Question	Answer	Marks
1	Use law of the logarithm of a product or power	**M1**
	Obtain a correct linear inequality in any form, e.g. $\ln 2 + (1 - 2x)\ln 3 < x \ln 5$	**A1**
	Solve for x	**M1**
	Obtain $x > \dfrac{\ln 6}{\ln 45}$	**A1**
		4

Question	Answer	Marks
2(a)	State a correct unsimplified version of the x or x^2 term of the expansion of $(2 - 3x)^{-2}$ or $\left(1 - \dfrac{3}{2}x\right)^{-2}$	**M1**
	State correct first term $\dfrac{1}{4}$	**B1**
	Obtain the next two terms $\dfrac{3}{4}x + \dfrac{27}{16}x^2$	**A1 + A1**
		4
2(b)	State answer $\lvert x \rvert < \dfrac{2}{3}$, or equivalent	**B1**
		1

Question	Answer	Marks
3	Use tan $(A \pm B)$ formula and obtain an equation in tan θ	M1
	Using $\tan 60° = \sqrt{3}$, obtain a horizontal equation in tan θ in any correct form	A1
	Reduce the equation to $3\tan^2\theta + 4\tan\theta - 1 = 0$, or equivalent	A1
	Solve a 3-term quadratic for tan θ	M1
	Obtain a correct answer, e.g. 12.1°	A1
	Obtain a second correct answer, e.g. 122.9°, and no others in the given interval	A1
		6

Question	Answer	Marks
4(a)	Use product rule	M1
	Obtain derivative in any correct form e.g. $2e^{2x}(\sin x + 3\cos x) + e^{2x}(\cos x - 3\sin x)$	A1
	Equate derivative to zero and obtain an equation in one trigonometric ratio	M1
	Obtain $x = 1.43$ only	A1
		4
4(b)	Use a correct method to determine the nature of the stationary point e.g. $x = 1.42,\ y' = 0.06e^{2.84} > 0$ $x = 1.44,\ y' = -0.07e^{2.88} < 0$	M1
	Show that it is a maximum point	A1
		2

Question	Answer	Marks
5(a)	Commence division and reach quotient of the form $2x + k$	**M1**
	Obtain quotient $2x - 1$	**A1**
	Obtain remainder 6	**A1**
		3
5(b)	Obtain terms $x^2 - x$ (**FT** on quotient of the form $2x + k$)	**B1FT**
	Obtain term of the form $a\tan^{-1}\left(\frac{x}{\sqrt{3}}\right)$	**M1**
	Obtain term $\frac{6}{\sqrt{3}}\tan^{-1}\left(\frac{x}{\sqrt{3}}\right)$ (**FT** on a constant remainder)	**A1FT**
	Use $x = 1$ and $x = 3$ as limits in a solution containing a term of the form $a\tan^{-1}(bx)$	**M1**
	Obtain final answer $\frac{1}{\sqrt{3}}\pi + 6$, or exact equivalent	**A1**
		5

Question	Answer	Marks
6(a)	State or imply $AT = r\tan x$ or $BT = r\tan x$	**B1**
	Use correct area formula and form an equation in r and x	**M1**
	Rearrange in the given form	**A1**
		3
6(b)	Calculate the values of a relevant expression or pair of expressions at $x = 1$ and $x = 1.4$	**M1**
	Complete the argument correctly with correct calculated values	**A1**
		2
6(c)	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

Question	Answer	Marks
7(a)	Use quotient or product rule	**M1**
	Obtain derivative in any correct form e.g. $\dfrac{-\sin x(1+\sin x)-\cos x(\cos x)}{(1+\sin x)^2}$	**A1**
	Use Pythagoras to simplify the derivative	**M1**
	Justify the given statement	**A1**
		4

Question	Answer	Marks
7(b)	State integral of the form $a \ln(1 + \sin x)$	***M1**
	State correct integral $\ln(1 + \sin x)$	**A1**
	Use limits correctly	**DM1**
	Obtain answer $\ln\frac{4}{3}$	**A1**
		4
8(a)	State $\frac{\mathrm{d}y}{\mathrm{d}x} = k\frac{y}{x\sqrt{x}}$, or equivalent	**B1**
	Separate variables correctly and attempt integration of at least one side	**M1**
	Obtain term $\ln y$, or equivalent	**A1**
	Obtain term $-2k\frac{1}{\sqrt{x}}$, or equivalent	**A1**
	Use given coordinates to find k or a constant of integration c in a solution containing terms of the form $a \ln y$ and $\frac{b}{\sqrt{x}}$, where $ab \neq 0$	**M1**
	Obtain $k = 1$ and $c = 2$	**A1 + A1**
	Obtain final answer $y = \exp\left(-\frac{2}{\sqrt{x}} + 2\right)$, or equivalent	**A1**
		8

Question	Answer	Marks
8(b)	State that y approaches e^2 (FT *their c* in part **(a)** of the correct form)	**B1FT**
		1
9(a)	State $\overrightarrow{AB}$ (or $\overrightarrow{BA}$) and $\overrightarrow{BC}$ (or $\overrightarrow{CB}$) in vector form	**B1**
	Calculate their scalar product	**M1**
	Show product is zero and confirm angle ABC is a right angle	**A1**
		3
9(b)	Use correct method to calculate the lengths of AB and BC	**M1**
	Show that $AB = BC$ and the triangle is isosceles	**A1**
		2
9(c)	State a correct equation for the line through B and C, e.g. $\mathbf{r} = \mathbf{i} + \mathbf{j} + \mathbf{k} + \lambda(2\mathbf{i} + \mathbf{j} + 2\mathbf{k})$ or $\mathbf{r} = 3\mathbf{i} + 2\mathbf{j} + 3\mathbf{k} + \mu(-2\mathbf{i} - \mathbf{j} - 2\mathbf{k})$	**B1**
	Taking a general point of BC to be P, form an equation in λ by **either** equating the scalar product of $\overrightarrow{OP}$ and $\overrightarrow{BC}$ to zero, **or** applying Pythagoras to triangle OBP (or OCP), *or* setting the derivative of $\lvert\overrightarrow{OP}\rvert$ to zero	**M1**
	Solve and obtain $\lambda = -\frac{5}{9}$	**A1**
	Obtain answer $\frac{1}{3}\sqrt{2}$, or equivalent	**A1**

Question	Answer	Marks
	Alternative method for question 9(c)	
	Use a scalar product to find the projection CN (or BN) of OC (or OB) on BC	**M1**
	Obtain answer $CN = \frac{5}{3}\left(\text{or } BN = \frac{14}{3}\right)$	**A1**
	Use Pythagoras to find ON	**M1**
	Obtain answer $\frac{1}{3}\sqrt{2}$, or equivalent	**A1**
		4

Question	Answer	Marks
10(a)(i)	Multiply numerator and denominator by $a - 2\text{i}$, or equivalent	**M1**
	Use $\text{i}^2 = -1$ at least once	**A1**
	Obtain answer $\frac{6}{a^2+4} + \frac{3ai}{a^2+4}$	**A1**
		3
10(a)(ii)	Either state that $\arg u = -\frac{1}{3}\pi$ or express u^* in terms of a (FT on u)	**B1**
	Use correct method to form an equation in a	**M1**
	Obtain answer $a = -2\sqrt{3}$	**A1**
		3

Question	Answer	Marks
10(b)(i)	Show the perpendicular bisector of points representing 2i and 1 + i	**B1**
	Show the point representing 2 + i	**B1**
	Show a circle with radius 2 and centre 2 + i (FT on the position of the point for 2 + i)	**B1FT**
	Shade the correct region	**B1**
		4
10(b)(ii)	State or imply the critical point 2 + 3i	**B1**
	Obtain answer 56.3° or 0.983 radians	**B1**
		2