Q	Marking Instructions	AO	Marks	Typical Solution
6(a)	Writes in a form to which the binomial expansion can be applied Accept $A(1+\frac{x}{4})^{-\frac{1}{2}}$	AO3.1a	M1	$\frac{1}{\sqrt{4+x}}=\frac{1}{2}(1+\frac{x}{4})^{-\frac{1}{2}}$ $\approx\frac{1}{2}\left[1+\left(-\frac{1}{2}\right)\frac{x}{4}+\frac{\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)\left(\frac{x}{4}\right)^2}{2!}\right]$ $\approx\frac{1}{2}\left[1-\frac{x}{8}+\frac{3x^2}{128}\right]$ $\approx\frac{1}{2}-\frac{1}{16}x+\frac{3}{256}x^2$
	Uses binomial expansion for their $(1+kx)^{\pm\frac{1}{2}}$ with at least two terms correct (can be unsimplified)	AO1.1a	M1	
	Obtains correct simplified answer No need to expand brackets CAO	AO1.1b	A1	
(b)	Substitutes $-x^3$ in their three term expansion from part (a)	AO1.1a	M1	$\frac{1}{\sqrt{4-x^3}}\approx\frac{1}{2}-\frac{1}{16}\left(-x^3\right)+\frac{3}{256}\left(-x^3\right)^2$ $\approx\frac{1}{2}+\frac{x^3}{16}+\frac{3x^6}{256}$
	Obtains correct expansion. FT their (a)	AO1.1b	A1F	
(c)	Uses their three term expansion as the integrand ignore limits PI by next mark	AO1.1a	M1	$\int_0^1\frac{1}{\sqrt{4-x^3}}\mathrm{d}x\approx\int_0^1\frac{1}{2}+\frac{x^3}{16}+\frac{3x^6}{256}\mathrm{d}x$ $\approx\left[\frac{x}{2}+\frac{x^4}{64}+\frac{3x^7}{1792}\right]_0^1$ $\approx\frac{1}{2}+\frac{1}{64}+\frac{3}{1792}$ ≈ 0.5172991
	Integrates (at least two terms correct)	AO1.1a	M1	
	Obtains correct value CAO	AO1.1b	A1	
(d)(i)	Explains that each term in the expansion is positive	AO2.4	E1	Each term in the expansion is positive. So increasing the terms will increase the estimated value hence the value must be an underestimate.
	Deduces that increasing the number of terms will increase the estimated value and that the value must be an underestimate. (Condone inference if evidence given ie value calculated numerically and compared)	AO2.2a	R1	
(d)(ii)	States the validity of their binomial expansion for part (b) Provided their $k\neq\pm1$	AO3.1a	B1F	The binomial expansion is valid for $\lvert x\rvert<\sqrt[3]{4}$ $2>\sqrt[3]{4}$
	Compares integral lower limit with validity of correct expansion CAO	AO2.3	E1	
	Total		**12**	