1	Obtain integral of form $k \ln x$	M1		[any non-zero constant k; or equiv such as $k \ln 3x$]
	Obtain $3 \ln 8 - 3 \ln 2$	A1		[or exact equiv]
	Attempt use of at least one relevant log property	M1		[would be earned by initial $\ln x^3$]
	Obtain $3 \ln 4$ or $\ln 8^3 - \ln 2^3$ and hence $\ln 64$	A1	4	[AG; with no errors]
2	Attempt use of identity linking $\sec^2\theta$, $\tan^2\theta$ and 1	M1		[to write eqn in terms of $\tan\theta$]
	Obtain $\tan^2\theta - 4\tan\theta + 3 = 0$	A1		[or correct unsimplified equiv]
	Attempt solution of quadratic eqn to find two values of $\tan\theta$	M1		[any 3 term quadratic eqn in $\tan\theta$]
	Obtain at least two correct answers	A1		[after correct solution of eqn]
	Obtain all four of 45, 225, 71.6, 251.6	A1	5	[allow greater accuracy or angles to nearest degree – and no other answers between 0 and 360]
3 (a)	Attempt use of product rule	M1		[involving ... + ...]
	Obtain $2x(x+1)^6$ ...	A1		
	Obtain ... $+ 6x^2(x+1)^5$	A1	3	[or equivs; ignore subsequent attempt at simplification]
(b)	Attempt use of quotient rule	M1		[or, with adjustment, product rule; allow u v confusion]
	Obtain $\dfrac{(x^2-3)2x-(x^2+3)2x}{(x^2-3)^2}$	A1		[or equiv]
	Obtain -3	A1	3	[from correct derivative only]
4 (i)	State $y \le 2$	B1	1	[or equiv; allow <; allow any letter or none]
(ii)	Show correct process for composition of functions	M1		[numerical or algebraic]
	Obtain 0 and hence 2	A1	2	[and no other value]
(iii)	State a range of values with 2 as one end-point	M1		[continuous set, not just integers]
	State $0 < k \le 2$	A1	2	[with correct < and ≤ now]
5	Obtain integral of form $k(1-2x)^6$	M1		[any non-zero constant k]
	Obtain correct $-\frac{1}{12}(1-2x)^6$	A1		[or unsimplified equiv; allow + c]
	Use limits to obtain $\frac{1}{12}$	A1		[or exact (unsimplified) equiv]
	Obtain integral of form ke^{2x-1}	M1		[or equiv; any non-zero constant k]
	Obtain correct $\frac{1}{2}e^{2x-1} - x$	A1		[or equiv; allow + c]
	Use limits to obtain $-\frac{1}{2}e^{-1}$	A1		[or exact (unsimplified) equiv]
	Show correct process for finding required area	M1		[at any stage of solution; if process involves two definite integrals, second must be negative]
	Obtain $\frac{1}{12} + \frac{1}{2}e^{-1}$	A1	8	[or exact equiv; no + c]

6 (a)	Either:	State proportion $\frac{440}{275}$	**B1**		
		Attempt calculation involving proportion	**M1**		[involving multn and X value]
		Obtain 704	**A1**	**3**	
	Or:	Use formula of form $275e^{kt}$ or $275a^t$	**M1**		[or equiv]
		Obtain $k = 0.047$ or $a = \sqrt[10]{1.6}$	**A1**		[or equiv]
		Obtain 704	**A1**	**(3)**	[allow ±0.5]
	(b)(i)	Attempt correct process involving logarithm	**M1**		[or equiv including systematic trial and improvement attempt]
		Obtain $\ln\frac{20}{80} = -0.02t$	**A1**		[or equiv]
		Obtain 69	**A1**	**3**	[or greater accuracy: scheme for T&I: M1A2]
	(ii)	Differentiate to obtain $ke^{-0.02t}$	**M1**		[any constant k different from 80]
		Obtain $-1.6e^{-0.02t}$ (or $1.6e^{0.02t}$)	**A1**		[or unsimplified equiv]
		Obtain 0.88	**A1**	**3**	[or greater accuracy: allow −0.88]

7	**(i)**	Sketch curve showing (at least) translation in x direction	**M1**		[either positive or negative]
		Show correct sketch with one of 2 and 3π indicated	**A1**		
		... and with other one of 2 and 3π indicated	**A1**	**3**	
	(ii)	Draw straight line through O with positive gradient	**B1**	**1**	[label and explanation not required]
	(iii)	Attempt calculations using 1.8 and 1.9	**M1**		[allow here if degrees used]
		Obtain correct values and indicate change of sign	**A1**	**2**	[or equiv, $x = 1.8$: LHS = 1.93, diff = 0.13; $x = 1.9$: LHS = 1.35, diff = -0.55; radians needed now]
	(iv)	Obtain correct first iterate 1.79 or 1.78	**B1**		[or greater accuracy]
		Attempt correct process to produce at least 3 iterates	**M1**		
		Obtain 1.82	**A1**		[answer required to exactly 2 d.p.: $2 \rightarrow 1.7859 \rightarrow 1.8280 \rightarrow 1.8200$. SR: answer 1.82 only - B2]
		Attempt rearrangement of $3\cos^{-1}(x-1) = x$ or of $x = 1 + \cos(\frac{1}{3}x)$	**M1**		[involving at least two steps]
		Obtain required formula or equation respectively	**A1**	**5**	

8	(i)	Differentiate to obtain $kx(5-x^2)^{-1}$	M1		[any non-zero constant]
		Obtain correct $-2x(5-x^2)^{-1}$	A1		[or equiv]
		Obtain -4 for value of derivative	A1		
		Attempt equation of straight line through (2, 0) with numerical value of gradient obtained from attempt at derivative	M1		[not for attempt at eqn of normal]
		Obtain $y = -4x + 8$	A1	5	[or equiv]
	(ii)	State or imply $h = \frac{1}{2}$	B1		
		Attempt calculation involving attempts at y values	M1		[addition with each of coefficients 1, 2, 4 occurring at least once]
		Obtain $k(\ln 5 + 4\ln 4.75 + 2\ln 4 + 4\ln 2.75 + \ln 1)$	A1		[or equiv perhaps with decimals: any constant k]
		Obtain 2.44	A1	4	[allow ± 0.01]
	(iii)	Attempt difference of two areas	M1		[allow if area of their triangle + area A]
		Obtain $8 - 2.44$ and hence 5.56	A1√	2	[following their tangent and area of A providing answer positive]

9	(i)	State $\sin 2\theta \cos\theta + \cos 2\theta \sin\theta$	B1		
		Use at least one of $\sin 2\theta = 2\sin\theta\cos\theta$ and $\cos 2\theta = 1 - 2\sin^2\theta$	B1		
		Attempt complete process to express in terms of $\sin\theta$	M1		[using correct identities]
		Obtain $3\sin\theta - 4\sin^3\theta$	A1	4	[AG: all correctly obtained]
	(ii)	State 3	B1		
		Obtain expression involving $\sin 10\alpha$	M1		[allow θ / α confusion]
		Obtain 9	A1	3	[and no other value]
	(iii)	Recognise cosec 2β as $\frac{1}{\sin 2\beta}$	B1		[allow θ / β confusion]
		Attempt to express equation in terms of $\sin 2\beta$ only	M1		[or equiv involving $\cos 2\beta$]
		Attempt to find non-zero value of $\sin 2\beta$	M1		[or of $\cos 2\beta$]
		Obtain at least $\sin 2\beta = \sqrt{\frac{5}{12}}$	A1		[or equiv, exact or approx]
		Attempt correct process to find two values of β	M1		[provided equation is $\sin 2\beta = k$, or equiv with $\cos 2\beta$]
		Obtain 20.1, 69.9	A1	6	[and no others between 0 and 90]