Question Number	Scheme			Marks
5(a)	$\frac{2}{21}\int_0^k x\,\mathrm{d}x +$ $\frac{2}{15}\int_k^6 (6-x)\,\mathrm{d}x = 1$	$\frac{1}{2}(k-0)\times\frac{2}{21}k$ and $\frac{1}{2}(6-k)\times\frac{2}{15}(6-k)$	For $0,, x,, k$ $\mathrm{F}(x) = \frac{1}{21}x^2$	M1
	$\frac{2}{21}\left[\frac{x^2}{2}\right]_0^k +$ $\frac{2}{15}\left[6x - \frac{x^2}{2}\right]_k^6 [=1]$	$\frac{1}{2}(k-0)\times\frac{2}{21}k +$ $\frac{1}{2}(6-k)\times\frac{2}{15}(6-k) = 1$	For $k < x,, 6$ $\mathrm{F}(x) = \frac{2}{15}\left(6x - \frac{x^2}{2}\right) - \frac{7}{5}$ oe	M1
	$\frac{1}{21}k^2 +$ $\frac{2}{15}\left(18 - \left(6k - \frac{k^2}{2}\right)\right)[=1]$	$\frac{1}{21}k^2 +$ $\frac{1}{15}(36 - 12k + k^2)[=1]$ oe	$\frac{1}{21}x^2 = \frac{2}{15}\left(6x - \frac{x^2}{2}\right) - \frac{7}{5}$	dM1
	$4k^2 - 28k + 49 = 0$ oe			dM1
	e.g. $(2k-7)^2 = 0$ leading to $k = 3.5$ *			A1*
				(5)
(b)	$\mathrm{E}(X) = \frac{2}{21}\int_0^{3.5} x^2\,\mathrm{d}x + \frac{2}{15}\int_{3.5}^6 (6x - x^2)\,\mathrm{d}x$			M1
	$\frac{2}{21}\left[\frac{x^3}{3}\right]_0^{3.5} + \frac{2}{15}\left[3x^2 - \frac{x^3}{3}\right]_{3.5}^6$			dM1
	$\frac{2}{21}\left(\frac{343}{24}\right) + \frac{2}{15}\left(36 - \left(\frac{147}{4} - \frac{343}{24}\right)\right) = \frac{19}{6}$			dM1A1
				(4)
(c)	$\mathrm{Var}(X) = \frac{277}{24} - "\left(\frac{19}{6}\right)"^2 = \frac{109}{72}$			M1A1
				(2)
	Notes			**Total 11**
(a)	**M1**	for writing/using the integral of f(x) and setting = 1 ignore limits or both areas identified (these do not need to be added nor set = 1) or a correct expression for F(x) between $0 \leqslant x \leqslant k$		
	M1	for an attempt at integration on either part with $x^n \to x^{n+1}$ ignore limits or adding the area of the 2 triangles and set = 1 or a correct expression for F(x) between $k \leqslant x \leqslant 6$		
	dM1	dependent on 1st M1 for substitution of k, 0 and 6 into the integral of f(x) or an un-simplified 3TQ quadratic or setting the 2 parts of F(x) equal to each other		
	dM1	dependent on previous M1 for a correct 3TQ equal to 0 e.g. $\frac{4}{35}k^2 - \frac{12}{15}k + \frac{7}{5} = 0$ oe		
	A1*	for solving the 3TQ leading to the given answer (Working must be shown)		

NB Solution based on the assumption that $\frac{2}{21}k=\frac{2}{15}(6-k)$ scores M0M0dM0dM0A0 e.g. $\frac{2}{21}k=\frac{2}{15}(6-k)$ or $\frac{1}{2}\times 6\times\frac{2}{21}k=1$ or $\frac{1}{2}(k-0)\times\frac{2}{21}k+\frac{1}{2}(6-k)\times\frac{2}{21}k=1$ Use of verification can score M1M1dM0dM0A0 e.g. $\frac{2}{21}\left[\frac{x^2}{2}\right]_0^{3.5}+\frac{2}{15}\left[6x-\frac{x^2}{2}\right]_{3.5}^{6}\ [=1]$ or $\frac{1}{2}(3.5-0)\times\frac{2}{21}(3.5)+\frac{1}{2}(6-3.5)\times\frac{2}{15}(6-3.5)=1$		
(b)	**M1**	for writing or using the integral of $xf(x)$ ignore limits but must be both parts
	dM1	dependent on 1st M1 for an attempt at integration on both parts with $x^n \to x^{n+1}$ ignore limits
	dM1	dependent on previous M1 for substitution of 3.5, 0 and 6 ($\frac{49}{36}$ and $\frac{65}{36}$ is the minimum required to imply this mark)
	A1	allow awrt 3.17
(c)	**M1**	for use of $\mathrm{E}(X^2)-\mathrm{E}(X)^2$ ft their E(X)
	A1	allow awrt 1.51