			Syllabus	Paper
Page 4	**Mark Scheme**		**Syllabus**	**Paper**
	Cambridge International A Level – May/June 2016		**9709**	**53**

Qu		Answer	Part Marks	Marks	Notes
1		$v^2 = 12^2 - (16\cos45)^2$	M1		
		$v = 4$	A1		
		$-4 = 4 - gt$	M1		
		$t = 0.8\,\text{s}$	A1	4	
2	**(i)**	$OG = 0.4\sin(\pi/2)/(\pi/2)$	B1		$= 0.25464...$
		$d = OG\cos70 + 0.4\sin70$	M1		
		$d = 0.463$ **AG**	A1	3	
	(ii)	$0.463W = 15 \times 0.8\cos35$	M1		
		$W = 21.2\,\text{N}$	A1	2	
3	**(i)**	$0.4v\,dv/dx = 0.4\,g\sin30 - 0.8\,e^{-x}$	M1		
		$v\,dv/dx = 5 - 2\,e^{-x}$ **AG**	A1	2	
	(ii)	$\int v\,dv = \int(5 - 2e^{-x})\,dx$	M1		Separates the variables and attempts to integrate
		$v^2/2 = 5x + 2\,e^{-x}\ (+c)$	A1		
			M1		Uses limits or finds c (c = –2)
		$v = 2.05$	A1	4	
4	**(i)**	$\mu = W\sin20/(W\cos20)$	M1		$\mu = \tan20$
		$\mu = 0.364$	A1	2	
	(ii)	$Wx/2 + W(x+4.4/4) = 2WOG$	M1 A1		Attempts to take moments OG = distance to C from M
		$OG = 0.4\tan70\ (= 0.4/\tan20)$	B1		
		$x = 0.732$	A1	4	
5	**(i)**	$v\cos\theta = 8/2$	B1		
		$-26 = -2v\sin\theta - g\,2^2/2$	M1		Accept with sign errors
		$v\sin\theta = 3$	A1		
		$v^2 = (+/-3)^2 + 4^2$ or $\tan\theta = 3/4$	M1		
		$v = 5\,\text{m}\,s^{-1}$	A1		

		Part Marks	Marks	Notes

Qu	Answer	Part Marks	Marks	Notes
	$\theta = 36.9$	**A1**	6	
(ii)	$v_v = (+/-3) + 2g$	**M1**		
	$\tan\alpha = v_v/(8/2)$	**M1**		
	Angle = 80.1 with the horizontal or angle = 9.9 with the vertical	**A1**	3	
6 (i) (a)	$2\cos45 + 2 \times 3/5 = 0.4\,\omega^2 \times 0.3$	**M1** **A1**		Uses N2L with 2 components of T and accn = $0.3\,\omega^2$
	$\omega = 4.67$ rad s^{-1}	**A1**	3	
(i) (b)	$R + 2\sin45 + 2 \times 4/5 = 0.4\,g$	**M1**		
	$R = 0.986$ N	**A1**	2	
(ii)	$T\sin45 + T(4/5) = 0.4\,g$	**M1**		
	$T = 2.65$	**A1**		2.654
	$T\cos45 + T(3/5) = 0.4\,v^2/0.3$	**M1**		
	$v = 1.61$ m s^{-1}	**A1**	4	
7 (i)	$12(1.6–1.2)/1.2 = mg\sin30$	**M1**		Uses $T = \lambda ext/l$
	$m = 0.8$ kg	**A1**	2	
(ii)	PE change = 1.6	**B1** **B1**		$2 \times$ ans(i) Both EE terms correct
	$IKE + 12 \times 0.4^2/2.4 =$ $1.6 \times 0.2g\sin30 + 12 \times 0.2^2/2.4$	**M1**		KE/PE/EE balance Both EE terms correct
	IKE = 1 J **AG**	**A1**	4	
(iii)	$12e/1.2 = 1.6\,g\sin30$	**M1**		$\lambda e \times t/l$ = new weight component
	$e = 0.8$	**A1**		May be stated without explanation
	$1.6\,v^2/2 + 12 \times 0.8^2/2.4 =$ $1.6g \times 0.6\sin30 + 12 \times 0.2^2/2.4$	**M1** **A1**		Must use new equilibrium position
	$v = 1.5$ m s^{-1}	**A1**	5	