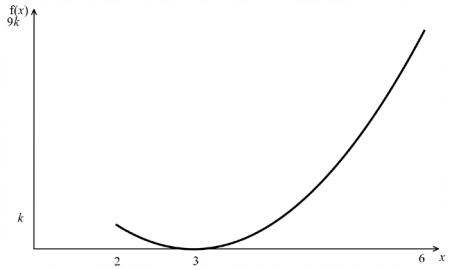
Question Number	Scheme	Marks
7 (a)	 Correct shape Fully correct including labels for 2, 3, 6, k and $9k$. Must be on the sketch	M1 A1 (2)
(b)	Mode = 6	B1 (1)
(c)(i)	$\int k(x-3)^2 \, dx = 1$	M1
	$k\int_2^6 x^2-6x+9 \, dx = k\left[\frac{1}{3}x^3-3x^2+9x\right]_2^6$ or $k\left[\frac{1}{3}(x-3)^3\right]_2^6$ Alt method $\Rightarrow k\left(\frac{1}{3}x^3-3x^2+9x\right)+c$	M1
	$18k-\frac{26k}{3}=1$ or $9k--\frac{k}{3}=1$ $k\left(\frac{1}{3}(2)^3-3(2)^2+9(2)\right)+c=0$ $\Rightarrow c=-\frac{26}{3}k$ $k\left(\frac{1}{3}(6)^3-3(6)^2+9(6)\right)-\frac{26}{3}k=1$	dM1
	e.g. $\frac{28k}{3}=1 \quad \therefore k=\frac{3}{28}$*	A1*
		(4)
(ii)	$\frac{3}{28}\int_2^{5.71} x^2-6x+9 \, dx = 0.7465...$ and $\frac{3}{28}\int_2^{5.72} x^2-6x+9 \, dx = 0.7544...$ $\frac{3}{28}\int_{5.71}^6 x^2-6x+9 \, dx = 0.25348...$ and $\frac{3}{28}\int_{5.72}^6 x^2-6x+9 \, dx = 0.24558...$	M1 dM1
	e.g. $0.7465\ldots < 0.75 < 0.7544\ldots$ therefore $5.71 < Q_3 < 5.72$ oe e.g. $0.24558\ldots < 0.25 < 0.25348\ldots$ therefore $5.71 < Q_3 < 5.72$ oe	A1
		(3)
Alt(ii)	$\frac{3}{28}\int_2^{5.71} x^2-6x+9 \, dx - 0.75 = -0.003...$ and $\frac{3}{28}\int_2^{5.72} x^2-6x+9 \, dx - 0.75 = 0.004...$ $\frac{3}{28}\int_{5.71}^6 x^2-6x+9 \, dx - 0.25 = 0.003...$ and $\frac{3}{28}\int_{5.72}^6 x^2-6x+9 \, dx - 0.25 = -0.004...$	M1 dM1
	e.g. there is a change of sign therefore Q_3 lies between 5.71 and 5.72 oe	A1
		(3)
		Total 10

	Notes	
(a)	**M1**	for correct positive quadratic shape in first quadrant ignore labelling with a minimum point on the x-axis. End point on the lhs should be lower than the end point on rhs. Condone poor curvature but not straight lines provided the intention is clear
	A1	fully correct including the coordinates $(2, k)$ (accept $(2, \frac{3}{28})$) , $(3, 0)$ and $(6, 9k)$ (accept $(6, \frac{27}{28})$) shown on sketch. Labels on axes are sufficient.
(b)	**B1**	mode = 6 only
(c)(i)	**M1**	correct integral set equal to 1. May be seen or implied in later work. Does not require limits.
	M1	attempt to expand brackets and integrate with at least one x^{n+1} term. Ignore coefficients of terms. May attempt to integrate $(x-3)^2 \to (x-3)^3$. Does not require limits
	dM1	dep on both previous M marks for use of correct limits proceeding to a linear equation in k set equal to 1 or implied.
	A1*	cso including correct use of brackets. Must show some evidence of evaluation after substituting in limits before proceeding to $k = \frac{3}{28}$. e.g. $k\left(\frac{1}{3}(6-3)^3 - \frac{1}{3}(2-3)^3\right) = 1 \Rightarrow k = \frac{3}{28}$ is A0*
Alt(c)(i)	**M1**	correct integral set equal to 1. May be seen or implied in later work. Does not require limits.
	M1	attempt to expand brackets and integrate with at least one x^{n+1} term. Ignore coefficients of terms. May attempt to integrate $(x-3)^2 \to (x-3)^3$. Does not require limits.
	M1	for substituting $x = 2$ into their integrated expression and set equal to 0 to find c in terms of k $\left(-\frac{26k}{3}\right)$ Then substitutes in $x = 6$ and set equal to 1 achieves a linear equation in k. (or the opposite way round using $x = 6$ and setting equal to 1 to find c and then substituting $x = 2$ and setting equal to 0)
	A1*	cso including correct use of brackets. Must show some evidence of evaluation after substituting in $x = 6$ (or $x = 2$ if the other way round) before proceeding to $k = \frac{3}{28}$.
(ii)	**M1**	1 calculation attempted, ie attempting to evaluate 1 definite integral with the correct limits. Implied by awrt 0.747 (or allow 0.746) or awrt 0.754 or awrt 0.253 or awrt 0.246 (allow 0.245)
	dM1	dep on 1st M for 2 calculations attempted. Implied by both correct values to 3sf
	A1	for correct values awrt 0.747 (or allow 0.746) and awrt 0.754 (or awrt 0.253 and awrt 0.246 (allow 0.245)), comparisons and justification of Q_3. Must refer to the upper quartile oe. Not just e.g. x. Do not penalise mislabelling of their functions.
Alt(ii)	**M1**	1 calculation attempted, ie attempting to evaluate 1 definite integral with the correct limits and subtracting 0.75 or 0.25 as appropriate
	dM1	dep on 1st M for 2 calculations attempted (imp. by correct values rounded to 1sf or truncated)
	A1	for correct values (rounded or truncated), comparisons and justification of Q_3. Must refer to the upper quartile oe. Not just e.g. x. The comparisons with 0 may be done in their working. Do not penalise mislabelling of their functions.
		Note: May substitute 5.71 and 5.72 into $a^3 - 9a^2 + 27a - 47 = 0$ instead proceeding to values of $-0.0974...$ and $0.12364...$
(ii)	**SC M1dM1 A0**	Integrates, sets equal to 0.75 and solves with a justification of Q_3: $\frac{3}{28}\int_2^a x^2 - 6x + 9 \, dx = 0.75 \Rightarrow \frac{3}{28}\left[\frac{1}{3}x^3 - 3x^2 + 9x\right]_2^a = 0.75 \Rightarrow a = 5.714...$ $\left(= a^3 - 9a^2 + 27a - 47 = 0\right) \Rightarrow a =$ awrt 5.714 $5.71 < 5.714 < 5.72$ therefore $5.71 < Q_3 < 5.72$ oe

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