1	*EITHER*:	State or imply non-modular inequality $(4x + 3)^2 > x^2$, or corresponding equation or pair of equations $4x + 3 = \pm x$	M1	
		Obtain a critical value, e.g. -1	A1	
		Obtain a second critical value, e.g. $-\frac{3}{5}$	A1	
		State final answer $x < -1$, $x > -\frac{3}{5}$	A1	
	OR:	Obtain critical value $x = -1$, by solving a linear equation or inequality, or from a graphical method or by inspection	B1	
		Obtain the critical value $-\frac{3}{5}$ similarly	B2	
		State final answer $x < -1$, $x > -\frac{3}{5}$	B1	[4]
		[Do not condone $\le$ or $\ge$.]		

2	Use law for the logarithm of a product, quotient or power	M1	
	Use ln e = 1 or exp(l) = 3	M1	
	Obtain correct equation free of logarithms in any form, e.g. $\frac{y+1}{y} = ex^3$	A1	
	Rearrange as $y = (ex^3 - 1)^{-1}$, or equivalent	A1	[4]

3	Use correct tan $2A$ formula and cot x = 1/tan x to form an equation in tan x	M1	
	Obtain a correct horizontal equation in any form	A1	
	Solve an equation in $\tan^2 x$ for x	M1	
	Obtain answer, e.g. 40.2°	A1	
	Obtain second answer, e.g. 139.8°, and no other in the given interval	A1√	[5]
	[Ignore answers outside the given interval.]		
	[Treat answers in radians as a misread and deduct A1 from the marks for the angles.]		
	[SR: For the answer x = 90° give B1 and A1 for one of the other angles.]		

4	**(i)**	State $R = 2$	B1	
		Use trig formula to find α	M1	
		Obtain $\alpha = \frac{1}{6}\pi$ with no errors seen	A1	[3]
	(ii)	Substitute denominator of integrand and state integral $k \tan(x - \alpha)$	M1*	
		State correct indefinite integral $\frac{1}{4}\tan\left(x - \frac{1}{6}\pi\right)$	A1√	
		Substitute limits	M1 (dep*)	
		Obtain the given answer correctly	A1	[4]

5	**(i)**	Substitute $x = -\frac{1}{2}$, or divide by $(2x + 1)$, and obtain a correct equation, e.g. $a - 2b + 8 = 0$	B1	
		Substitute $x = \frac{1}{2}$ and equate to 1, or divide by $(2x - 1)$ and equate constant remainder to 1	M1	
		Obtain a correct equation, e.g. $a + 2b + 12 = 0$	A1	
		Solve for a or for b	M1	
		Obtain $a = -10$ and $b = -1$	A1	[5]
	(ii)	Divide by $2x^2 - 1$ and reach a quotient of the form $4x + k$	M1	
		Obtain quotient $4x - 5$	A1	
		Obtain remainder $3x - 2$	A1	[3]
6	**(i)**	State the correct derivatives $2e^{2x-3}$ and $2/x$	B1	
		Equate derivatives and use a law of logarithms on an equation equivalent to $ke^{2x-3} = m/x$	M1	
		Obtain the given result correctly (or work *vice versa*)	A1	[3]
	(ii)	Consider the sign of $a - \frac{1}{2}(3 - \ln a)$ when $a = 1$ and $a = 2$, or equivalent	M1	
		Complete the argument with correct calculated values	A1	[2]
	(iii)	Use the iterative formula correctly at least once	M1	
		Obtain final answer 1.35	A1	
		Show sufficient iterations to 4 d.p. to justify 1.35 to 2 d.p., or show there is a sign change in the interval (1.345, 1.355)	A1	[3]
7	**(i)**	Show that $a^2 + b^2 = (a + ib)(a - ib)$	B1	
		Show that $(a + ib - ki)^* = a - ib + ki$	B1	[2]
	(ii)	Square both sides and express the given equation in terms of z and z^*	M1	
		Obtain a correct equation in any form, e.g. $(z - 10i)(z^* + 10i) = 4(z - 4i)(z^* + 4i)$	A1	
		Obtain the given equation	A1	
		Either express $\lvert z - 2i \rvert = 4$ in terms of z and z^* or reduce the given equation to the form $\lvert z - u \rvert = r$	M1	
		Obtain the given answer correctly	A1	[5]
	(iii)	State that the locus is a circle with centre 2i and radius 5	B1	[1]

8	(i)	Separate variables correctly and integrate at least one side	M1	
		Obtain term ln t, or equivalent	B1	
		Obtain term of the form $a\ \ln(k - x^3)$	M1	
		Obtain term $-\frac{2}{3}\ln(k - x^3)$, or equivalent	A1	
		EITHER: Evaluate a constant or use limits $t = 1$, $x = 1$ in a solution containing a ln t and $b\ \ln(k - x^3)$	M1*	
		Obtain correct answer in any form e.g. $\ln t = -\frac{2}{3}\ln(k - x^3) + \frac{2}{3}\ln(k - 1)$	A1	
		Use limits $t = 4$, $x = 2$, and solve for k	M1(dep*)	
		Obtain $k = 9$	A1	
		OR: Using limits $t = 1$, $x = 1$ and $t = 4$, $x = 2$ in a solution containing a ln t and $b\ \ln\ (k - x^3)$ obtain an equation in k	M1*	
		Obtain a correct equation in any form, e.g. $\ln 4 = -\frac{2}{3}\ln(k - 8) + \frac{2}{3}\ln(k - 1)$	A1	
		Solve for k	M1(dep*)	
		Obtain $k = 9$	A1	
		Substitute $k = 9$ and obtain $x = (9 - 8t^{-\frac{3}{2}})^{\frac{1}{3}}$	A1	[9]
	(ii)	State that x approaches $9^{\frac{1}{3}}$, or equivalent	B1√	[1]
9	(i)	Use product rule	M1	
		Obtain correct derivative in any form, e.g. $4\sin 2x \cos 2x \cos x - \sin^2 2x \sin x$	A1	
		Equate derivative to zero and use a double angle formula	M1*	
		Reduce equation to one in a single trig function	M1(dep*)	
		Obtain a correct equation in any form, e.g. $10 \cos^3 x = 6 \cos x$, $4 = 6 \tan^2 x$ or $4 = 10 \sin^2 x$	A1	
		Solve and obtain $x = 0.685$	A1	[6]
	(ii)	Using $\mathrm{d}u = \pm \cos x\ \mathrm{d}x$, or equivalent, express integral in terms of u and du	M1	
		Obtain $\int 4u^2(1 - u^2)\,\mathrm{d}u$, or equivalent	A1	
		Use limits $u = 0$ and $u = 1$ in an integral of the form $au^3 + bu^5$	M1	
		Obtain answer $\frac{8}{15}$ (or 0.533)	A1	[4]
10	(i)	Equate scalar product of direction vector of l and p to zero	M1	
		Solve for a and obtain $a = -6$	A1	[2]
	(ii)	Express general point of l correctly in parametric form, e.g. $3\mathbf{i} + 2\mathbf{j} + \mathbf{k} + \mu(2\mathbf{i} + \mathbf{j} + 2\mathbf{k})$ or $(1 - \mu)(3\mathbf{i} + 2\mathbf{j} + \mathbf{k}) + \mu(\mathbf{i} + \mathbf{j} - \mathbf{k})$	B1	
		Equate at least two pairs of corresponding components of l and the second line and solve for λ or for μ	M1	
		Obtain either $\lambda = \frac{2}{3}$ or $\mu = \frac{1}{3}$; or $\lambda = \frac{2}{a-1}$ or $\mu = \frac{1}{a-1}$; or reach $\lambda(a - 4) = 0$ or $(1 + \mu)(a - 4) = 0$	A1	
		Obtain $a = 4$ having ensured (if necessary) that all three component equations are satisfied	A1	[4]

(iii)	Using the correct process for the moduli, divide scalar product of direction vector if *l* and normal to *p* by the product of their moduli and equate to the sine of the given angle, or form an equivalent horizontal equation	M1*	
	Use $\frac{2}{\sqrt{5}}$ as sine of the angle	A1	
	State equation in any form, e.g. $\frac{a+6}{\sqrt{(a^2+4+1)}\sqrt{(1+4+4)}}=\frac{2}{\sqrt{5}}$	A1	
	Solve for *a*	M1 (dep*)	
	Obtain answers for $a = 0$ and $a = \frac{60}{31}$, or equivalent	A1	[5]
	[Allow use of the cosine of the angle to score M1M1.]		