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Mark Scheme (Results)
Summer 2009

GCE

GCE Mathematics (6677/01)

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June 2009
6677 Mechanics M1
Mark Scheme

Question Number	Scheme	Marks
Q1	$45 = 2u + \frac{1}{2}a2^2 \quad \Rightarrow \quad 45 = 2u + 2a$	M1 A1
	$165 = 6u + \frac{1}{2}a6^2 \quad \Rightarrow \quad 165 = 6u + 18a$	M1 A1
	eliminating either u or a	M1
	$u = 20$ and $a = 2.5$	A1 A1 **[7]**
Q2 (a)	$\tan\theta = \frac{p}{2p} \Rightarrow \theta = 26.6°$	M1 A1 (2)
(b)	$\mathbf{R} = (\mathbf{i} - 3\mathbf{j}) + (p\mathbf{i} + 2p\mathbf{j}) = (1 + p)\mathbf{i} + (-3 + 2p)\mathbf{j}$	M1 A1
	$\mathbf{R}$ is parallel to $\mathbf{i} \Rightarrow (-3 + 2p) = 0$	DM1
	$\Rightarrow p = \frac{3}{2}$	A1 (4) **[6]**
Q3 (a)	For A: $-\frac{7mu}{2} = 2m(v_A - 2u)$	M1 A1
	$v_A = \frac{u}{4}$	A1 (3)
(b)	For B: $\frac{7mu}{2} = m(v_B - -3u)$	M1 A1
	$v_B = \frac{u}{2}$	A1 (3)
	OR CLM:	OR
	$4mu - 3mu = 2m\frac{u}{4} + mv_B$	M1 A1
	$v_B = \frac{u}{2}$	A1 (3) **[6]**

Question Number	Scheme	Marks
Q4	$0.5g\sin\theta - F = 0.5a$	M1 A1 A1
	$F = \frac{1}{3}R$ seen	B1
	$R = 0.5g\cos\theta$	M1 A1
	Use of $\sin\theta = \frac{4}{5}$ or $\cos\theta = \frac{3}{5}$ or decimal equiv or decimal angle e.g 53.1^o or 53^o	B1
	$a = \frac{3g}{5}$ or $5.88\ \text{m s}^{-2}$ or $5.9\ \text{m s}^{-2}$	DM1 A1 **[9]**
Q5	$F = P\cos 50^o$	M1 A1
	$F = 0.2R$ seen or implied.	B1
	$P\sin 50^o + R = 15g$	M1 A1 A1
	Eliminating R; Solving for P ; $P =$ 37 (2 SF)	DM1;D M1; A1 **[9]**
Q6 (a)	For whole system: $1200 - 400 - 200 = 1000a$	M1 A1
	$a = 0.6\ \text{m s}^{-2}$	A1 (3)
(b)	For trailer: $T - 200 = 200$ x 0.6	M1 A1 **ft**
	$T = 320$ N	A1
		OR:
	OR: For car: $1200 - 400 - T = 800$ x 0.6	M1 A1 **ft**
	$T = 320$ N	A1 (3)
(c)	For trailer: $200 + 100 = 200f$ or $-200f$	M1 A1
	$f = 1.5\ \text{m s}^{-2}$ (-1.5)	A1
	For car: $400 + F - 100 = 800f$ or $-800f$	M1 A2
	$F = 900$	A1 (7)
	(N.B. For both: $400 + 200 + F = 1000f$)	**[13]**

Question Number	Scheme	Marks
Q7 (a)	$M(Q),\quad 50g(1.4-x)+20g \text{ x } 0.7 = T_P \text{ x } 1.4$	M1 A1
	$T_P = 588 - 350x$ Printed answer	A1 (3)
(b)	$M(P),\quad 50gx + 20g \text{ x } 0.7 = T_Q \text{ x } 1.4$ or $R(\uparrow),\ T_P + T_Q = 70g$	M1 A1
	$T_Q = 98 + 350x$	A1 (3)
(c)	Since $0 < x < 1.4$, $98 < T_P < 588$ and $98 < T_Q < 588$	M1 A1 A1 (3)
(d)	$98 + 350x = 3\,(588 - 350x)$	M1
	$x = 1.19$	DM1 A1 (3) **[12]**
Q8 (a)	$\lvert\mathbf{v}\rvert = \sqrt{1.2^2 + (-0.9)^2} = 1.5 \text{ m s}^{-1}$	M1 A1 (2)
(b)	$(\mathbf{r}_H =) 100\mathbf{j} + t(1.2\mathbf{i} - 0.9\mathbf{j})$ m	M1 A1 (2)
(c)	$(\mathbf{r}_K =) 9\mathbf{i} + 46\mathbf{j} + t(0.75\mathbf{i} + 1.8\mathbf{j})$ m	M1 A1
	$\overrightarrow{HK} = \mathbf{r}_K - \mathbf{r}_H = (9 - 0.45t)\mathbf{i} + (2.7t - 54)\mathbf{j}$ m **Printed Answer**	M1 A1 (4)
(d)	Meet when $\overrightarrow{HK} = \mathbf{0}$	
	$(9 - 0.45t) = 0$ and $(2.7t - 54) = 0$	M1 A1
	$t = 20$ from both equations	A1
	$\mathbf{r}_K = \mathbf{r}_H = (24\mathbf{i} + 82\mathbf{j})$ m	DM1 A1 **cso** (5) **[13]**