Question	Scheme	Marks
7(a)	$$\left(1+\frac{x}{3}\right)^{-3} = \left[1+(-3)\left(\frac{x}{3}\right)+\frac{(-3)(-3-1)}{2!}\left(\frac{x}{3}\right)^2 + \frac{(-3)(-3-1)(-3-2)}{3!}\left(\frac{x}{3}\right)^3 ...\right]$$ $$= 1 - x + \frac{2}{3}x^2 - \frac{10}{27}x^3$$	M1A1 A1 [3]
(b)	$-3 < x < 3$ or $\mid x \mid < 3$	B1 [1]
(c)	$$\left((3+x)^{-3} = 3^{-3} \times \left(1+\frac{x}{3}\right)^{-3} = \frac{1}{27} \times \left(1+\frac{x}{3}\right)^{-3}\right)$$ $$P = \frac{1}{27}, \ Q = \frac{1}{3}$$	B1, B1 [2]
(d)	$$\frac{(1+4x)}{(3+x)^3} = (1+4x) \times \frac{1}{27} \times \left(1-x+\frac{2}{3}x^2\right)$$ $$= \frac{1}{27} \times \left(1-x+\frac{2}{3}x^2 + 4x - 4x^2 + ...\right)$$ $$= \frac{1}{27}\left(1+3x-\frac{10x^2}{3}\right) \quad \text{or} \quad \frac{1}{27}+\frac{x}{9}-\frac{10x^2}{81}$$	M1 A1 [2]
(e)	$$\int_0^{0.2}\left(\frac{1}{27}+\frac{x}{9}-\frac{10x^2}{81}\right)dx = \left[\frac{x}{27}+\frac{x^2}{18}-\frac{10x^3}{243}\right]_0^{0.2}$$ $$= \left(\frac{0.2}{27}+\frac{0.2^2}{18}-\frac{10\times0.2^3}{243}\right)-[0]$$ $$= 0.0093004$$	M1 M1 A1 [3]
		Total 11 marks

Part	Mark	Notes
(a)	**M1**	For applying a correct binomial expansion in unsimplified form. Minimum required: • The expansion begins with 1 • The next term is correct • The powers of $\dfrac{x}{3}$ must be correct eg $\left(\dfrac{x}{3}\right)^2$ • The denominators are correct. Do not allow missing brackets unless recovered later – this is a general point of marking. Ignore any terms with powers higher than 3.
	A1	Following M1 (this is a general point of marking, A marks can only follow M marks), all conditions above met, must see $1 - x$ and at least the term in x^2 or x^3 correct and simplified. Ignore any terms with powers higher than 3.
	A1	A fully correct and simplified expansion. Ignore any terms with powers higher than 3..
(b)	**B1**	For the correct validity.
(c)	**B1**	For the correct value of P or Q explicitly written or embedded in $\dfrac{1}{27}\times\left(1+\dfrac{x}{3}\right)^{-3}$
	B1	For the correct values of P and Q explicitly written or embedded in $\dfrac{1}{27}\times\left(1+\dfrac{x}{3}\right)^{-3}$
(d)	**M1**	For attempting to multiply their expansion, which must be of the form $"P"\times$ (their expansion from part (a), with a minimum of 3 terms, by $(1 + 4x)$. An attempt must include 3 correctly multiplied out terms of their expansion before simplification. The $"P"$ may remain factorised. Ignore any terms which to powers of x higher than 2.
	A1	For the correct expansion in either form shown. Allow equivalent coefficients. Ignore powers of x higher than 2.
(e)	**M1**	For an attempt to integrate their expression from part (d), provided it has at least one constant term and at least one algebraic term. See general guidance, no power of x must decrease.
	M1	For substituting in the value of 0.2 into a changed expression and subtracting the correct way. Must see the explicit substitution of 0.2 at least once, if the final answer is not correct. Can be implied if final answer correct. Substitution of 0 does not need to be seen.
	A1	For the value of 0.0093004 [The calculator value is 0.0093316] Accept the value of $\dfrac{113}{12150}$ if seen.