

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge International A Level – October/November 2014	9709	52
1	$X = 2V \cos 30$ $Y = 2V \sin 30 - g \frac{2^2}{2}$ $\tan 15 = \frac{\left(2V \sin 30 - g \frac{2^2}{2}\right)}{2V \cos 30}$ $V = 37.3$	B1 B1 M1 A1 [4]	$1.731V$ $V - 20$
2 (i)	Horizontal distance = $0.8 \times \frac{3}{4} \times \sin 30$ OR $0.8 \tan 30 \cos 30 - \frac{0.8}{4} \sin 30$ Mom. = $(0.6 \sin 30 \times 20 =) 6 \text{ Nm}$ AG OR $\text{Mom} = 20 \cos 30 \times 0.8 \tan 30 - 20 \sin 30 \times \frac{0.8}{4}$ Mom = 6 Nm AG	M1 A1 [2] M1 A1	P to centre of mass (= 0.3 m) Resolves $Wt //$ and perp axis and finds moments of both components
(ii)	$6 = F \times 0.8 \tan 30$ $F = 13(.0)$	M1 A1 [2]	Takes moments about P
3	$\frac{28e}{1.6} = 0.35g$ $e = 0.2$ $\frac{0.35v^2}{2} = 28 \times \frac{0.2^2}{2} \times 1.6 + 0.35 \times \frac{1.8^2}{2} - 0.35g \times 0.2$ $v = 1.11 \text{ m s}^{-1}$	M1 A1 M1 A1 A1 [5]	Equates $\lambda \text{ ext} / l$ and weight $OP = 1.8 \text{ m}$ EE/KE/PE balance All correct terms with candidate's value of e
4 (i)	$ABCF$ area = 0.64 and $CDE = 0.36$ $(0.64 + 0.36)d = 0.64 \times \frac{0.4}{2} + 0.36 \times \left(0.4 + \frac{1.8}{3}\right)$ $d = 0.488 \text{ m}$ AG	B1 M1 A1 A1 [4]	Both areas correct Table of moments idea All terms correct
(ii)	$0.488 \times 100 = 1.6T$ $T = 30.5 \text{ N}$ $(0.488 - 0.4) \times 100 = 1.6T$ $T = 5.5$	M1 A1 A1 [3]	Either limiting case (no turning about A) (no turning about F)

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5 (i)	$x \tan \alpha = 0$ so $\alpha = 0$ $\frac{gx^2}{2V^2 \cos^2 \theta} = 0.05x^2$ $V = 10 \text{ m s}^{-1}$	B1 M1 A1 [3]	Justification needed Comparison with standard eqn
5 (ii)	$\frac{dy}{dx} = -0.1x$ $-0.1x = -\tan 60$ $y (= -0.05(10 \tan 60)^2) = -15$ $v^2 =$ $10^2 + 2g15$ $v = 20 \text{ m s}^{-1}$ <i>OR</i> $y' = 10 \tan 60$ $(10\sqrt{3})^2 = 2gh$ $y = -15$ $v^2 =$ $10^2 + (10\sqrt{3})^2$ $v = 20 \text{ m s}^{-1}$ <i>OR</i> $v \cos 60 = 10$ $v = 20 \text{ m s}^{-1}$ $10\sqrt{3} = 10t$ $t = \sqrt{3}$ $y = 10\sqrt{3} \times \frac{\sqrt{3}}{2}$ $y = 15$ (below) or -15	M1 M1 A1 M1 A1 A1 [6] M1 M1 A1 M1 A1 A1 M1 A1 M1 A1 M1 A1	Uses Pythagoras ft candidate's value ($V(i), y$) $y' = B$'s downward velocity $= 10\sqrt{3}$ Negative, $y = -h$ Uses Pythagoras ft candidate's value ($V(i)$)
6 (i)	$0.6v \frac{dv}{dx} = 0.4v^{1/2}$ $3v^{1/2} \frac{dv}{dx} = 2$	M1 AG A1 [2]	Newton's 2nd law, $a = v \frac{dv}{dx}$
6 (ii)	$3 \int v^2 dv = 2 \int dx$ $\frac{3v^3}{3} = 2x (+c)$ $\frac{3}{2}$ $3 \times 1^2 \times \frac{2}{3} = 2 + c$ $v = x^3$	M1 A1 M1 A1 [4]	Integrates Accept omission of $+c$ Evaluates $c (=0)$

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(iii)	$\int x^{-2} dx = \int dt$ $\left[\frac{1}{x^{-1}} \right]_1^8 = t$ $t = 3$	M1 A1 A1 [3]	Integrates using $v = \frac{dx}{dt}$
7 (i)	$T = \frac{15 \left(\frac{0.4}{\cos \theta} \right)}{2}$ $T = \frac{3}{\cos \theta} \quad \text{AG}$ $T \cos \theta = mg$ $m = 0.3$	M1 A1 M1 A1 [4]	Uses $T = \frac{\lambda \text{ext}}{2}$ Resolves vertically for P
(ii)	$r = 0.4 \tan \theta$ $\frac{0.3v^2}{r} = T \sin \theta \quad \text{OR} \quad 0.3\omega^2 r = T \sin \theta$ $0.3\omega^2 (0.4 \tan \theta) = \frac{3}{\cos \theta} \times \sin \theta$ $\omega = 5$ SC Candidates who choose at least two specific values of θ : Calculation of r twice Both calculations give $\omega = 5$	B1 M1 A1 ^{ft} A1 [4] B1 B1	Newton's 2 nd law with correct expression for radial accn, ft cv(m(i))
(iii)	$\text{EPE} = \frac{15 \left(\frac{0.4}{\cos \theta} \right)^2}{2 \times 2}$ $\text{KE} = \frac{0.3(5 \times 0.4 \tan \theta)^2}{2}$ $\frac{15 \left(\frac{0.4}{\cos \theta} \right)^2}{2 \times 2} = \left(\frac{0.3(2 \tan \theta)^2}{2} \right) \times 2$ $\cos^2 \theta \tan^2 \theta = 0.5 \quad \text{OR} \quad \sin^2 \theta = 0.5$ $\theta = 45$	B1 B1 ^{ft} M1 A1 [4]	ft candidate's value of ω Award if $\times 2$ is with wrong term www