Question	Answer	Marks
1	**EITHER:** State or imply non-modular inequality $(2x+1)^2 < (3(x-2))^2$, or corresponding quadratic equation, or pair of linear equations $(2x+1) = \pm 3(x-2)$	**(B1**
	Make reasonable solution attempt at a 3-term quadratic e.g. $5x^2 - 40x + 35 = 0$ or solve two linear equations for x	**M1**
	Obtain critical values $x = 1$ and $x = 7$	**A1**
	State final answer $x < 1$ and $x > 7$	**A1)**
	OR: Obtain critical value $x = 7$ from a graphical method, or by inspection, or by solving a linear equation or inequality	**(B1**
	Obtain critical value $x = 1$ similarly	**B2**
	State final answer $x < 1$ and $x > 7$	**B1)**
	Total:	**4**
2	**EITHER:** State a correct unsimplified version of the x or x^2 or x^3 term in the expansion of $(1+6x)^{-\frac{1}{3}}$	**(M1**
	State correct first two terms $1-2x$	**A1**
	Obtain term $8x^2$	**A1**
	Obtain term $-\frac{112}{3}x^3$ $\left(37\frac{1}{3}x^3\right)$ in final answer	**A1)**
	OR: Differentiate expression and evaluate $\mathrm{f}(0)$ and $\mathrm{f}'(0)$, where $\mathrm{f}'(x) = k(1+6x)^{-\frac{4}{3}}$	**(M1**
	Obtain correct first two terms $1-2x$	**A1**
	Obtain term $8x^2$	**A1**
	Obtain term $-\frac{112}{3}x^3$ in final answer	**A1)**
	Total:	**4**

Question	Answer	Marks
3(i)	Remove logarithms correctly and obtain $e^x = \frac{1-y}{y}$	B1
	Obtain the **given answer** $y = \frac{e^{-x}}{1+e^{-x}}$ following full working	B1
	Total:	2
3(ii)	State integral $k\ln(1+e^{-x})$ where $k = \pm 1$	*M1
	State correct integral $-\ln(1+e^{-x})$	A1
	Use limits correctly	DM1
	Obtain the **given answer** $\ln\left(\frac{2e}{e+1}\right)$ following full working	A1
	Total:	4
4(i)	Use chain rule to differentiate x $\left(\frac{dx}{d\theta} = -\frac{\sin\theta}{\cos\theta}\right)$	M1
	State $\frac{dy}{d\theta} = 3 - \sec^2\theta$	B1
	Use $\frac{dy}{dx} = \frac{dy}{d\theta} \div \frac{dx}{d\theta}$	M1
	Obtain correct $\frac{dy}{dx}$ in any form e.g. $\frac{3-\sec^2\theta}{-\tan\theta}$	A1
	Obtain $\frac{dy}{dx} = \frac{\tan^2\theta - 2}{\tan\theta}$, or equivalent	A1
	Total:	5
4(ii)	Equate gradient to −1 and obtain an equation in $\tan\theta$	M1
	Solve a 3 term quadratic $\left(\tan^2\theta + \tan\theta - 2 = 0\right)$ in $\tan\theta$	M1
	Obtain $\theta = \frac{\pi}{4}$ and $y = \frac{3\pi}{4} - 1$ only	A1
	Total:	3

Question	Answer	Marks
5(i)	Use correct sector formula at least once and form an equation in r and x	M1
	Obtain a correct equation in any form	A1
	Rearrange in the given form	A1
	Total:	3
5(ii)	Calculate values of a relevant expression or expressions at $x = 1$ and $x = 1.5$	M1
	Complete the argument correctly with correct calculated values	A1
	Total:	2
5(iii)	Use the iterative formula correctly at least once	M1
	Obtain final answer 1.374	A1
	Show sufficient iterations to 5 d.p. to justify 1.374 to 3 d.p., or show there is a sign change in the interval (1.3745, 1.3755)	A1
	Total:	3
6(i)	State or obtain coordinates (1, 2, 1) for the mid-point of AB	B1
	Verify that the midpoint lies on m	B1
	State or imply a correct normal vector to the plane, e.g. $2\mathbf{i}+2\mathbf{j}-\mathbf{k}$	B1
	State or imply a direction vector for the segment AB, e.g. $-4\mathbf{i}-4\mathbf{j}+2\mathbf{k}$	B1
	Confirm that m is perpendicular to AB	B1
	Total:	5
6(ii)	State or imply that the perpendicular distance of m from the origin is $\frac{5}{3}$, or unsimplified equivalent	B1
	State or imply that n has an equation of the form $2x+2y-z=k$	B1
	Obtain answer $2x+2y-z=2$	B1
	Total:	3

Question	Answer	Marks
7(i)	State that $u - 2w = -7 - i$	B1
	EITHER: Multiply numerator and denominator of $\frac{u}{w}$ by $3 - 4i$, or equivalent	(M1
	Simplify the numerator to $25 + 25i$ or denominator to 25	A1
	Obtain final answer $1 + i$	A1)
	OR: Obtain two equations in x and y and solve for x or for y	(M1
	Obtain $x = 1$ or $y = 1$	A1
	Obtain final answer $1 + i$	A1)
	Total:	4
7(ii)	Find the argument of $\frac{u}{w}$	M1
	Obtain the given answer	A1
	Total:	2
7(iii)	State that OB and CA are parallel	B1
	State that $CA = 2OB$, or equivalent	B1
	Total:	2
8(i)	Use $\sin(A - B)$ formula and obtain an expression in terms of $\sin x$ and $\cos x$	M1
	Collect terms and reach $\sqrt{3}\sin x - 2\cos x$, or equivalent	A1
	Obtain $R = \sqrt{7}$	A1
	Use trig formula to find α	M1
	Obtain $\alpha = 49.11°$ with no errors seen	A1
	Total:	5

Question	Answer	Marks
8(ii)	Evaluate $\sin^{-1}(1/\sqrt{7})$ to at least 1 d.p. (22.21° to 2 d.p.)	**B1 FT**
	Use a correct method to find a value of x in the interval $0° < x < 180°$	**M1**
	Obtain answer 71.3°	**A1**
	[ignore answers outside given range.]	
	Total:	**3**
9(i)	Carry out a relevant method to obtain A and B such that $\frac{1}{x(2x+3)} \equiv \frac{A}{x} + \frac{B}{2x+3}$, or equivalent	**M1**
	Obtain $A = \frac{1}{3}$ and $B = -\frac{2}{3}$, or equivalent	**A1**
	Total:	**2**
9(ii)	Separate variables and integrate one side	**B1**
	Obtain term $\ln y$	**B1**
	Integrate and obtain terms $\frac{1}{3}\ln x - \frac{1}{3}\ln(2x+3)$, or equivalent	**B2 FT**
	Use $x = 1$ and $y = 1$ to evaluate a constant, or as limits, in a solution containing $a\ln y,\ b\ln x,\ c\ln(2x+3)$	**M1**
	Obtain correct solution in any form, e.g. $\ln y = \frac{1}{3}\ln x - \frac{1}{3}\ln(2x+3) + \frac{1}{3}\ln 5$	**A1**
	Obtain answer $y = 1.29$ (3s.f. only)	**A1**
	Total:	**7**
10(i)	State or imply $\mathrm{d}u = -\sin x\ \mathrm{d}x$	**B1**
	Using correct double angle formula, express the integral in terms of u and $\mathrm{d}u$	**M1**
	Obtain integrand $\pm(2u^2-1)^2$	**A1**
	Change limits and obtain correct integral $\int_{\frac{1}{\sqrt{2}}}^{1}(2u^2-1)^2\,\mathrm{d}u$ with no errors seen	**A1**
	Substitute limits in an integral of the form $au^5 + bu^3 + cu$	**M1**
	Obtain answer $\frac{1}{15}(7-4\sqrt{2})$, or exact simplified equivalent	**A1**
	Total:	**6**

Question	Answer	Marks
10(ii)	Use product rule and chain rule at least once	**M1**
	Obtain correct derivative in any form	**A1**
	Equate derivative to zero and use trig formulae to obtain an equation in $\cos x$ and $\sin x$	**M1**
	Use correct methods to obtain an equation in $\cos x$ or $\sin x$ only	**M1**
	Obtain $10\cos^2 x = 9$ or $10\sin^2 x = 1$, or equivalent	**A1**
	Obtain answer 0.32	**A1**
	Total:	**6**