Question	Scheme	Marks
	Ignore any incorrect comparison eg 0.0465 < 0.025 if all previous marks have been awarded.	

Question	Scheme	Marks
4(a)	$\mathrm{E}(X^2) = \int_1^3 \frac{1}{15}(3x^4 - x^5)\,\mathrm{d}x + \int_3^5 \frac{3}{10}(x^3 - 3x^2)\,\mathrm{d}x$	M1
	$= \left[\frac{1}{15}\left(\frac{3x^5}{5} - \frac{x^6}{6}\right)\right]_1^3 + \left[\frac{3}{10}\left(\frac{x^4}{4} - x^3\right)\right]_3^5$	M1 A1
	$= \frac{2923}{225} = 12.99....$ awrt **<u>13.0</u>**	A1 (4)
(b)	$\int_1^x \frac{1}{15}(3t^2 - t^3)\,\mathrm{d}t$ or $\int \frac{1}{15}(3x^2 - x^3)\,\mathrm{d}x$ with $+c$ and $\mathrm{F}(1) = 0$	M1
	$\int_1^3 \frac{1}{15}(3t^2 - t^3)\,\mathrm{d}t + \int_3^x \frac{3}{10}(t-3)\,\mathrm{d}t$ or $\int \frac{3}{10}(x-3)\,\mathrm{d}x$ with $+d$ and $\mathrm{F}(5) = 1$	M1
	$[\mathrm{F}(x) =] \begin{cases} 0 & x < 1 \\ \frac{1}{15}x^3 - \frac{1}{60}x^4 - \frac{1}{20} & 1 \le x < 3 \\ \frac{3}{20}x^2 - \frac{9}{10}x + \frac{7}{4} \text{ or } \frac{3}{20}(x-3)^2 + 0.4 & 3 \le x \le 5 \\ 1 & x > 5 \end{cases}$	B1 A1 A1 (5)
(c)	$\mathrm{P}(2 < X < 4) = \mathrm{F}(4) - \mathrm{F}(2)$ or $\int_2^3 \frac{1}{15}(3x^2 - x^3)\,\mathrm{d}x + \int_3^4 \frac{3}{10}(x-3)\,\mathrm{d}x$	M1
	$\frac{3}{20}(4^2) - \frac{9}{10}(4) + \frac{7}{4} - \left(\frac{1}{15}(2^3) - \frac{1}{60}(2^4) - \frac{1}{20}\right) = \underline{\frac{1}{3}}$	A1 (2)
(d)	$1 - \mathrm{F}(k) = 0.2$ or $\int_k^5 \frac{3}{10}(x-3)\,\mathrm{d}x = 0.2$	M1
	$\frac{3}{20}k^2 - \frac{9}{10}k + \frac{7}{4} = 0.8$ or $\frac{3}{20}(k-3)^2 = 0.4 \rightarrow k = 4.63299...$ awrt **<u>4.63</u>**	dM1 A1 (3)

	Notes	Total [14]
(a)	1st M1 for sum of two integrals $\int x^2 \mathrm{f}(x)\mathrm{d}x$ (ignore limits) 2nd M1 for attempting to integrate one part of $\int x^2 \mathrm{f}(x)\mathrm{d}x$ (one term correct) Implied by 11.4 or awrt 1.59 1st A1 correct integration with limits – both integrals but do not need to add the two integrals. A1: accept exact fraction or awrt 13.0	
(b)	1st M1 Attempting to integrate1st line of pdf (1 term correct)with correct limits **<u>or</u>** $+c$ and F(1)=0 or F(3)= 0. 4 2nd M1 for attempting to integrate (1 term correct) 2nd line of pdf with correct limits + $\int_3^x \frac{3}{10}(t-3)\,\mathrm{d}t$ **<u>or</u>** + F(3) **<u>or</u>** correct ft expression for their F(3) **<u>or</u>** + d and F(5) = 1 B1 1st and 4th line correct. Allow one to have range of otherwise 1st A1 correct 2nd line with limits. Allow ⩽ for < and ⩾ for > and vice versa 2nd A1 correct 3rd line with limits. Allow ⩽ for < and ⩾ for > and vice versa	
(c)	M1 writing or using F(4) – F(2) or addition of correct integrals. Implied by 11/20 – 13/60oe. Allow for ft expression if cdf incorrect. A1 0.333 or better.	
(d)	1st M1 writing or using 1 – F(k) = 0.2 (or F(k) = 0.8) or correct integral. Allow either line of their cdf for F(k) 2nd dM1 dep on previous method mark being awarded. Setting up 3TQ using 2nd line of cdf = 0.8	