

Q	Marking instructions	AO	Marks	Typical solution
12(a)	Substitutes $x = \sqrt{3}$ and $y = \frac{\pi}{6}$ to obtain an equation or an expression for A	1.1a	M1	$(\sqrt{3})^3 \sin \frac{\pi}{6} + \cos \frac{\pi}{6} = A\sqrt{3}$
	Completes argument to show $A = 2$ Must clearly show use of $\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$ and $\sin \frac{\pi}{6} = \frac{1}{2}$ AG	2.1	R1	$\frac{3\sqrt{3}}{2} + \frac{\sqrt{3}}{2} = A\sqrt{3}$ $\frac{3}{2} + \frac{1}{2} = A$ $A = 2$
<b>Subtotal</b>			<b>2</b>	
12(b)(i)	Uses implicit differentiation correctly at least once with sight of $\sin y \frac{dy}{dx}$ or $\cos y \frac{dy}{dx}$ Condone sign error	3.1a	M1	$3x^2 \sin y + x^3 \cos y \frac{dy}{dx} - \sin y \frac{dy}{dx} = 2$ $\frac{dy}{dx}(x^3 \cos y - \sin y) = 2 - 3x^2 \sin y$
	Uses product rule with sight of $Px^2 \sin y \pm x^3 \cos y \frac{dy}{dx}$ Condone omission of $\frac{dy}{dx}$	3.1a	M1	$\frac{dy}{dx} = \frac{2 - 3x^2 \sin y}{x^3 \cos y - \sin y}$
	Obtains equation of the form $Px^2 \sin y \pm x^3 \cos y \frac{dy}{dx} \pm \sin y \frac{dy}{dx} = 2$	1.1b	A1	
	Obtains completely correct equation	1.1b	A1	
	Isolates $\frac{dy}{dx}$ terms and factorises to complete rigorous argument with no slips to show the given result AG	2.1	R1	
	<b>Subtotal</b>			<b>5</b>
12(b)(ii)	Substitutes $x = \sqrt{3}$ and $y = \frac{\pi}{6}$ to obtain an expression for the gradient	1.1a	M1	$\frac{dy}{dx} = \frac{2 - 3(\sqrt{3})^2 \sin \frac{\pi}{6}}{(\sqrt{3})^3 \cos \frac{\pi}{6} - \sin \frac{\pi}{6}}$
	Obtains correct gradient of $-\frac{5}{8}$ OE	1.1b	A1	$= -\frac{5}{8}$
<b>Subtotal</b>			<b>2</b>	

12(b)(iii)	<p>Forms equation for the tangent (condone normal) at P using 'their' gradient and <math>(\sqrt{3}, \frac{\pi}{6})</math> ACF</p> <p>or</p> <p>Writes the equation as <math>y = mx + c</math> using 'their' gradient of tangent (condone normal) and substitutes <math>(\sqrt{3}, \frac{\pi}{6})</math> to obtain an equation in <math>c</math></p> <p>PI by correct exact value for <math>x</math></p>	3.1a	M1	$y - \frac{\pi}{6} = -\frac{5}{8}(x - \sqrt{3})$ $0 - \frac{\pi}{6} = -\frac{5}{8}(x - \sqrt{3})$ $x = \sqrt{3} + \frac{4\pi}{15}$
	<p>Obtains fully correct equation for the 'their' tangent at P ACF</p> <p>Note <math>c = \frac{5\sqrt{3}}{8} + \frac{\pi}{6}</math> or <math>c = 1.606..</math></p> <p>Follow through 'their' gradient of tangent from 12(b)(ii) must be to at least 3 dp</p>	1.1b	A1F	
	<p>Substitutes <math>y = 0</math> into 'their' tangent (condone normal) equation and solves to find the <math>x</math> coordinate of Q</p> <p>Accept decimals</p>	3.1a	M1	
	<p>Obtains <math>x = \sqrt{3} + \frac{4\pi}{15}</math></p> <p>OE must be exact form</p> <p>Eg <math>x = \frac{8}{5}(\frac{5\sqrt{3}}{8} + \frac{\pi}{6})</math></p>	1.1b	A1	
	<b>Subtotal</b>		<b>4</b>	
	<b>Question Total</b>		<b>13</b>	