Question			Answer	Mark	AO	Guidance
5	(a)	(i)	$f'(x) = -\sin x + \sqrt{3}\cos x$	M1	3.1a	Attempt differentiate f(x), allow sign errors but both trig functions must be changed. oe e.g. $2\cos\left(x + \frac{\pi}{6}\right)$
			$\tan x = \sqrt{3}$	M1	1.1	Setting their $f'(x) = 0$ and correctly manipulating to reach an equation in a single trig function (e.g. $4\cos^2 x = 1$ or $4\sin^2 x = 3$) do not allow incorrect working e.g. $a - b = 0 \Rightarrow a^2 - b^2 = 0$
			$x = \frac{1}{3}\pi$	A1	1.1	www, must be in radians (allow decimal 1.05 3sf)
			or $\frac{4}{3}\pi$	A1	1.1	www, must be in radians (allow decimal 4.19 3sf), and for this mark have no other solutions in the given range (ignore any outside) SC**B1** for each correct solution (max [2/4]) if insufficient or no working shown, but not from incorrect working. If both solutions given correctly in degrees (60°,240°) then can get M1M1SCB1 (max [3/4])
				[4]		
5	(a)	(ii)	$f''(x) = -\cos x - \sqrt{3}\sin x$ or…	M1	3.1a	Attempt to differentiate their f' (x) (allow sign errors but both trig functions must be changed), setting their $f''(x) = 0$ and attempting to manipulate. May see $f''(x) = -2\sin\left(x + \frac{\pi}{6}\right)$
			$\tan x = -\frac{1}{\sqrt{3}}$	A1	1.1	For correctly reaching an equation in a single trig function (oe, may see $4\sin^2 x = 1$ or $4\cos^2 x = 3$) Not from incorrect working e.g. $a - b = 0 \Rightarrow a^2 - b^2 = 0$
			$x = \frac{5}{6}\pi$ or $x = \frac{11}{6}\pi$	A1	1.1	www, for both correct in radians (allow decimals 2.62, 5.76 3sf) SC**B1** for both correct solutions (max [1/3]) if insufficient or no working shown, but not from incorrect working. Answers in degrees can get M1A1A0 (max [2/3])
				[3]		

5	**(b)**		A: $(\frac{1}{3}\pi, 0)$ AND C: $(\frac{4}{3}\pi, 0)$ B: $(\frac{5}{6}\pi, -2)$ AND D: $(\frac{11}{6}\pi, 2)$	**B1FT** **B1FT** **[2]**	**1.1** **1.1**	FT their x-values in radians or degrees from **(a)(i)**, both with y=0 Both must be correctly labelled with A and C, allow decimals 3sf FT their x-values in radians or degrees from **(a)(ii),** with both y=-2 and y=2 correct Both must be correctly labelled with B and D, allow decimals 3sf If neither mark awarded then can get one of (max [1/2]): SC**B1FT** for any two correct pairs x and y, correctly labelled SC**B1FT** for all four x-coords, correctly labelled and in ascending order (only if 2 distinct answers given in both **(a)(i)** and **(a)(ii)**) SC**B1FT** for all four y-coords, correctly labelled
5	**(c)**	**(i)**	Where the graph (of $f'(x)$) is above the x-axis or the graph is positive	**B1** **[1]**	**2.4**	Must reference the graph – do not accept just 'gradient is positive' or just 'f'(x)>0'
5	**(c)**	**(ii)**	$0 \leq x < \frac{1}{3}\pi$, $\frac{4}{3}\pi < x \leq 2\pi$ $\{x: 0 \leq x < \frac{1}{3}\pi\} \cup \{x: \frac{4}{3}\pi < x \leq 2\pi\}$ Or $[0, \frac{1}{3}\pi) \cup (\frac{4}{3}\pi, 2\pi]$	**B1** **B1** **[2]**	**2.2a** **2.5**	Both intervals correctly identified, ignore set notation for this mark cao (values must be correct) but condone any clear indication of both correct intervals e.g. $0 \rightarrow \frac{\pi}{3}$ and $\frac{4\pi}{3} \rightarrow 2\pi$ (allow decimals) Accept any combination of $\leq$ and < or ( ) and [ ] Writing their answer in correct set notation, values may be incorrect for this mark but there must be two separate intervals. Allow single-tailed inequalities as long as written in correct set notation, e.g. $\left\{x: x < \frac{\pi}{3}\right\} \cup \left\{x: x > \frac{4\pi}{3}\right\}$ Accept any combination of $\leq$ and < or ( ) and [ ] but do not accept $\cap$ instead of $\cup$.