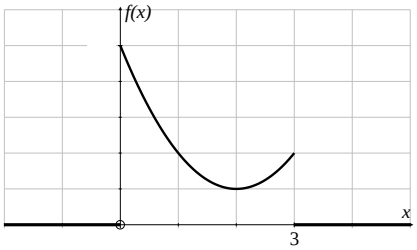
Question Number	Scheme	Marks
5(a)	f(0) = 5k	
	$k\left\{(a-2)^2+1\right\} < 5k$ condone $k\left\{(a-2)^2+1\right\} = 5k$	M1
	$(a-2)^2 < 4 \Rightarrow \quad 0 < a < 4$	A1
		(2)
(b)(i)(ii)		
	Shape for $0 < x < 3$	B1
	(2, k) or labels 2 and k	B1
		(2)
(c)	$\int_0^3 \mathrm{f}(x)\,\mathrm{d}x = 1$	
	$k\left[\frac{x^3}{3} - 2x^2 + 5x\right]_0^3 = 1$ or $k\left[\frac{(x-2)^3}{3} + x\right]_0^3 = 1$	M1A1
	$k\left(\frac{27}{3} - 2\times 9 + 15\right) - 0k = 1$ or $k\left(\frac{1}{3}+3\right) - \frac{-8}{3}k = 1$	dM1
	$6k = 1 \quad \Rightarrow \quad k = \frac{1}{6}$ *	A1*
		(4)
(d)	$\mathrm{E}(X) = \int_0^3 x \times \frac{1}{6}(x^2 - 4x + 5)\,\mathrm{d}x$	M1
	$= \int_0^3 \frac{1}{6}(x^3 - 4x^2 + 5x)\,\mathrm{d}x = \frac{1}{6}\left[\frac{x^4}{4} - \frac{4x^3}{3} + \frac{5x^2}{2}\right]_0^3$	dM1A1
	$= \frac{1}{6}\left(\frac{81}{4} - \frac{108}{3} + \frac{45}{2} - 0\right)$ or $\frac{9}{8}$	dM1
	Var (X) $= 2.1 - \left(\frac{9}{8}\right)^2 = \frac{267}{320}$	dM1
	$= \frac{267}{320}$ awrt 0.834	dA1
		(6)
(e)	$\frac{1}{6}\left[\frac{x^3}{3} - 2x^2 + 5x\right]_2^3$ oe or $1 - \frac{1}{6}\left[\frac{x^3}{3} - 2x^2 + 5x\right]_0^2$ oe	M1
	$\frac{1}{6}\left[9 - 18 + 15 - \left(\frac{8}{3} - 8 + 10\right)\right] = \frac{2}{9}$ * or $1 - \frac{1}{6}\left[\left(\frac{8}{3} - 8 + 10\right)\right] = \frac{2}{9}$ *	A1* cso
		(2)
(f)	P $1 < X < 2 = \frac{2}{9}$ or use of symmetry | P$(X<1) = \left[\frac{1}{6}\left(\frac{x^3}{3} - 2x^2 + 5x\right)\right]_0^1$	M1
	P $X > 1 = \frac{4}{9}$ | P $X < 1 = \frac{5}{9}$	A1
	Therefore median < 1	A1cso
		(3)
		Total 19

		Notes
(a)	M1	for forming appropriate (in)equality using f(0), or for using symmetry of pdf graph. Condone missing k
	A1	c.a.o. (must be strict inequalities) **NB** A correct answer seen is M1 A1
(b)(i)	B1	a curve in a U shape only between 0 and 3 with curve lower at 3 than at 0. Must be above x-axis and it must not go beyond 0 or 3 For <0 or >3 may have patios or nothing
(ii)	B1	Allow 1/6 instead of k
(c)	M1	Attempting to integrate f(x), at least 1 term correct.
	A1	fully correct integration (Ignore limits here)
	dM1	dep on previous M being given. For putting = 1 and for use of correct limits leading to an equation for k. Need to see some substitution before $6k$ Condone missing $0k$
	A1*	c.s.o.
(d)	M1	for realising need for $\mathrm{E}(X) = \int x \times \mathrm{f}(x)$ oe Ignore limits.
	dM1	Dependent on 1st M1 Attempting to integrate, at least 1 term correct. Condone missing k
	A1	fully correct Integration with k **or** $\frac{1}{6}$ (Ignore limits here)
	dM1	Dependent on 2nd M1 For correct use of limits, implied by a correct mean. Condone missing 0
	dM1	Dependent on 3rd M1. For 2.1 – (their mean)^2 implied by correct answer.
	A1	dependent on all previous marks being awarded. Accept awrt 0.834 **NB** A correct answer does not imply the method marks we need see integration
(e)	M1	One of the 4 statements in the main MS **or** correct cdf line of $\frac{1}{6}\left(\frac{x^3}{3} - 2x^2 + 5x\right)$ with 1 – F(2) or F(3) – F(2) seen. Allow with k or $\frac{1}{6}$ Allow equivalent probability statement using < or $\leqslant$ for F(2) and F(3). These are not implied by $1-\frac{7}{9}$
	A1	cso both 3 and 2 substituted separately and correctly eg minimum of $\frac{1}{6}\left[\frac{4}{3}\right]$ or $1-\frac{1}{6}\left(\frac{14}{3}\right)$ leading to $=\frac{2}{9}^*$
(f)	M1	Allow $\frac{1}{6}\left(\frac{x^3}{3} - 2x^2 + 5x\right) = 0.5$ oe Implied by a correct probability statement or the correct median being given. Allow statements in terms of k. Reference to skew is M0
	A1	P $X > 1 = \frac{4}{9}$ (0.44 or better) or (0.55 or 0.56 or better) or median = 0.8458… (allow awrt 0.85) **NB** allow $\frac{1}{3}\int_0^1 x^2 - 4x + 5[\mathrm{d}x]$ or F(1) for P(X < 1)
	A1cso	stating median < 1 **NB** $\int_0^1 x^2 - 4x + 5[\mathrm{d}x]$ or P $X \leq 1$ for P $X < 1$