Question	Answer	Marks
1	State or imply non-modular inequality $(2x-1)^2 > 3^2(x+2)^2$, or corresponding quadratic equation, or pair of linear equations	**B1**
	Make reasonable attempt at solving a 3-term quadratic, or solve two linear equations for x	**M1**
	Obtain critical values $x = -7$ and $x = -1$	**A1**
	State final answer $-7 < x < -1$	**A1**
	Alternative method for question 1	
	Obtain critical value $x = -1$ from a graphical method, or by solving a linear equation or linear inequality	**B1**
	Obtain critical value $x = -7$ similarly	**B2**
	State final answer $-7 < x < -1$ [Do not condone $\leqslant$ for $<$ in the final answer.]	**B1**
		4

Question	Answer	Marks
2	Commence integration and reach $a(2-x)e^{-2x}+b\int e^{-2x}\,\mathrm{d}x$, or equivalent	**M1***
	Obtain $-\frac{1}{2}(2-x)e^{-2x}-\frac{1}{2}\int e^{-2x}\,\mathrm{d}x$, or equivalent	**A1**
	Complete integration and obtain $-\frac{1}{2}(2-x)e^{-2x}+\frac{1}{4}e^{-2x}$, or equivalent	**A1**
	Use limits correctly, having integrated twice	**DM1**
	Obtain answer $\frac{1}{4}\left(3-e^{-2}\right)$, or exact equivalent	**A1**
		5

Question	Answer	Marks
3(a)	Remove logarithms correctly and state $1 + e^{-x} = e^{-2x}$, or equivalent	**B1**
	Show equation is $u^2 + u - 1 = 0$, where $u = e^x$, or equivalent	**B1**
		2
3(b)	Solve a 3-term quadratic for u	**M1**
	Obtain root $\frac{1}{2}\left(-1+\sqrt{5}\right)$, or decimal in [0.61, 0.62]	**A1**
	Use correct method for finding x from a positive root	**M1**
	Obtain answer $x = -0.481$ only	**A1**
		4

Question	Answer	Marks
4(a)	Use the product rule	**M1**
	State or imply derivative of $\tan^{-1}(\frac{1}{2}x)$ is of the form $k/(4+x^2)$, where $k = 2$ or 4, or equivalent	**M1**
	Obtain correct derivative in any form, e.g. $\tan^{-1}\left(\frac{1}{2}x\right)+\frac{2x}{x^2+4}$, or equivalent	**A1**
		3
4(b)	State or imply y-coordinate is $\frac{1}{2}\pi$	**B1**
	Carry out a complete method for finding p, e.g. by obtaining the equation of the tangent and setting $x = 0$, or by equating the gradient at $x = 2$ to $\frac{\frac{1}{2}\pi - p}{2}$	**M1**
	Obtain answer $p = -1$	**A1**
		3

Question	Answer	Marks
5	Use tan $2A$ formula to express RHS in terms of tan θ	M1
	Use tan $(A \pm B)$ formula to express LHS in terms of tan θ	M1
	Using tan 45° = 1, obtain a correct horizontal equation in any form	A1
	Reduce equation to $2\tan^2\theta + \tan\theta - 1 = 0$	A1
	Solve a 3-term quadratic and find a value of θ	M1
	Obtain answer $\theta = 26.6°$ and no other	A1
		6

Question	Answer	Marks
6(a)	Sketch a relevant graph, e.g. $y = x^5$	**B1**
	Sketch a second relevant graph, e.g. $y = x + 2$ and justify the given statement	**B1**
		2
6(b)	State a suitable equation, e.g. $x = \dfrac{4x^5 + 2}{5x^4 - 1}$	**B1**
	Rearrange this as $x^5 = 2 + x$ or commence working *vice versa*	**B1**
		2
6(c)	Use the iterative formula correctly at least once	**M1**
	Obtain final answer 1.267	**A1**
	Show sufficient iterations to 5 d.p. to justify 1.267 to 3 d.p., or show there is a sign change in the interval (1.2665, 1.2675)	**A1**
		3

Question	Answer	Marks
7(a)	State or imply the form $\dfrac{A}{2x-1}+\dfrac{B}{2x+1}$ and use a relevant method to find A or B	**M1**
	Obtain $A=1$, $B=-1$	**A1**
		2
7(b)	Square the result of part (**a**) and substitute the fractions of part (**a**)	**M1**
	Obtain the given answer correctly	**A1**
		2
7(c)	Integrate and obtain $-\dfrac{1}{2(2x-1)}-\dfrac{1}{2}\ln(2x-1)+\dfrac{1}{2}\ln(2x+1)-\dfrac{1}{2(2x+1)}$, or equivalent	**B3, 2, 1, 0**
	Substitute limits correctly	**M1**
	Obtain the given answer correctly	**A1**
		5

Question	Answer	Marks
8(a)	State or imply $\overrightarrow{AB}$ or $\overrightarrow{AD}$ in component form	**B1**
	Use a correct method for finding the position vector of C	**M1**
	Obtain answer $4\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$, or equivalent	**A1**
	Using the correct process for the moduli, compare lengths of a pair of adjacent sides, e.g. AB and AD	**M1**
	Show that $ABCD$ has a pair of unequal adjacent sides	**A1**
	Alternative method for question 8(a)	
	State or imply $\overrightarrow{AB}$ or $\overrightarrow{AD}$ in component form	**B1**
	Use a correct method for finding the position vector of C	**M1**
	Obtain answer $4\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$, or equivalent	**A1**
	Use the correct process to calculate the scalar product of $\overrightarrow{AC}$ and $\overrightarrow{BD}$, or equivalent	**M1**
	Show that the diagonals of $ABCD$ are not perpendicular	**A1**
		5
8(b)	Use the correct process to calculate the scalar product of a pair of relevant vectors, e.g. $\overrightarrow{AB}$ and $\overrightarrow{AD}$	**M1**
	Using the correct process for the moduli, divide the scalar product by the product of the moduli of the two vectors and evaluate the inverse cosine of the result	**M1**
	Obtain answer 100.3°	**A1**
		3

Question	Answer	Marks
8(c)	Use a correct method to calculate the area, e.g. calculate *AB.AC* sin *BAD*	**M1**
	Obtain answer 11.0 (**FT** on angle BAD)	**A1 FT**
		2

Question	Answer	Marks
9(a)	Eliminate u or w and obtain an equation w or u	**M1**
	Obtain a quadratic in u or w, e.g. $u^2 - 2\mathrm{i}u - 6 = 0$ or $w^2 + 2\mathrm{i}w - 6 = 0$	**A1**
	Solve a 3-term quadratic for u or for w	**M1**
	Obtain answer $u = \sqrt{5} + \mathrm{i}$, $w = \sqrt{5} - \mathrm{i}$	**A1**
	Obtain answer $u = -\sqrt{5} + \mathrm{i}$, $w = -\sqrt{5} - \mathrm{i}$	**A1**
		5
9(b)	Show the point representing $2 + 2\mathrm{i}$	**B1**
	Show a circle with centre $2 + 2\mathrm{i}$ and radius 2 (**FT** is on the position of $2 + 2\mathrm{i}$)	**B1 FT**
	Show half-line from origin at 45° to the positive x-axis	**B1**
	Show line for Re $z = 3$	**B1**
	Shade the correct region	**B1**
		5

Question	Answer	Marks
10(a)	State or imply $\frac{dV}{dt} = -k\sqrt{h}$	**B1**
	State or imply $\frac{dV}{dh} = 2\pi rh - \pi h^2$, or equivalent	**B1**
	Use $\frac{dV}{dt} = \frac{dV}{dh} \cdot \frac{dh}{dt}$	**M1**
	Obtain the **given answer** correctly	**A1**
		4
10(b)	Separate variables and attempt integration of at least one side	**M1**
	Obtain terms $\frac{4}{3}rh^{\frac{3}{2}} - \frac{2}{5}h^{\frac{5}{2}}$ and $-Bt$	**A3, 2, 1, 0**
	Use $t = 0$, $h = r$ to find a constant of integration c	**M1**
	Use $t = 14$, $h = 0$ to find B	**M1**
	Obtain correct c and B, e.g. $c = \frac{14}{15}r^{\frac{5}{2}}$, $B = \frac{1}{15}r^{\frac{5}{2}}$	**A1**
	Obtain final answer $t = 14 - 20\left(\frac{h}{r}\right)^{\frac{3}{2}} + 6\left(\frac{h}{r}\right)^{\frac{5}{2}}$, or equivalent	**A1**
		8