Question Number	Scheme	Marks
1	$(2+5x)^{-2}$	
(a)	$(2+5x)^{-2}=\frac{1}{4}\left(1+\frac{5}{2}x\right)^{-2}$	B1
	$\left(1+\frac{5}{2}x\right)^{-2}=1+(-2)\times\left(\frac{5}{2}x\right)+\frac{(-2)\times(-3)}{2}\times\left(\frac{5}{2}x\right)^2+\frac{(-2)\times(-3)\times(-4)}{3!}\times\left(\frac{5}{2}x\right)^3$	M1A1
	$(2+5x)^{-2}=\frac{1}{4}-\frac{5}{4}x+\frac{75}{16}x^2-\frac{125}{8}x^3$	A1A1
		(5)
(b)	$\lvert x\rvert<\frac{2}{5}$	B1
		(1)
(c)	$\left(\frac{4}{2+5x}\right)^2\approx 4-20x+75x^2$ or $a=4, b=-20$ and $c=75$	B1ft
		(1)
		(7 marks)

(a) Note that B1M1A0A1A0 is a possible mark trait

B1: For taking out a common factor of $\frac{1}{4}$ (or 0.25 or accept 2^{-2}) so score for $\frac{1}{4}(1+kx)^{-2}$ or $0.25(1+kx)^{-2}$. It cannot be for just $\frac{1}{4}$ on its own

M1: Attempts the binomial expansion with index -2

Score for the correct binomial coefficient for the 3rd or 4th term with the correct power of *x*

Look for $\frac{(-2)\times(-3)}{2}\times(...x)^2$ oe or $\frac{(-2)\times(-3)\times(-4)}{3!}\times(...x)^3$ oe If no working is shown then the coefficient must be consistent with their *k*. Condone invisible or poor bracketing for this mark.

Do not allow notation such as $\binom{-2}{1}, \binom{-2}{2}$ unless interpreted correctly in further work.

A1: Correct binomial expansion for $\left(1+\frac{5}{2}x\right)^{-2}$ up to the 4th term. This may be left unsimplified. May be implied by four correct terms. Isw if they subsequently simplify incorrectly. Invisible brackets may be implied by further work.

A1: Three correct and **simplified terms** from $\frac{1}{4}-\frac{5}{4}x+\frac{75}{16}x^2-\frac{125}{8}x^3$ May be written as decimal equivalents e.g. $0.25-1.25x+4.6875x^2-15.625x^3$. May be seen as a list or written on different lines. Condone $-\frac{5}{4}x^1$ for this mark.

A1: $\frac{1}{4}-\frac{5}{4}x+\frac{75}{16}x^2-\frac{125}{8}x^3$ oe See notes above for decimal equivalent forms. May be seen as a list or written on different lines. Isw once the four correct terms are seen unless they attempt to multiply by e.g. 16 Do not accept $-\frac{5}{4}x^1$

Alt(a) Direct expansion

$$(2\pm 5x)^{-2}=2^{-2}+(-2)\left(2^{-3}\right)(\pm 5x)+\frac{(-2)(-3)}{2}\left(2^{-4}\right)(\pm 5x)^2+\frac{(-2)(-3)(-4)}{6}\left(2^{-5}\right)(\pm 5x)^3+\ldots$$

B1: For 2^{-2} oe seen as the constant term e.g. $=\frac{1}{4}+\ldots x+\ldots$

M1: For the correct 3rd or 4th term of the expansion. Condone missing brackets on $(\pm 5x)^2$ or $(\pm 5x)^3$

A1: Correct expansion up to the 4th term which may be left unsimplified. May be implied by four correct terms. Isw if they subsequently simplify incorrectly. Invisible brackets may be implied by further work.

A1: As above in main scheme notes

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(b)

B1: $|x| < \frac{2}{5}$ oe e.g. $-\frac{2}{5} < x < \frac{2}{5}$ or e.g. $\left(-\frac{2}{5}, \frac{2}{5}\right)$ isw once a correct inequality is seen.

Condone $|x| < \left|-\frac{2}{5}\right|$

(c)

B1ft: $\left(\frac{4}{2+5x}\right)^2 \approx 4 - 20x + 75x^2$ but follow through on $16 \times "\left(\frac{1}{4} - \frac{5}{4}x + \frac{75}{16}x^2\right)"$. Must be a three- term quadratic but ignore any terms in x^3 or higher.

May just state e.g. $a = "4", b = "-20", c = "75"$

They must all be values (not unevaluated expressions)

Question Number	Scheme	Marks
2	Volume = $\int_{(2)}^{(8)} \frac{25\pi(x-1)}{9}(\mathrm{d}x)$ oe e.g. $\frac{25\pi}{9}\int_{(2)}^{(8)} x-1(\mathrm{d}x)$	B1
	$(\pi)\int \frac{25(x-1)}{9}\mathrm{d}x = (\pi)\frac{25(x-1)^2}{18}$ or $(\pi)\left(\frac{25x^2}{18}-\frac{25x}{9}\right)$	M1A1
	Volume = $\left[\frac{25\pi(x-1)^2}{18}\right]_2^8 = \left(\frac{25\pi(8-1)^2}{18}-\frac{25\pi(2-1)^2}{18}\right)=\frac{200}{3}\pi$	M1A1
		(5) **(5 marks)**

B1: Correct expression for the volume ignoring limits

May see e.g. $\frac{25\pi}{9}\int x-1(\mathrm{d}x)$ or $\int \frac{25\pi x}{9}-\frac{25\pi}{9}(\mathrm{d}x)$ May be unsimplified so allow $\pi\int\left(\frac{5}{3}\sqrt{x-1}\right)^2(\mathrm{d}x)$ Condone omission of dx. It cannot be scored if they make errors before the integral expression is written. π may appear later in a correct integral or integrand. Alternatively may use substitution e.g. $u^2=x-1$ and proceeding to $\pi\int\left(\frac{50}{9}u^3\right)(\mathrm{d}u)$ oe

M1: Correct attempt at integrating $(x-1)$. Look for $A(x-1)^2$ or Bx^2-Cx where *A*, *B* and C are non zero constants (indices do not need to be processed for this mark). Do not award this mark if this is only part of a sum of integrals. If using the substitution $u^2=x-1$ then look for $u^3\to u^4$

A1: $(\pi)\frac{25(x-1)^2}{18}$ or $(\pi)\left(\frac{25x^2}{18}-\frac{25x}{9}\right)$ oe (or using the substitution $u^2=x-1\Rightarrow$ $(\pi)\frac{25}{18}u^4$ oe)

Ignore any reference to π which could even appear as 2π