4729 Mechanics 2

1 (i)	12 x cos55°	M1	
	6.88 m s⁻¹	A1 **2**	
(ii)	12 x cos55° x 0.65	M1	
	(±) 4.47 m s⁻¹	A1 **2**	✓ 0.65 x their (i) **4**

2	F = 0.2 mg cos30°	M1	=
		A1	= (1.6974m) (49√3/50m)
	0.2mgcos30° x d	B1	a=0.2gcos30°+gsin30°
	mg x d x sin30°	B1	a= (±) 6.60
	d=½x25/(0.2x9.8cos30°+9.8xsin30°)	M1	$0 = 5^2 – 2x6.60d$
	1.89 m	A1 **6**	**6**

3	direction of R perp. to wall	B1	
	R at 70° to rod	B1	10° to horiz.
	0.8 x 25cos60° = 1.6 x R sin70°	M1	moments about A
	0.8 x 25 cos60°	A1	
	1.6 x R sin70°	A1	
	R = 6.65 N	A1 **6**	**6**

4 (i)	45 000/v = kv	M1	
	k = 50	A1 **2**	**AG**
(ii)	45 000/20 – 50x20 = 1200a	M1	
		A1	
	a = 1.04 m s⁻²	A1 **3**	
(iii)	P/15 = 50x15 + 1200x9.8sin10°	M1	
		A1	
	41 900 W	A1 **3**	**8**

5 (i)	2mu – 3kmu = –mu + kmv	M1	
	v = …..	M1	attempting to make v the subject
	v = 3u(1 – k)/k	A1	
			3u/k – 3u
	(0 <) k < 1	A1 **4**	not ≤ 1
(ii)	I = mu – – 2mu	M1	or km(3u/k - 3u + 3u)
	3mu	A1 **2**	+ only
(iii)	v = ± 3u	B1	
	e = (u/2 + 3u)/4u	M1	
	e = 7/8 or 0.875	A1 **3**	**9**

6 (i)(a)	$T \cos 45° = 2.94$ $T = 4.16$ N	M1 A1 **2**	Resolving vertically **AG**
(b)	$T\cos45° + T = 0.3 \times 1.96\omega^2$ (res. horiz.) $\omega = 3.47$ rad s^{-1}	M1 A1 A1 **3**	calculates $v = 6.81$ (Max 2/3)
(ii)(a)	$T\cos30° + T\cos60° = 2.94$ $T = 2.15$ N	M1 A1 A1 **3**	Resolving vertically
(b)	$T\cos30° + T\cos60° = 0.3v^2/1.5$ (res. horiz.) $v = 3.83$ m s^{-1}	M1 A1 A1 **3**	calculates $\omega = 2.56$ (Max 2/3) **11**

7 (i)	$0 = (175\sin\theta)^2 - 2\times9.8\times650$ $\theta = 40.2°$	M1 A1 A1 **3**	
(ii)	Attempt at t_1 , t_2 , t_{top} or t_{total} 5.61, 23.65, 14.63, 29.26 $t_2 - t_1$ or $2(t_{top} - t_1)$ or $t_{total} - 2t_1$ time difference = 18.0	M1 A1 M1 A1 A1 **5**	$650 = 175\sin55°.t - 4.9t^2$ etc
(iii)	$v_h = 175\cos55°$ (100.4) $v_v = 175\sin55° - 9.8 \times 5.61$ speed $= \sqrt{(88.4^2 + 100.4^2)}$ 134 m s^{-1}	B1 M1 M1 A1 **4**	or KE $\frac{1}{2}mv^2$ (B1) PE $m\times9.8\times650$ $v = \sqrt{(175^2 - 2\times9.8\times650)}$ **12**

8 (i)	$(2\times4\times\sin\Pi/2)/3\times\Pi/2$ 1.70	M1 A1 **2**	or $4r/3\Pi$ **AG**
(ii)(a)	$\bar{x}\times d(8\times20 - \Pi\times4^2/2) = 10\times8\times20d -$ $12\times\Pi\times4^2/2\times d$ $10\times8\times20(d)$ (1600) $(8\times20 - \Pi\times4^2/2)$ (d) (134.9) $(12\times\Pi\times4^2/2)$ (d) (301.6) $\bar{x} = 9.63$ cm	M1 A1 A1 A1 A1 **5**	or $134.9\,\bar{x} =$ $64\times4 + 38.9\times12 + 32\times18$ (1298.8) 64×4 38.9×12 32×18 **AG**
(ii)(b)	$\bar{y}\times d(8\times20 - \Pi\times4^2/2) = 4\times8\times20d -$ $1.7\times\Pi\times4^2/2\times d$ $4\times8\times20$ (d) $1.7d \times \Pi \times 4^2/2$ (13.6Π) $\bar{y} = 4.43$ cm	M1 A1 A1M1 A1 **4**	or $64\times4 = 42.7 + 38.9\,\bar{y}$ $\bar{y} = 5.49$ $135\,\bar{y} = 32\times4 + 38.9\times5.49 + 64\times4$
(iii)	$20\cos10° \times T$ $15\cos10° \times 9.63$ $15\sin10° \times 4.43$ $20\cos10°.T = 15\cos10°\times9.63 -$ $15\sin10°\times4.43$ (needs 3 parts) $T = 6.64$ N	B1 B1 B1 M1 A1 **5**	= or 10.6 (A to com) 34.7° $\angle$ comAH $= 15\times10.6\times\cos34.7°$ **16**