Q	Marking instructions	AO	Marks	Typical solution
13(a)	Substitutes $y = 0$ and $x = 16$ correctly into $x^2 + y^2 = a\sqrt{x} - y$	3.4	M1	$x^2 + y^2 = a\sqrt{x} - y$ $16^2 + 0^2 = a\sqrt{16} - 0$ $256 = 4a$ $a = 64$
	Obtains $a = 64$	1.1b	A1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
13(b)	Differentiates implicitly with either $2y\frac{dy}{dx}$ or $-\frac{dy}{dx}$ seen	3.1b	B1	$2x + 2y\frac{dy}{dx} = \frac{64}{2}x^{-\frac{1}{2}} - \frac{dy}{dx}$ $\frac{dy}{dx} = 0 \Rightarrow 2x = \frac{32}{\sqrt{x}}$ $x^{\frac{3}{2}} = 16$ $x = 6.3496...$ $(6.3496...)^2 + y^2 = 64\sqrt{6.3496...} - y$ $y = 10.51$ Maximum height is approximately 10.5 metres
	Differentiates any two of the four terms correctly. Can be in terms of a or with their a value	1.1a	M1	
	Obtains a fully correct differentiated equation Can be in terms of a Follow through their a value $2x + 2y\frac{dy}{dx} = \frac{a}{2}x^{-\frac{1}{2}} - \frac{dy}{dx}$	1.1b	A1F	
	Uses $\frac{dy}{dx} = 0$	1.1a	M1	
	Substitutes their numerical x value where $0 < x < 16$, into the model with their a value	3.4	M1	
	Obtains a value for y AWRT 10.51 and concludes that the maximum height is approximately 10.5 metres AG Condone equals Must state units CSO	3.2a	R1	
	Subtotal		**6**	

Q	Marking instructions	AO	Marks	Typical solution
13(c)	States or infers that the entrance is unlikely to be a smooth curve Accept: • The cave has dents • Entrance is not perfectly smooth Ignore comments about the floor or the vertical cross section	3.5b	E1	The entrance to the cave is unlikely to be perfectly smooth
	Subtotal		**1**	

	Question 13 Total		**9**	