Question	Answer	Marks	Guidance
1(a)	Make a recognisable sketch graph of $y = \|x-2\|$	B1	
		1	
1(b)	Find x-coordinate of intersection with $y = 3x - 4$	M1	
	Obtain $x = \frac{3}{2}$	A1	
	State final answer $x > \frac{3}{2}$ only	A1	
	Alternative method for question 1(b)		
	Solve the linear inequality $3x - 4 > 2 - x$, or corresponding equation	M1	
	Obtain critical value $x = \frac{3}{2}$	A1	
	State final answer $x > \frac{3}{2}$ only	A1	
	Alternative method for question 1(b)		
	Solve the quadratic inequality $(x-2)^2 < (3x-4)^2$, or corresponding equation	M1	
	Obtain critical value $x = \frac{3}{2}$	A1	
	State final answer $x > \frac{3}{2}$ only	A1	
		3	

Question	Answer	Marks	Guidance
2	Use law of logarithm of a power and sum and remove logarithms	**M1**	
	Obtain a correct equation in any form, e.g. $3(2x+5)=(x+2)^2$	**A1**	
	Use correct method to solve a 3-term quadratic, obtaining at least one root	**M1**	
	Obtain final answer $x = 1+2\sqrt{3}$ or $1 + \sqrt{12}$ only	**A1**	
		4	

Question	Answer	Marks	Guidance
3(a)	Sketch the graph $y = \sec x$	**M1**	
	Sketch the graph $y=2-\frac{1}{2}x$, and justify the given statement	**A1**	
		2	
3(b)	Calculate the values of a relevant expression or pair of expressions at $x = 0.8$ and $x = 1$	**M1**	
	Complete the argument correctly with correct calculated values	**A1**	
		2	
3(c)	Use the iterative formula correctly at least once	**M1**	
	Obtain final answer 0.88	**A1**	
	Show sufficient iterations to 4 d.p. to justify 0.88 to 2 d.p., or show there is a sign change in the interval (0.875, 0.885)	**A1**	
		3	

Question	Answer	Marks	Guidance
4	Integrate by parts and reach $ax\tan x + b\int \tan x\,\mathrm{d}x$	M1*	
	Obtain $x\tan x - \int \tan x\,\mathrm{d}x$	A1	
	Complete the integration, obtaining a term $\pm\ln\cos x$, or equivalent	M1	
	Obtain integral $x\tan x + \ln\cos x$, or equivalent	A1	
	Substitute limits correctly, having integrated twice	DM1	
	Use a law of logarithms	M1	
	Obtain answer $\frac{5}{18}\sqrt{3}\pi - \frac{1}{2}\ln 3$, or exact simplified equivalent	A1	
		7	

Question	Answer	Marks	Guidance
5(a)	Express LHS correctly as a single fraction	B1	
	Use $\cos(A \pm B)$ formula to simplify the numerator	M1	
	Use sin $2A$ formula to simplify the denominator	M1	
	Obtain the given result.	A1	
		4	

Question	Answer	Marks	Guidance
5(b)	Obtain an equation in $\tan 2x$ and use correct method to solve for x	**M1**	
	Obtain answer, e.g. 0.232	**A1**	
	Obtain second answer, e.g. 1.80	**A1**	Ignore answers outside the given interval.
		3	

Question	Answer	Marks	Guidance
6(a)	Separate variables correctly and attempt integration of at least one side	**B1**	
	Obtain term of the form $a\tan^{-1}(2y)$	**M1**	
	Obtain term $\frac{1}{2}\tan^{-1}(2y)$	**A1**	
	Obtain term $-e^{-x}$	**B1**	
	Use $x = 1$, $y = 0$ to evaluate a constant or as limits in a solution containing terms of the form $a\tan^{-1}(by)$ and $ce^{\pm x}$	**M1**	
	Obtain correct answer in any form	**A1**	
	Obtain final answer $y = \frac{1}{2}\tan\left(2e^{-1} - 2e^{-x}\right)$, or equivalent	**A1**	
		7	

Question	Answer	Marks	Guidance
6(b)	State that y approaches $\frac{1}{2}\tan\left(2e^{-1}\right)$, or equivalent	**B1FT**	The FT is on correct work on a solution containing e^{-x}.
		1	

Question	Answer	Marks	Guidance
7(a)	State or imply $3y^2 + 6xy\frac{dy}{dx}$ as derivative of $3xy^2$	**B1**	
	State or imply $3y^2\frac{dy}{dx}$ as derivative of y^3	**B1**	
	Equate attempted derivative of LHS to zero and solve for $\frac{dy}{dx}$	**M1**	Need to see $\frac{dy}{dx}$ factorised out prior to AG
	Obtain the given answer correctly	**A1**	AG
		4	
7(b)	Equate denominator to zero	***M1**	
	Obtain $y = 2x$, or equivalent	**A1**	
	Obtain an equation in x or y	**DM1**	
	Obtain the point (1, 2)	**A1**	
	State the point $\left(\sqrt[3]{5},0\right)$	**B1**	Alternatively (1.71, 0).
		5	

Question	Answer	Marks	Guidance
8(a)	Obtain $\overrightarrow{OM} = 2\mathbf{i} + \mathbf{j}$	**B1**	
	Use a correct method to find $\overrightarrow{MN}$	**M1**	
	Obtain $\overrightarrow{MN} = -\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$	**A1**	
		3	
8(b)	Use a correct method to form an equation for *MN*	**M1**	
	Obtain $\mathbf{r} = 2\mathbf{i} + \mathbf{j} + \lambda(-\mathbf{i} + 2\mathbf{j} + 2\mathbf{k})$, or equivalent	**A1**	
		2	
8(c)	Find $\overrightarrow{DP}$ for a point *P* on *MN* with parameter λ, e.g. $(2-\lambda, 1+2\lambda, -2+2\lambda)$	**B1**	
	Equate scalar product of $\overrightarrow{DP}$ and a direction vector for *MN* to zero and solve for λ	**M1**	
	Obtain $\lambda = \frac{4}{9}$	**A1**	
	State that the position vector of *P* is $\frac{14}{9}\mathbf{i} + \frac{17}{9}\mathbf{j} + \frac{8}{9}\mathbf{k}$	**A1**	
		4	

Question	Answer	Marks	Guidance
9(a)	State or imply the form $\dfrac{A}{1+2x}+\dfrac{B}{1-2x}+\dfrac{C}{2+x}$	**B1**	
	Use a correct method for finding a constant	**M1**	
	Obtain one of $A=-2$, $B=1$ and $C=4$	**A1**	
	Obtain a second value	**A1**	
	Obtain the third value	**A1**	
		5	
9(b)	Use correct method to find the first two terms of the expansion of $(1+2x)^{-1}$, $(1-2x)^{-1}$, $(2+x)^{-1}$ or $\left(1+\dfrac{1}{2}x\right)^{-1}$	**M1**	
	Obtain correct unsimplified expansions up to the term in x^2 of each partial fraction	**A1FT** **+ A1FT** **+ A1FT**	The FT is on A, B and C.
	Obtain final answer $1+5x-\dfrac{7}{2}x^2$	**A1**	
		5	

Question	Answer	Marks	Guidance
10(a)	Solve for v or w	**M1**	
	Use $i^2 = -1$	**M1**	
	Obtain $v = -\dfrac{2i}{1+i}$ or $w = \dfrac{5+7i}{-1+i}$	**A1**	
	Multiply numerator and denominator by the conjugate of the denominator	**M1**	
	Obtain $v = -1 - i$	**A1**	
	Obtain $w = 1 - 6i$	**A1**	
		6	
10(b)(i)	Show a circle with centre 2 + 3i	**B1**	
	Show a circle with radius 1 and centre not at the origin	**B1**	
		2	
10(b)(ii)	Carry out a complete method for finding the least value of arg z	**M1**	
	Obtain answer $40.2°$ or 0.702 radians	**A1**	
		2	