Q	Marking instructions	AO	Marks	Typical solution
9(a)(i)	Expands x^2 with at least 3 correct terms or y^2 with at least 3 correct terms	3.1a	M1	$x^2 = 16cos^2t - 8sintcost + sin^2t$ $y^2 = 16sin^2t - 8sintcost + cos^2t$
	Obtains $17\sin^2 t + 17\cos^2 t - 16\sin t\cos t$ OE Can be unsimplified	1.1b	A1	$x^2 + y^2 = 17sin^2t + 17cos^2t - 16sintcost$ $= 17(sin^2t + cos^2t)$ $- 8(2\sin t\cos t)$
	Uses $\cos^2 t + \sin^2 t = 1$ to correctly eliminate all $\sin^2 t$ and $\cos^2 t$ terms from their expression	1.1a	M1	$= 17 - 8sin\ 2t$
	Uses $\sin 2t = 2\sin t \cos t$ in their $16\sin t \cos t$ to eliminate all $\sin t \cos t$ terms from their expression	1.1a	M1	
	Completes reasoned argument to obtain $17 - 8\sin 2t$	2.1	R1	
	Subtotal		**5**	

Q	Marking instructions	AO	Marks	Typical solution
9(a)(ii)	Obtains value for their $p + \lvert q \rvert$ PI by $\sqrt{p + \lvert q \rvert}$	3.1a	M1	Max $x^2 + y^2 = 25$ $\therefore$ max distance = 5
	Obtains 5	3.2a	A1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
9(b)	Writes $x + 4y$ as $4\cos t - \sin t + 4(4\sin t - \cos t)$ OE **or** $4x + y$ as $4(4\cos t - \sin t) + 4\sin t - \cos t$ OE Or Expands $(x+4y)^2 + (4x+y)^2$ and writes $17x^2 + 17y^2$ as $289 - 136\sin 2t$ OE **or** $16xy$ as $272\cos t \sin t - 64\sin^2 t - 64\cos^2 t$ OE may be unsimplified Condone 255 or 272 for 289 Condone 240 or 256 for 272	3.1a	M1	$x+4y = 4\cos t - \sin t + 4(4\sin t - \cos t)$ $= 15\sin t$ $4x+y = 4(4\cos t - \sin t) + 4\sin t - \cos t$ $= 15\cos t$ $(x+4y)^2 + (4x+y)^2$ $= (15\sin t)^2 + (15\cos t)^2$ $= 225(\sin^2 t + \cos^2 t)$ $= 225$
	Obtains $x + 4y = 15\sin t$ **and** $4x + y = 15\cos t$ Or Obtains $17x^2 + 17y^2 = 289 - 136\sin 2t$ **and** $16xy = 272\cos t \sin t - 64\sin^2 t - 64\cos^2 t$ Allow $\sin 2t$ or $2\sin t \cos t$ in either expansion	1.1b	A1	
	Completes reasoned argument to obtain 225	2.1	R1	
	Subtotal		**3**	

	Question 9 Total		**10**	