $\frac{-\frac{1}{2}\times-\frac{3}{2}}{2}4^{-\frac{5}{2}}(-5x)^2$ condoning sign slips

A1: Any (unsimplified) but correct form of the binomial expansion for $\left(1-\frac{5x}{4}\right)^{-\frac{1}{2}}$.

Ignore the factor preceding the bracket for this mark

Score for $1+\left(-\frac{1}{2}\right)\times\left(-\frac{5x}{4}\right)+\frac{\left(-\frac{1}{2}\right)\times\left(-\frac{3}{2}\right)}{2!}\times\left(-\frac{5x}{4}\right)^2$ o.e.

In the alternative version look for $(4-5x)^{-\frac{1}{2}}=4^{-\frac{1}{2}}+\left(-\frac{1}{2}\right)4^{-\frac{3}{2}}(-5x)+\frac{-\frac{1}{2}\times-\frac{3}{2}}{2}4^{-\frac{5}{2}}(-5x)^2$

A1: cao $\frac{1}{2}+\frac{5}{16}x+\frac{75}{256}x^2+...$ This must be simplified

$$(2+kx)\left(P+Qx+Rx^2+...\right)=1+\frac{3}{10}x+mx^2$$

(b)

M1: For a correct equation in k formed by comparing the x terms. It must lead to a value for k

Follow through on their expansion. So look for $Pk+2Q=\frac{3}{10}\Rightarrow k=...$ Condone slips, i.e copying errors.

Condone $Pkx+2Qx=\frac{3}{10}x$ as long as it leads to a value for k

A1: $k=-\frac{13}{20}$

(c)

M1: Correctly compares the x^2 terms, following through on their expansion and their value for k leading to a value for m . Condone slips, i.e copying errors.

Look for $Qk+2R=m$ Condone $Qkx^2+2Rx^2=mx^2$ as long as it leads to a value for m

A1: $m = \frac{49}{128}$ oe Condone sight of $\frac{49}{128}x^2$ as evidence for a correct value for m.

Question Number	Scheme	Marks
3	Calculates the upper limit as $2\ln 2$ or $\ln 4$	B1
	$\int \left(e^{0.5x} - 2\right)^2 dx = \int \left(e^x - 4e^{0.5x} + 4\right) dx = e^x - 8e^{0.5x} + 4x$	M1 A1 A1
	Volume $= \pi\left[\text{"}e^x - 8e^{0.5x} + 4x\text{"}\right]_0^{\text{"}2\ln 2\text{"}} = \ldots$	dM1
	Volume $= 8\pi\ln 2 - 5\pi$	A1 **(6 marks)**

B1: Calculates the upper limit as $2\ln 2$ or $\ln 4$ only. Do not accept 1.386, $\frac{\ln 2}{0.5}$ or anything else.

Recovery from $\frac{\ln 2}{0.5}$ is allowed so if the candidate progresses to $8\pi\ln 2 - 5\pi$ do not withhold this mark.

M1: Attempts to square $\left(e^{0.5x} - 2\right)$ **with** $\int e^{kx}dx \to e^{kx}$ seen at least once. Ignore any factor of π

This may be awarded when candidates fails to square $e^{0.5x}$ correctly

So for example $\int \left(e^{0.5x}\right)^2 - 4e^{0.5x} + 4\, dx \to \ldots. \pm \ldots e^{0.5x}$ is sufficient

A1: Two terms correct $e^x - 8e^{0.5x} + 4x$ Ignore any factor of π

A1: All three terms correct $e^x - 8e^{0.5x} + 4x$ Ignore any factor of π

dM1: A full and complete method of finding the volume of the solid generated.

Look for an attempt to find $\pi\int_0^{\text{"}a\text{"}} \left(e^{0.5x} - 2\right)^2 dx$ with a being $2\ln 2$, $\ln 4$, 1.38.. or $\frac{\ln 2}{2}$

It is dependent upon the previous M so some correct integration must be seen as well as use of both limits. There must be some evidence for the 0. Those terms cannot just "disappear" or be set to 0.

A1: cao $8\pi\ln 2 - 5\pi$ or $-5\pi + 8\pi\ln 2$ Condone $\pi(8\ln 2 - 5)$

(Note that a requirement of the question is to write in the form $a\ln 2 + b$)