Continuous random variables A1 MS

Q1.

1 **(i)** 1/12	B1 [1]	Accept 0.0833
(ii) trains arrive every 12 minutes	B1 [1]	must have 'every 12 minutes'

Q2.

7 **(i)**	$\int_{-1}^{1} k(1-x)\mathrm{d}x = 1$ $(k[x - \frac{x^2}{2}]_{-1}^{1} = 1)$ $2k = 1$ $(k = \frac{1}{2}$ **AG)**	M1 A1 [2]	Attempt integ f(x) = 1 with correct limits
(ii)	$(\int_{0.5}^{1} \frac{1}{2}(1-x)\mathrm{d}x = \frac{1}{2}[x - \frac{x^2}{2}]_{0.5}^{1})$ $= \frac{1}{16}$ or 0.0625	 B1 [1]	
(iii)	$\int_{-1}^{1} \frac{1}{2}(x - x^2)\mathrm{d}x$ $= \frac{1}{2}[\frac{x^2}{2} - \frac{x^3}{3}]_{-1}^{1}$ $= -\frac{1}{3}$ or –0.333	M1 A1 A1 [3]	$\int xf(x)\mathrm{d}x$ ignore limits Correct integrand and limits
(iv)	$\int_{-1}^{a} \frac{1}{2}(1-x)\mathrm{d}x = 0.25$ $(\frac{1}{2}[x - \frac{x^2}{2}]_{-1}^{a} = 0.25)$ $(\frac{1}{2}(a - \frac{a^2}{2} - (-1 - \frac{1}{2}) = 0.25)$ $a^2 - 2a - 2 = 0$ $a = 1 - \sqrt{3}$ or –0.732	M1 A1 A1 [3]	Correct limits (or integral from a to 1 = 0.75) any correct QE with "= 0"(or in completed square form $(a-1)^2 = 3$) Not $a = 1 \pm \sqrt{3}$; Not –0.732 or 2.732
	[Total: 9]		

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Q3.

5	**(i)** $\int_1^\infty \frac{k}{x^4}\,dx = 1$	M1	Attempt integ f(x) & "= 1"; ignore limits
	$\left[-\frac{k}{3x^3}\right]_1^\infty = 1$ oe		Correct integrand & limits leading to AG, no errors seen
	$(0+\frac{k}{3} = 1 \Rightarrow k = 3$ **AG)**	A1 [2]	
	(ii) $\int_1^\infty x \times \frac{3}{x^4}\,dx$	M1	Attempt integ xf(x); ignore limits.
	$\left[-\frac{3}{2x^2}\right]_1^\infty$		
	$= \frac{3}{2}$	A1	CWO
	$\int_1^\infty x^2 \times \frac{3}{x^4}\,dx$	M1*	Attempt integ x^2f(x); ignore limits.
	$\left[-\frac{3}{x}\right]_1^\infty$ (= 3)	A1	Correct integrand; correct limits
	"3" $-\left("\frac{3}{2}"\right)^2$	M1*dep	dep 2nd M1 attempt $E(X^2) - [E(X)]^2$
	$= \frac{3}{4}$	A1 [6]	cwo

Q4.

4	**(i)** $0.5(0.5 + 0.75)\times 0.5$ or $\int_1^{1.5} \frac{x}{2}\,dx$	M1	Attempt find correct area eg 1 squ + $^1/_4$ squ
	$= {}^5/_{16}$ or 0.3125 or 0.313	A1 [2]	or integral with correct limits any f(x)
	(ii) $^1/_2\, m \times {}^m/_2$ or $\int_0^m \frac{x}{2}\,dx$	M1	Attempt area from 0 to m (or m to 2) their f(x)
	$= {}^1/_2$	M1	Expression for area = $^1/_2$. Ignore limits
	$m = \sqrt{2}$ or 1.41	A1 [3]	
	(iii) $\int_0^2 \frac{x^2}{2}\,dx$	M1	Attempt $\int xf(x)dx$. Ignore limits
	$= {}^4/_3$ oe	A1 [2]	

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Q5.

6	**(i)**	$-k\int_2^3(x^2-5x+6)\mathrm{d}x = 1$ $(-k(\frac{3^3}{3}-5\times\frac{3^2}{2}+6\times3-[\frac{2^3}{3}-5\times\frac{2^2}{2}+6\times2])=1)$ $-k\times(-\frac{1}{6})=1$ or $k\times\frac{1}{6}=1$ $(k=6$ **AG)**	M1 A1 [2]	Integ = 1; ignore limits Correctly obtain $-\frac{1}{6}$ or $\frac{1}{6}$ CWO No rounded decimals	$-6\int_2^3(x^2-5x+6)\mathrm{d}x$ ignore limits Correctly obtain 1
	(ii)	E(X) = 2.5 $-6\int_2^3(x^4-5x^3+6x^2)\mathrm{d}x$ (= –6 × (–1.05)) – "2.5"^{2} = 0.05	B1 M1* Dep M1* A1 [4]	Condone 25000 Integ x^2f(x); ignore limits Subtr μ^2, ISW	
	(iii)	$-6\int_2^{2.2}(x^2-5x+6)\mathrm{d}x$ (= 0.104) $1-(1-$"0.104"$)^4$ = 0.355/0.356	M1 M1 A1 [3]	Integ with limits 2, 2.2 or 2.2, 3 Or equivalent	
			[Total: 9]		

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Q6.

7 (i) (a) X or 5	B1 [1]	
(b) V or 3	B1	Should mention values or prob Not just graph or spread eg not "More spread"
Higher and lower values more likely or there are more higher and lower values or more prob at both extremes	B1dep [2]	
(ii) $\frac{2+1}{2}\times 0.5$ or $\int_0^{0.5}(2-2x)\mathrm{d}x$	M1	('or' method requires linear function and correct limits)
$=0.75$	A1 [2]	CWO
(iii) (a) $\int_0^1 ax^n\mathrm{d}x=1$	M1	Attempt integ of correct form = 1 (ignore limits)
$\left[\frac{ax^{n+1}}{n+1}\right]_0^1=1$	A1	Correct integrand & limits
$\frac{a}{n+1}=1$	A1	No errors seen
$(a=n+1$ **AG**)	[3]	
(b) $\int_0^1 ax^{n+1}\mathrm{d}x=\frac{5}{6}$ oe	M1*	Integral of form $\int xf(x)\mathrm{d}x=\frac{5}{6}$, ignore limits
$\left[\frac{ax^{n+2}}{n+2}\right]_0^1=\frac{5}{6}$ oe	A1	Correct integrand & limits
$\frac{a}{n+2}=\frac{5}{6}$ $(6a=5n+10)$	M1dep	Attempt to use $a=n+1$ within 2nd equ to get an equ in n (or a)
$a=5, n=4$	A1 [4]	