Question Number	Scheme	Marks
1(a)	$(2-5x)^{-2} = \frac{1}{4}\left(1-\frac{5x}{2}\right)^{-2}$ or e.g. $\frac{8}{4\left(1-\frac{5x}{2}\right)^2}$	B1
	$=8\times\frac{1}{4}\left(1+(-2)\times\left(-\frac{5x}{2}\right)+\frac{(-2)\times(-3)}{2!}\times\left(-\frac{5x}{2}\right)^2+\frac{(-2)\times(-3)\times(-4)}{3!}\times\left(-\frac{5x}{2}\right)^3\ldots\right)$	M1A1
	$\frac{8}{(2-5x)^2}=2+10x+\frac{75}{2}x^2+125x^3\ldots$	A1
		(4)
Alt (a) by direct expansion	$8\times(2-5x)^{-2}$ $=8\times\left(2^{-2},+(-2)2^{-3}(-5x)^1+\frac{-2\times-3}{2!}2^{-4}(-5x)^2+\frac{-2\times-3\times-4}{3!}2^{-5}(-5x)^3\right)$	B1, M1A1
	$\frac{8}{(2-5x)^2}=2+10x+\frac{75}{2}x^2+125x^3\ldots$	A1
(b)	$\lvert x\rvert<\frac{2}{5}$ o.e.	B1
		(1)
		(5 marks)

(a)

B1: For taking out a factor of 2^{-2} or $\frac{1}{4}$ **from** $(2-5x)^{-2}$ to obtain e.g. $\frac{1}{4}(1\pm\ldots)^{-2}$, $2^{-2}(1\pm\ldots)^{-2}$.

May be implied by a constant term of 2 or by e.g. $2(1\pm\ldots)^{-2}$

The "8" is likely to be present but it is not required for this mark.

M1: For the form of the binomial expansion $(1+ax)^{-2}$

Requires the correct structure for either term three or term four. Allow a slip on the sign.

So allow for either $\frac{(-2)\times(-3)}{2}(\pm ax)^2$ or $\frac{(-2)\times(-3)\times(-4)}{3!}(\pm ax)^3$ where $a \neq 1$, could be -5 but must be the "a" in their $"2"(1\pm ax)^{-2}$.

Condone missing brackets around the "ax" for this mark.

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

Ignore the factor preceding the bracket for this mark and ignore any extra terms if found.

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

Brackets must be present unless they are implied by later work. Allow $\left(\frac{5x}{2}\right)^2$ for $\left(-\frac{5x}{2}\right)^2$.

The simplified form is $1+5x+\frac{75}{4}x^2+\frac{125}{2}x^3+\ldots$ Allow as a list of terms.

A1: cao $2+10x+\frac{75}{2}x^2+125x^3\ldots$ This must be simplified and allow as a list of terms.

Allow equivalents for $\frac{75}{2}$ e.g. 37.5 and ignore any extra terms.

Do **not** isw and mark the final answer. E.g. Fully correct work leading to $2+10x+\frac{75}{2}x^2+125x^3...$ followed by $=4+20x+75x^2+250x^3...$ loses the final mark.

Alternative to (a) by direct expansion

B1: This is awarded for $(2-5x)^{-2}=2^{-2}+....$ which may be implied by a final answer of 2 + …

M1: For the form of the expansion of $(2-5x)^{-2}$

Requires the correct structure for either term three or term four. Allow a slip on the sign.

So allow for either $\frac{(-2)\times(-3)}{2}(2)^{-4}(\pm 5x)^2$ or $\frac{(-2)\times(-3)\times(-4)}{3!}(2)^{-5}(\pm 5x)^3$

Condone missing brackets around the 5*x*.

A1: Any unsimplified or simplified but correct form of the binomial expansion for $(2-5x)^{-2}$

Ignore the factor preceding the bracket for this mark and ignore any extra terms if found.

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

Brackets must be present unless they are implied by later work.

The simplified form is $\frac{1}{4}+\frac{5}{4}x+\frac{75}{16}x^2+\frac{125}{8}x^3+...$ Allow as a list of terms.

A1: cao $2+10x+\frac{75}{2}x^2+125x^3...$ This must be simplified and allow as a list of terms.

Allow equivalents for $\frac{75}{2}$ e.g. 37.5 and ignore any extra terms.

Do **not** isw and mark the final answer. E.g. Fully correct work leading to $2+10x+\frac{75}{2}x^2+125x^3...$ followed by $=4+20x+75x^2+250x^3...$ loses the final mark.

Note: Correct or partially correct answers with <u>no working</u> in (a) should be sent to review.

(b)

B1: $|x|<\frac{2}{5}$ oe e.g. $-\frac{2}{5}<x<\frac{2}{5}$, $x>-\frac{2}{5}$ and $x<\frac{2}{5}$, $\left(-\frac{2}{5},\frac{2}{5}\right)$

But **not** $-\frac{2}{5}<|x|<\frac{2}{5}$, $x<\frac{2}{5}$, $\left|\frac{5x}{2}\right|<1$, $\left|-\frac{5x}{2}\right|<1$, $-1<\frac{5x}{2}<1$

Question Number	Scheme	Marks
2(a)	States or uses $S = 6x^2$ **or** $\frac{\mathrm{d}S}{\mathrm{d}t} = 4$	B1
	States or uses $S = 6x^2$ **and** $\frac{\mathrm{d}S}{\mathrm{d}t} = 4$	B1
	Attempts to use $\frac{\mathrm{d}S}{\mathrm{d}t} = \frac{\mathrm{d}S}{\mathrm{d}x} \times \frac{\mathrm{d}x}{\mathrm{d}t} \Rightarrow 4 = 12x \times \frac{\mathrm{d}x}{\mathrm{d}t} \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}t} = ...$	M1
	$\Rightarrow \frac{\mathrm{d}x}{\mathrm{d}t} = \frac{1}{3x}$ oe	A1
		(4)
(a) Alt	States or uses $S = 6x^2$ **or** $\frac{\mathrm{d}S}{\mathrm{d}t} = 4$	B1
	States or uses $S = 6x^2$ **and** $\frac{\mathrm{d}S}{\mathrm{d}t} = 4$	B1
	$\frac{\mathrm{d}S}{\mathrm{d}t} = 4 \Rightarrow S = 4t + c \Rightarrow S = 6x^2 \Rightarrow 6x^2 = 4t + c \Rightarrow 12x\frac{\mathrm{d}x}{\mathrm{d}t} = 4 \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}t} = ...$ or $S = 6x^2 \Rightarrow 6x^2 = 4t + c \Rightarrow 12x = 4\frac{\mathrm{d}t}{\mathrm{d}x} \Rightarrow \frac{\mathrm{d}x}{\mathrm{d}t} = ...$	M1
	$\Rightarrow \frac{\mathrm{d}x}{\mathrm{d}t} = \frac{1}{3x}$ oe	A1
(b)	States or uses $\frac{\mathrm{d}V}{\mathrm{d}x} = 3x^2$	B1
	Attempts to use $\frac{\mathrm{d}V}{\mathrm{d}t} = \frac{\mathrm{d}V}{\mathrm{d}x} \times \frac{\mathrm{d}x}{\mathrm{d}t} \Rightarrow \frac{\mathrm{d}V}{\mathrm{d}t} = 3x^2 \times \frac{1}{3x} = x$	M1
	$\Rightarrow \frac{\mathrm{d}V}{\mathrm{d}t} = V^{\frac{1}{3}}$	A1
		(3)
(b) Alt	$V = x^3,\ S = 6x^2 \Rightarrow S = 6V^{\frac{2}{3}} \Rightarrow \frac{\mathrm{d}S}{\mathrm{d}V} = 4V^{-\frac{1}{3}}$	B1
	Attempts to use $\frac{\mathrm{d}V}{\mathrm{d}t} = \frac{\mathrm{d}V}{\mathrm{d}S} \times \frac{\mathrm{d}S}{\mathrm{d}t} = \frac{1}{4V^{-\frac{1}{3}}} \times 4$	M1
	$\Rightarrow \frac{\mathrm{d}V}{\mathrm{d}t} = V^{\frac{1}{3}}$	A1
		(7 marks)