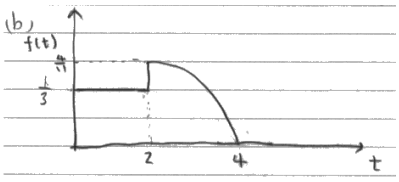
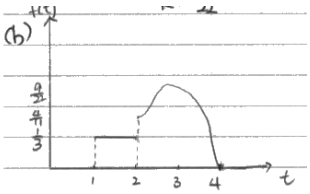
Question Number	Scheme		Marks
4(a)	$\int_1^2 \frac{1}{3}\,\mathrm{d}t + \int_2^4 k(4t^2 - t^3)\,\mathrm{d}t = 1$		M1
	$\left[\frac{1}{3}t\right]_1^2 + \left[k\left(\frac{4t^3}{3} - \frac{t^4}{4}\right)\right]_2^4 = 1$		A1
	$\frac{1}{3} + k\left(\frac{64}{3} - \frac{20}{3}\right) = 1$ or $\frac{44}{3}k = \frac{2}{3}$ leading to $k = \frac{1}{22}$		A1cso
			(3)
(b)	[f(t)] [4/11] [1/3] 1 2 4 [t]		B1(shape) dB1 (labels)
			(2)
(c)	$\frac{\mathrm{d}f(t)}{\mathrm{d}t} = k\left(8t - 3t^2\right)$		B1
	$8t - 3t^2 = 0$		M1
	$t = \frac{8}{3}$ only	awrt 2.67	A1
			(3)
(d)	$\int_1^t \frac{1}{3}\,\mathrm{d}x = \left[\frac{x}{3}\right]_1^t$		M1
	$\mathrm{F}(2) + \int_2^t \frac{1}{22}\left(4x^2 - x^3\right)\mathrm{d}t = \frac{1}{3} + \left[\frac{4x^3}{66} - \frac{x^4}{88}\right]_2^t$ Or $\int \frac{1}{22}\left(4t^2 - t^3\right)\mathrm{d}t = \frac{2t^3}{33} - \frac{t^4}{88} + C$ and $\mathrm{F}(4) = 1$		M1
	$\mathrm{F}(t) = \begin{cases} 0 & t<1 \\ \frac{1}{3}t - \frac{1}{3} & 1 \le t < 2 \\ \frac{2t^3}{33} - \frac{t^4}{88} + \frac{1}{33} & 2 \le t \le 4 \\ 1 & \text{otherwise} \end{cases}$		A1 A1 A1
			(5)
(e)	$\mathrm{P}(T > 3) = 1 - \mathrm{F}(3)$		
	$= 1 - \left[\frac{4\times 3^3}{66} - \frac{3^4}{88} + \frac{1}{33}\right]$		M1
	$= \frac{67}{264}$ or 0.2537…	awrt 0.254	A1
			(2)
			Total 15

		Notes
4(a)	**M1**	Adding the two integrals together with correct limits and setting = 1 (may be done in stages) Allow $\frac{1}{3}$ instead of first integral
	A1	Correct integration (again allow $\frac{1}{3}$ instead of first integration)
	A1cso	Must have at least one line of working before the given answer and no errors
(b)	**B1**	Correct shape with correct curvature Horizontal line, then quadratic (increasing then decreasing as t increases) starting above horizontal line and finishing on horizontal axis. The sketch is not continuous. There should be no **solid** vertical lines.
	dB1	Fully correct with 1, 2 and 4 each labelled at appropriate place on horizontal axis (Ignore vertical labelling). e.g.  B0B0 (solid vertical line)  B1B1Condone curvature
(c)	**B1**	For $k\left(8t-3t^2\right)$
	M1	Putting their differential = 0 ignore missing k
	A1	Allow awrt 2.67 only
(d)	**M1**	For $\int_1^t \frac{1}{3}\mathrm{d}x$ with attempt to integrate. Must have correct limits. Or for integration with +C and use of F(1) = 0
	M1	For $\mathrm{F}(2)+\int_2^t \frac{1}{22}\left(4x^2-x^3\right)\mathrm{d}x$ and attempt to integrate or $\int \frac{1}{22}\left(4t^2-t^3\right)\mathrm{d}t=\frac{4t^3}{66}-\frac{t^4}{88}+C$ and using F(4) =1 or F(2) = $\frac{1}{3}$ – must attempt to integrate, have + C
	A1	For 2nd line of cdf oe (allow < instead of $\leq$ and vice versa ditto > and $\geq$) (allow any letter to be used for this A1 mark)
	A1	For 3rd line of cdf oe (allow < instead of $\leq$ and vice versa ditto > and $\geq$) (allow any letter to be used for this A1 mark)
	A1	All correct and in terms of t including F(t). Allow the otherwise to be for any of the parts but there must be only one. (allow < instead of $\leq$ and vice versa ditto > and $\geq$)
(e)	**M1**	Attempting to find 1 – F(3) with attempt to use 3rd line of their F(t) or $\int_3^4 k(4t^2-t^3)\mathrm{d}t$
	A1	$\frac{67}{264}$ oe or awrt 0.254