

Question			Answer	Marks	AO	Guidance
6	(a)		$A = \frac{C+D}{2}, B = \frac{C-D}{2} \text{ and}$ $\sin C - \sin D = 2 \cos A \sin B$ $\sin C - \sin D = 2 \cos\left(\frac{C+D}{2}\right) \sin\left(\frac{C-D}{2}\right)$	B1	2.1	AG Must see as a minimum the following three components: [1]: the correct expressions for A and B stated explicitly (not just in a final answer or as part of trig. expressions) or $2 \cos\left(\frac{A+B+A-B}{2}\right) \sin\left(\frac{A+B-(A-B)}{2}\right) = 2 \cos A \sin B$ (if working right to left) [2]: $\sin C - \sin D = 2 \cos A \sin B$ [3]: the given answer or both $\sin C - \sin D = 2 \cos A \sin B$ and $2 \cos A \sin B = 2 \cos\left(\frac{C+D}{2}\right) \sin\left(\frac{C-D}{2}\right)$ (so linking the two parts of the given answer explicitly via the expression $2 \cos A \sin B$)
				[1]		

Question			Answer	Marks	AO	Guidance	
6	(b)		$QR = r \tan \theta$ or $PR = \frac{r}{\cos \theta}$	B1*	3.1a	Can be implied by the correct expression for the area of ΔPQR	B1 for either expression soi in the area of ΔPQR
			$(\Delta PQR =) \frac{1}{2} r(r \tan \theta)$ or $\frac{1}{2} r \left(\frac{r}{\cos \theta} \right) \sin \theta$	B1*	1.1	One correct area expression	
			$(\Delta PQT =) \frac{1}{2} r^2 \sin \theta$				
			or (sector $PQST =) \frac{1}{2} r^2 \theta$				
			$\frac{1}{2} r^2 \sin \theta < \frac{1}{2} r^2 \theta < \frac{1}{2} r^2 \tan \theta$	B1dep*	2.1	Correct sandwich inequality in terms of r and θ - must be seen at some point in this form and not just as separate inequalities	This result with no working scores B3 but $\sin \theta < \theta < \tan \theta$ with no working is no marks
			$\sin \theta < \theta < \frac{\sin \theta}{\cos \theta} \Rightarrow 1 < \frac{\theta}{\sin \theta} < \frac{1}{\cos \theta}$	B1	2.2a	AG – www sufficient working seen therefore tan must be replaced with $\frac{\sin}{\cos}$ and therefore $\sin \theta < \theta < \tan \theta$ $\Rightarrow 1 < \frac{\theta}{\sin \theta} < \frac{1}{\cos \theta}$ is B0	
						Dependent on all previous B marks	
				[4]			

Question			Answer	Marks	AO	Guidance	
6	(c)	(i)	$\cos \theta < \frac{\sin \theta}{\theta} < 1$	B1 [1]	3.1a	or $1 > \frac{\sin \theta}{\theta} > \cos \theta$ but not as two separate inequalities (unless correctly brought together)	condone $\frac{\cos \theta}{1} < \frac{\sin \theta}{\theta} < 1$
6	(c)	(ii)	1	B1 [1]	2.2a	Ignore any working seen but B0 if implying $< 1, > 1$ etc.	

Question			Answer	Marks	AO	Guidance	
6	(d)		$\left(\frac{f(x+h)-f(x)}{h}=\right)\frac{\sin(x+h)-\sin x}{h}$	B1*	2.1	cao	Denominator must be simplified to h
			$=\frac{2\cos\left(\frac{2x+h}{2}\right)\sin\left(\frac{h}{2}\right)}{h}$	M1dep*	1.1	Using the given expression for $\sin C-\sin D$ from part (a) with $C=x+h$ and $D=x$ – allow un-simplified	If not using result from part (a) then M0
			$\lim_{h\rightarrow 0}\frac{f(x+h)-f(x)}{h}=\cos x\times\lim_{h\rightarrow 0}\left[\frac{2}{h}\sin\left(\frac{h}{2}\right)\right]$	A1	1.1	Using the result that $\lim_{h\rightarrow 0}\cos\left(\frac{2x+h}{2}\right)=\cos x$ to obtain $\cos x\times\lim_{h\rightarrow 0}\left[\frac{2}{h}\sin\left(\frac{h}{2}\right)\right]$	Must see limit present for this A mark
			$=\cos x\times\lim_{h\rightarrow 0}\left[\frac{\sin\left(\frac{h}{2}\right)}{\frac{h}{2}}\right]=\cos x$ (as from part (c)(ii)) $\lim_{\theta\rightarrow 0}\frac{\sin\theta}{\theta}=1$ therefore $\frac{d}{dx}(\sin x)=\cos x$	A1	2.2a	Re-writing $\frac{2}{h}\sin\left(\frac{h}{2}\right)$ so that the result from part (c)(ii) can be applied and obtaining the correct derivative	Or equivalent limit argument e.g. $\lim_{h\rightarrow 0}\left(\frac{\sin\left(\frac{1}{2}h\right)}{h}\right)=\frac{1}{2}$
				[4]			

Question			Answer	Marks	AO	Guidance	
6	(e)		The line $\frac{dy}{dx} = \cos\left(\frac{\pi}{2} - x\right)$ is incorrect; (by the chain rule) it should be $\frac{dy}{dx} = -\cos\left(\frac{\pi}{2} - x\right)$	B1 [1]	2.3	Clearly identify the error made e.g. stating that it should be $-\cos\left(\frac{\pi}{2} - x\right)$ or ‘the student forgot to multiply $\cos\left(\frac{\pi}{2} - x\right)$ by -1’ or ‘$\sin\left(\frac{\pi}{2} - x\right)$ does not differentiate to $\cos\left(\frac{\pi}{2} - x\right)$’, oe B0 for ‘the student forgot to multiply by -1’ only B0 for ‘the student forgot to divide $\cos\left(\frac{\pi}{2} - x\right)$ by -1’	Just stating that the derivative should be $-\sin x$ is B0 If mentioning that ‘the student forgot to multiply/include the -1’ then it must be clear this is on line 3