

Problem Solving With Circular Motion

Q1, (OCR 4729, Jun 2013, Q5)

(i)	Vertical force = mg Horizontal force = $m \times 0.4 \times 7^2$ Uses vertical force = $\mu \times$ horizontal force $\mu = 0.5$	*B1 *M1A1 dep*M1 A1 [5]	Dependent on B1 and M1 If a value for m used B0M1A0M1A0 max.
(ii)	$mg = T \times 0.3/0.5$ $m \times 0.4 \omega^2 = T \times 0.4/0.5$ Solve for ω or v $\omega = 5.72 \text{ rad s}^{-1}$	B1 *M1 A1 dep*M1 A1 [5]	Resolve T and equate to mass $\times (r\omega^2$ or $v^2/r)$ allow $7\sqrt{6}/3$ If a value for m and/or T used B0M1A0M1A0 max.

Q2, (OCR 4729, Jun 2015, Q8)

(i)	$0.4v^2/0.6 = 6, v = 3$	M1 A1 [2]	Attempt at use of N2L with $a = v^2/r$ or $a = r\omega^2$; allow verification. AG If +/-3 then -3 must be rejected for A1.
(ii)	$3(0.4) = 0.4v_A + 0.5v_B$ $v_B - v_A = 3(0.35)$ $v_A = 0.75 \text{ m s}^{-1} \text{ and } v_B = 1.8 \text{ m s}^{-1}$	*M1 A1 *M1 A1 dep*M1 A1 [6]	Attempt at use of conservation of linear momentum Attempt at use of restitution equation, must be correct way round Must be consistent with the directions used for CoLM Solving simultaneous equations Both values positive as final answer.
(iii)	$Y = 0.4g (= 3.92)$ $(4.9)^2 - (0.4g)^2 (= 2.94^2)$ $0.4(0.6)\omega^2 = cv(2.94)$ $\omega = 3.5$ <p>OR</p> $4.9\cos\theta = 0.4g$ $\cos\theta = 0.8 \text{ or } \theta = 36.9$ $0.4(0.6)\omega^2 = 4.9\sin\theta$ $\omega = 3.5$ <p>OR</p> $Y = 0.4g (= 3.92)$ $X = 0.4(0.6)\omega^2 (= 0.24\omega^2)$ $(0.4g)^2 + (0.4(0.6)\omega^2)^2 = 4.9^2$ $\omega = 3.5$	B1 B1 M1 A1 [4] B1 B1 M1 A1 [4] B1 B1 M1 A1 [4]	Resolve vertically Use of Pythagoras Resolve horizontally, cv(2.94) from a legitimate attempt at 2.94 Exact Resolve vertically, θ angle with vertical Resolve horizontally, θ substituted and from a legitimate attempt Exact Resolve vertically Resolve horizontally Attempt at use of Pythagoras, from a legitimate attempt at X Exact

Q3, (OCR 4729, Jan 2013, Q8)

(i)	(a)	$0.8F + 0.6R = 0.4g$ $4F + 3R = 19.6$ [AG]	M1 A1 [2]	Attempt to resolve vertically www
(i)	(b)	$0.8R - 0.6F = 0.4 \times 4.5^2/3$ Solve for R or F $F = 1.516$ $R = 4.512$ Use $\mu = F/R$ to get $\mu = 0.336$ [AG]	M1 A1 M1 A1 A1 B1 [6]	Attempt with three terms. aef including cos, sin correct angle Use 2 relevant resolutions.
(ii)		$0.6R - 0.8F = 0.4g$ $R = 11.8$ or $F = 3.98$ $0.8R + 0.6F = 0.4 \times 3 \times \omega^2$ $\omega = 3.14 \text{ rad s}^{-1}$	M1 A1 A1 M1 A1 A1 [6]	Resolve vertically, three terms N2L, resolve horizontally, three terms