

Q	Marking instructions	AO	Marks	Typical solution
9(a)	Begins to find the required horizontal distance by considering an appropriate horizontal distance in a right-angled triangle For example: $d \cos \theta$, $d \cos 2\theta$ or $d \sin \left(\frac{\pi}{2} - 2\theta\right)$ Award for correctly identifying at least one of the horizontal components required. This can be done on a sketch or by clearly stating which distance they are referring to	3.3	M1	QP makes angle of 2θ with horizontal $x = d \cos \theta - d \cos 2\theta$ $x = d \cos \theta - d \sin \left(\frac{\pi}{2} - 2\theta\right)$ $x = d \left(\cos \theta + \sin \left(2\theta - \frac{\pi}{2}\right)\right)$
	Completes correct manipulation to show required result AG	2.1	R1	
Subtotal			2	

Q	Marking instructions	AO	Marks	Typical solution
9(b)	Uses a compound angle formula and expands $\sin \left(2\theta - \frac{\pi}{2}\right)$ or Uses complementary angles to obtain the formula without $\frac{\pi}{2}$ or States $x = d(\cos \theta - \cos 2\theta)$	3.1a	M1	$x = d \left(\cos \theta + \sin \left(2\theta - \frac{\pi}{2}\right)\right)$ $x = d(\cos \theta - \cos 2\theta)$ $x = d(\cos \theta - (2\cos^2\theta - 1))$
	Uses $\cos 2\theta = 2\cos^2\theta - 1$ to show the required result AG	2.1	R1	$x = d(1 + \cos \theta - 2\cos^2\theta)$
Subtotal			2	

Q	Marking instructions	AO	Marks	Typical solution
9(c)	States greatest value = $\frac{9d}{8}$	1.1b	B1	Greatest value = $\frac{9d}{8}$
	States $\cos \theta = \frac{1}{4}$	1.1b	B1	$\cos \theta = \frac{1}{4}$
Subtotal			2	

Q	Marking instructions	AO	Marks	Typical solution
9(d)	<p>Begins to find OQ by either using the cosine rule or the sine rule with d and θ</p> <p>Accept either</p> $OQ^2 = d^2 + d^2 - 2d^2 \cos \theta$ <p>or</p> $\frac{OQ}{\sin \theta} = \frac{d}{\sin \alpha}$ <p>Note $\alpha = \frac{\pi - \theta}{2}$</p>	3.1a	M1	$OQ^2 = d^2 + d^2 - 2d^2 \cos \theta$ $= 2d^2 - 2d^2 \times \frac{1}{4}$ $= \frac{3d^2}{2}$ $OQ = \frac{\sqrt{6}}{2}d$
	<p>Substitutes their exact value for $\cos \theta$ into the cosine rule or</p> <p>Finds and substitutes their corresponding exact values for $\sin \theta$ and $\cos \frac{\theta}{2}$ into the sine rule</p> <p>Note</p> <p>When $\cos \theta = \frac{1}{4}$, $\sin \theta = \frac{\sqrt{15}}{4}$ and</p> $\cos \frac{\theta}{2} = \sqrt{\frac{5}{8}}$	1.1a	M1	
	<p>Obtains the correct exact value of OQ</p> <p>ACF</p>	1.1b	A1	
	Subtotal		3	

	Question Total		9	
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