Question Number	Scheme	Marks
9.	(a) (i) $(1+x)^{-1} = 1+(-1)x+\frac{(-1)(-2)}{1\times 2}x^2+\frac{(-1)(-2)(-3)}{1\times 2\times 3}x^3\cdots$	M1
	$=1-x+x^2-x^3\cdots$	A1
	(ii) $(1-2x)^{-1} = 1-(-2x)+(-2x)^2-(-2x)^3\cdots$	M1
	$=1+2x+4x^2+8x^3\cdots$	A1
	(b) $\frac{2}{1-2x}+\frac{1}{1+x}=\frac{2(1+x)+(1-2x)}{(1-2x)(1+x)}$	M1
	$=\frac{3}{(1-2x)(1+x)}$ so $A=0$ and $B=3$	A1
	(c) (i) $\frac{1}{(1-2x)(1+x)}$	
	$=\frac{1}{3}\left(\frac{2}{1-2x}+\frac{1}{1+x}\right)$ *or* $(1+2x+4x^2+8x^3\cdots)(1-x+x^2-x^3\cdots)$	M1
	$=\frac{1}{3}\left(2(1+2x+4x^2+8x^3\cdots)+(1-x+x^2-x^3\cdots)\right)$	M1dep
	or $1-x+x^2+2x-2x^2+4x^2\cdots$	
	$=\frac{1}{3}\left(3+3x+9x^2\cdots\right)$	
	$=1+x+3x^2\cdots$	A1
	(ii) valid when $\lvert x\rvert < \frac{1}{2}$	B1
	(d) $\int_{0.1}^{0.2}\frac{1}{(1-2x)(1+x)}\mathrm{d}x \approx \int_{0.1}^{0.2}(1+x+3x^2)\mathrm{d}x$	
	$=\left[x+\frac{1}{2}x^2+x^3\right]_{0.1}^{0.2}$	M1 A1
	$=(0.2+0.02+0.008)-(0.1+0.005+0.001)$	M1dep
	$=0.122$	A1 (14)

Notes for Question 9

(a)(i) M1 for attempting the binomial expansion. Must have 1 and denominators 2! or 2 (with x^2) and 3! or 6 (with x^3)

A1 for $1-x+x^2-x^3$

(ii) M1 for replacing x with $\pm 2x$ in the expansion obtained in (a) **OR** use the binomial expansion again - rules as above and $(\pm 2x)^k \quad k>0$ in at least one term.

A1 for $1+2x+4x^2+8x^3$

(b)

M1 for adding the two fractions to form a single fraction

A1 for $A=0, \quad B=3$

(c)(i)

M1 for either $\dfrac{1}{(1-2x)(1+x)} = (\text{product of their expansions from (a)})$

or $\dfrac{1}{3}\left(\dfrac{2}{1-2x}+\dfrac{1}{1+x}\right)$ (allow if $\dfrac{1}{3}$ missing, as long as it appears later)

M1dep for multiplying **their** expansions from (a) - min 5 terms, no simplification yet, or adding 2 × **their** expansion of $(1 - 2x)^{-1}$ to **their** expansion of $(1 + x)^{-1}$ (allow if $\dfrac{1}{3}$ missing, as long as it appears later)

A1 for $1+x+3x^2$ or $\dfrac{1}{3}(3+3x+9x^2)$ Ignore higher powers.

(ii) B1 for $|x|<\dfrac{1}{2}$ oe use of $\leqslant$ gets B0

(d)M1 for integrating **their** expansion from (c)- minimum 2 terms

A1ft for correct integration of **their** expansion

M1dep for substituting the correct limits in their result

A1cso for 0.122 **must** be 3 dp.

NB: Use of calculator for (d):

If the correct results have been obtained in (c) and (d), award 4/4 for (d)

If either the expansion in (c) or the result in (d) is incorrect, award 0/4. (No part marks when insufficient working is shown.)