Question Number	Scheme	Marks
7. (a)	$\int_{-3}^{0} c(x+3)\,\mathrm{d}x + \int_{0}^{3} \frac{5}{36}(3-x)\,\mathrm{d}x$ **or** area of triangle $= \frac{3\times 3c}{2} + \frac{3\times\frac{5}{36}(3)}{2}$	M1
	$c(-\frac{9}{2}+9)+\frac{5}{8}=1$ oe $\qquad \frac{3\times 3c}{2}+\frac{5}{8}=1$ oe	dM1
	$c=\frac{1}{12}$*	A1cso (3)
	Alternative	
	$\left[\int c(x+3)\right] = c\left(\frac{x^2}{2}+3x\right)+d$ and $\left[\int \frac{5}{36}(3-x)\right] = \frac{5}{36}\left(3x-\frac{x^2}{2}\right)+e$	M1
	Using F(– 3) = 0 and F(3) = 1 and $d = e$	dM1
	$c=\frac{1}{12}$*	A1 cso
(b)(i)	A correct sketch of f(x) with straight line positive gradient from $-3 \le x < 0$ and straight line negative gradient from $0 \le x \le 3$, LHS below RHS at y axis	B1
	Correct labels: –3 and 3 on x-axis and $\frac{1}{4}$ and $\frac{5}{12}$ oe on y-axis	B1
(ii)	**Highest point** [at f(0), so $X = 0$ is the mode] oe	B1 (3)
(c)	$\int_{-3}^{x} \frac{1}{12}(t+3)\,\mathrm{d}t$ or $\int \frac{1}{12}(x+3)\,\mathrm{d}x$ with + c and F(–3) = 0	M1
	$\int_{-3}^{0} \frac{1}{12}(t+3)\,\mathrm{d}t + \int_{0}^{x} \frac{5}{36}(3-t)\,\mathrm{d}t$ or $\int \frac{5}{36}(3-x)\,\mathrm{d}x$ with + d and F(3) = 1	
	$\mathrm{F}(x)=\begin{cases}0 & x<-3\\ \frac{1}{24}x^2+\frac{1}{4}x+\frac{3}{8} & -3\le x<0\\ \frac{5}{12}x-\frac{5}{72}x^2+\frac{3}{8} & 0\le x\le 3\\ 1 & x>3\end{cases}$ **or** $\mathrm{F}(x)=\begin{cases}0\\ \frac{1}{24}(x+3)^2\\ 1-\frac{5}{72}(3-x)^2\\ 1\end{cases}$	B1 A1 A1 (4)
(d)	$[\mathrm{P}(X>d \mid X>0) =] \ \frac{1-\mathrm{F}(d)}{1-\mathrm{F}(0)} = \frac{2}{5}$ oe	M1
	$1-\mathrm{F}(d) = \frac{2}{5}\times\frac{5}{8}[=\frac{1}{4}]$ oe	A1
	Using cdf **or** area of triangle	
	$1-\left("\frac{5}{12}d-\frac{5}{72}d^2+\frac{3}{8}"\right)="\frac{2}{5}\times\frac{5}{8}"$ **or** $\frac{(3-d)\frac{5}{36}(3-d)}{2}="\frac{2}{5}\times\frac{5}{8}"$ oe	dM1
	$d =$ awrt **1.10**	A1 (4)
		[14 marks]

Notes

(a) M1 for correct integrals added, including limits, or area of triangle. Condone missing dx
Do not accept c(0 + 3)=5/36(3 – 0)
dM1 for equating to 1 and attempting to solve
A1 cso for $c = \frac{1}{12}$ with no incorrect working seen

(b)(ii) B1: oe eg Maximum value. Condone highest probability

(c) M1 for attempting to integrate first line of pdf with correct limits **or** + c and F(–3) = 0
or for attempting to integrate second line of pdf with correct limits +F(0) **or** + d and F(3) = 1

(d)	NB Allow use of F(0) = $\frac{3}{8}$ instead of either F(-3) =0 or F(3) =1 B1 1st and 4th line correct. Allow one of range to be otherwise, $\leq$ instead of $<$ and $\geq$ instead of $>$ 1st A1 correct 2nd line with limits. Allow $<$ instead of $\leq$ and vice versa 2nd A1 correct 3rd line with limits. Allow $<$ instead of $\leq$ and vice versa 1st M1 for a correct probability expression, allow $\frac{\mathrm{P}(X > d)}{\mathrm{P}(X > 0)} = \frac{2}{5}$oe implied by A1. Do not allow $\mathrm{P}(X > d) \cap \mathrm{P}(X > 0)$ for $\mathrm{P}(X > d)$ 1st A1 for $1 - \mathrm{F}(d) = \frac{2}{5} \times \frac{5}{8}$ or $1 - \mathrm{P}(x < d) = \frac{2}{5} \times \frac{5}{8} [= \frac{1}{4}]$ or $\mathrm{F}(d) = \frac{3}{4}$ or $\mathrm{P}(x > d) = \frac{1}{4}$oe 2nd dM1 previous M1 awarded. For $1 - \mathrm{F}(d) =$ their $\mathrm{P}(X > d)$ for their cdf oe **and** attempting to solve leading to a value for *d*.

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