Question Number	Scheme	Marks
3		
(a)	$mv\dfrac{\mathrm{d}v}{\mathrm{d}x} = mg\sin\alpha - \dfrac{1}{3}mx^2$	M1A1
	$\dfrac{1}{2}v^2 = xg\sin\alpha - \dfrac{1}{9}x^3 \ (+c)$	DM1A1
	$x = 2 \ \ \dfrac{1}{2}v^2 = 2g\sin\alpha - \dfrac{8}{9}$	DM1
	$(v = 3.728...)$	
	$v = 3.7$ or $3.73 \ \left(\mathrm{m\,s^{-1}}\right)$	A1cso (6)
ALT	By energy:	
	$mg\sin\alpha x = \int \dfrac{1}{3}mx^2\mathrm{d}x + \dfrac{1}{2}mv^2$	M1A1
	$xg\sin\alpha = \dfrac{1}{9}x^3 + \dfrac{1}{2}v^2\,(+c)$	DM1A1
	$x = 2 \ \ \dfrac{1}{2}v^2 = 2g\sin\alpha - \dfrac{8}{9}$	DM1
	$v = 3.7$ or $3.73 \ \left(\mathrm{m\,s^{-1}}\right)$	A1
(b)	$v = 0 \Rightarrow x^2 = 9g\sin\alpha = 9g \times \dfrac{2}{5} \ \ (x \neq 0)$	
	$x = 5.939... \Rightarrow OA = 5.9$ or $5.94 \ (\mathrm{m})$	M1A1 (2)
		[8]

Question Number	Scheme	Marks
(a)		
M1	Attempt an equation of motion parallel to the plane with acceleration in any form (including a)	
A1	Correct equation with the acceleration in $v\frac{\mathrm{d}v}{\mathrm{d}x}$ form	
DM1	Attempt the integration, powers increase by 1 in 2 terms – the constant may be missing. Acceleration must be in $v\frac{\mathrm{d}v}{\mathrm{d}x}$ form.	
A1	Correct integration.	
DM1	Sub $x = 2$ in their expression for v^2 Depends on all previous M marks.	
A1	Correct value for v and $+c$ should be dealt with. Must be 2 or 3 sf	
ALT		
M1	Attempt a 3 term energy equation – KE, GPE, work done. Integral form is not required here.	
A1	Fully correct equation with integral form for work done. Rest as main scheme.	
(b)		
M1	Use $v = 0$ in their expression for v and obtain a value of x	
A1	Correct value of length OA. (Allow if x instead of OA) Must be 2 or 3 sf (unless already penalised in (a)	
ALT (b)	Start again with energy and integrate to obtain a value of x	
M1	See mark scheme.	
A1		