Question	Answer	Marks	Guidance
7(a)	State $(\cos\theta\cos30-\sin\theta\sin30)(\cos\theta\cos60-\sin\theta\sin60)$	B1	
	Expand and use correct exact values	M1	
	Obtain $\frac{1}{4}\sqrt{3}(\cos^2\theta+\sin^2\theta)-\sin\theta\cos\theta$ or similarly simplified equivalent	A1	
	Conclude $\frac{1}{4}\sqrt{3}-\frac{1}{2}\sin2\theta$	A1	AG – necessary detail needed.
		4	
7(b)	Use identity to obtain value for $\sin4\alpha$	*M1	
	Obtain $\sin4\alpha=\frac{1}{2}\sqrt{3}-\frac{2}{5}$ or 0.466…	A1	
	Show correct process to obtain one value of α	DM1	
	Obtain 6.9 and 38.1	A1	Or greater accuracy; and no others between 0° and 90°.
		4	

Question Number	Scheme	Marks
9 (a)	Attempts $12=3x^2\times L\Rightarrow L=\dfrac{4}{x^2}$ or $Lx=\dfrac{4}{x}$	M1, A1
	$S=6x^2+5xL=6x^2+\dfrac{20}{x}$	dM1, A1
		(4)
(b)	$\dfrac{dS}{dx}=12x-\dfrac{20}{x^2}$	M1, A1ft
	$\dfrac{dS}{dx}=0\Rightarrow x^3=\dfrac{5}{3}\Rightarrow x=1.18563...$	dM1
	$S\big\|_{x=1.18563}=6\times\text{"}1.18563\text{"}^2+\dfrac{20}{\text{"}1.18563\text{"}}=25.3\,(\text{m}^2)$	ddM1, A1
		(5)
(c)	$\left(\dfrac{d^2S}{dx^2}=\right)12+\dfrac{40}{x^3}$	M1
	Justifies $\dfrac{d^2S}{dx^2}>0$ (at $x=1.18563...$), hence minimum *	A1*
		(2) **(11 marks)**

Question Number	Scheme	Marks
5(a)	Identifies $h = 1.5$	B1
	Area $= \frac{1.5}{2}\left\{12+0.023+2\left(4.243+1.5+0.530+0.188+0.066\right)\right\}$	M1
	$= 18.8$	A1
		(3)
(b) (i)	$\int_{-2}^{7} 3\left(\frac{1}{2}\right)^{x+2} \mathrm{d}x = \frac{1}{4}\int_{-2}^{7} 3\left(\frac{1}{2}\right)^{x} \mathrm{d}x = \frac{1}{4}\times\text{"}18.8\text{"} = 4.7$	B1ft
(ii)	$\int_{-2}^{7}\left(2^{-x}+2x\right)\mathrm{d}x = \frac{1}{3}\times\text{"}18.8\text{"}+\left[x^2\right]_{-2}^{7} = 51.3$	M1, A1ft
		(3)
		(6 marks)

Question Number	Scheme	Marks
8 (i)	Substitutes a value e.g. $n=6$ into n^2+3n+1 where n^2+3n+1 is **not prime**	M1
	Correct calculation for that value e.g $n^2+3n+1=55$ And conclusion "which is not prime"	A1
		(2)
(ii)	Attempts to find n^2-2 for either odds or evens E.g Attempts $\left(2p+1\right)^2-2$ or $\left(2p\right)^2-2$	M1
	Achieves either $\left(2p+1\right)^2-2=4p^2+4p-1$ or $\left(2p\right)^2-2=4p^2-2$ and shows or gives a reason why the expression is not a multiple of 4 where required (see notes)	A1
	Attempts to find n^2-2 for both odds and evens (See above)	dM1
	Achieves both $\left(2p+1\right)^2-2=4p^2+4p-1$ and $\left(2p\right)^2-2=4p^2-2$ and shows or gives reasons why these are not multiples of 4 where required (see notes) With a conclusion that they are not multiples of 4. *	A1*
		(4)
		(6 marks)

Question Number	Scheme	Marks
6 (i)	$x^2+y^2+10x-12y=k$	
(a)	Attempts $(x\pm5)^2+(y\pm6)^2 ..... =0$	M1
	Centre $(-5,6)$	A1
		(2)
(b)	Sets $k+(\pm5)^2+(\pm6)^2>0$	M1
	$k>-61$	A1
		(2)
(ii)	Centre $\left(\frac{-2+8}{2},\frac{10+(-14)}{2}\right)=...$; radius $\frac{1}{2}\sqrt{(-2-8)^2+(10-(-14))^2}=...$	M1
	Centre is $(3,-2)$; radius is 13	A1
	$\Rightarrow C_2:(x-3)^2+(y+2)^2=13^2\Rightarrow(p-3)^2+4=169\Rightarrow p=...$ Or $PX=r\Rightarrow(p-3)^2+(0-(-2))^2=169\Rightarrow p=...$	M1
	$p=3+\sqrt{165}$ only	A1
		(4)
		(8 marks)

Question Number	Scheme	Marks
3. (i)	$(x-4)^2\geqslant 2x-9\Rightarrow x^2-10x+25\;...\;0$	M1
	$\Rightarrow(x-5)^2\;...0$	A1
	Explains that "square numbers are greater than or equal to zero" hence (as $x\in\mathbb{R}$), $\Rightarrow(x-4)^2\geqslant 2x-9$ *	A1*
		(3)
(ii)	Shows that it is not true for a value of n Eg. When $n=3$, $2^n+1=8+1=9$ × Not prime	B1
		(1)
		(4 marks)

Question Number	Scheme	Marks
3	$\int_1^4 3x+\frac{16}{x^2}-8\,dx=\frac{3}{2}x^2-\frac{16}{x}-8x\ \ (+c)$	M1, A1, A1
	e.g. Area $=\frac{3}{2}(5+11)-\left[\frac{3}{2}x^2-\frac{16}{x}-8x\right]_1^4=24-\left(-12+\frac{45}{2}\right)=\frac{27}{2}$	dM1, A1
		(5)
		(5 marks)

Question Number	Scheme	Marks
8(i)	$5\sin(3x+0.1)+2=0$ $\Rightarrow 5\sin(3x+0.1)=-2$ $\Rightarrow \sin(3x+0.1)=-\frac{2}{5}$	M1
	$\sin(3x+0.1)=-\frac{2}{5}$ $\Rightarrow 3x+0.1=\sin^{-1}\left(-\frac{2}{5}\right)$ $\Rightarrow x=\frac{\sin^{-1}\left(-\frac{2}{5}\right)-0.1}{3}$	dM1
	$x=-0.94,\ -0.17,\ 1.15,\ 1.92$	A1A1
		(4)
(ii)	$2\tan\theta\sin\theta=\cos\theta+5$ $\Rightarrow 2\sin^2\theta=\cos^2\theta+5\cos\theta$	M1
	$\Rightarrow 2\left(1-\cos^2\theta\right)=\cos^2\theta+5\cos\theta$	M1
	$\Rightarrow 3\cos^2\theta+5\cos\theta-2=0$	A1
	$\cos\theta=\frac{1}{3}(,-2)$ $\Rightarrow \theta=\cos^{-1}\left(\frac{1}{3}\right)=...$	M1
	$(\theta=)\ 70.5°,\ 289.5°$	A1
		(5)
		Total 9

Question	Answer	Marks	Guidance
1	Differentiate using quotient rule (or product rule)	**M1**	
	Obtain $\frac{x-2x\ln x}{x^4}$	**A1**	OE
	Substitute $x=\mathrm{e}$ to obtain $-\frac{1}{\mathrm{e}^3}$ or exact equivalent	**A1**	
		3	