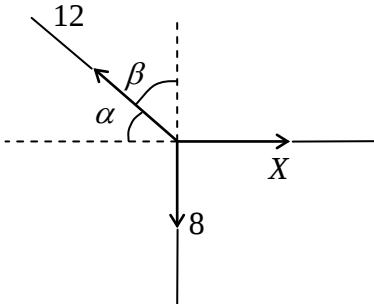


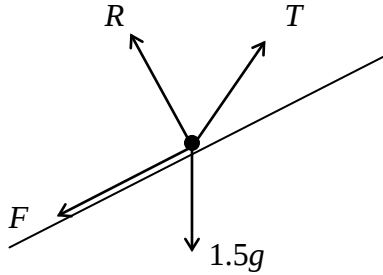
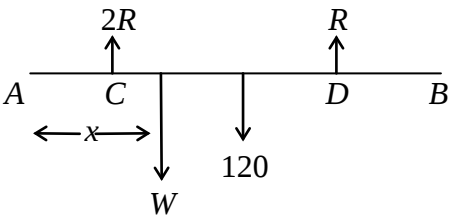
EDEXCEL MECHANICS M1 (6677)

JANUARY 2003 PROVISIONAL MARK SCHEME

Question Number	Scheme	Marks
1.	(a) CLM: $2000 \times 10 = 2000v + 3000 \times 5$ $v = 2.5 \text{ m s}^{-1}$ (b) $I = 3000 \times 5$ (or $2000(10 - 2.5)$) $= 15\,000 \text{ N s}$	M1, A1 B1 (3) M1 A1 (2) (5 marks)
2.	(a)  $R(\uparrow) \quad 8 = 12 \cos \beta \text{ or } 12 \sin \alpha$ $\Rightarrow \beta = 41.8^\circ \text{ or } \alpha = 48.2^\circ$ $\Rightarrow \theta = 138.2^\circ$ (b) $R(\rightarrow) \quad X = 12 \cos 41.8^\circ$ (or $12 \sin 48.2^\circ$) $= 8.94$	M1 A1 A1 (3) M1 A1ft A1 (3) (6 marks)
3.	(a) $\mathbf{a} = [-14\mathbf{i} + 21\mathbf{j} - (6\mathbf{i} - 27\mathbf{j})] \div 4$ $= (-5\mathbf{i} + 12\mathbf{j}) \text{ m s}^{-2}$ (b) $\mathbf{a} = \sqrt{5^2 + 12^2} = 13$ $\mathbf{F} = m \mathbf{a} = 0.4 \times 13 = 5.2 \text{ N}$	M1 A1 A1 (3) M1 M1 A1 (3) (6 marks)
Alt (b)	$\mathbf{F} = 0.4(5\mathbf{i} + 12\mathbf{j}) = 2\mathbf{i} + 4.8\mathbf{j}$ $\mathbf{F} = \sqrt{2^2 + 4.8^2} = 5.2 \text{ N}$	M1 M1 A1 (3)

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JANUARY 2003 PROVISIONAL MARK SCHEME

Question Number	Scheme	Marks
4.	(a) $\mathbf{p} = 10t\mathbf{j}$ $\mathbf{q} = (6\mathbf{i} + 12\mathbf{j}) + (-8\mathbf{i} + 6\mathbf{j})t$ (b) $t = 3: \mathbf{p} = 30\mathbf{j}, \mathbf{q} = -18\mathbf{i} + 30\mathbf{j}$ $\Rightarrow$ dist. apart = 18 km Alt. (b) $\mathbf{PQ} = \mathbf{q} - \mathbf{p} = (6 - 8t)\mathbf{i} + (12 - 4t)\mathbf{j}$ $t = 3: \mathbf{PQ} = -18\mathbf{i} + 0\mathbf{j}$ Dist. = 18 km (c) Q north of P $\Rightarrow 6 - 8t = 0$ $t = \frac{3}{4}$ or $\mathbf{PQ} ^2 = (6 - 8t)^2 + (12 - 4t)^2$ $t = 3 \rightarrow \mathbf{PQ} = 18$	B1 M1 A1 (3) M1 A1 A1 (3) M1 A1 A1 M1 A1 (2) (8 marks)
5.	 R($\nearrow$): $T \cos 20^\circ = F + 1.5g \sin 30^\circ$ R($\nwarrow$): $T \sin 20^\circ + R = 1.5g \cos 30^\circ$ Using $F = \frac{1}{3}R$ Eliminating R, solve T $T = 11$ or 11.0 N	M1 A2,1,0 M1 A2,1,0 M1 M1, M1 A1 (10 marks)
6.	 (a) M(A): $Wx + 120 \times 1.5 = R \times 2 + 2R \times 1$ R($\uparrow$) $3R = W + 120$ Hence $Wx + 180 = 3R = W = 120$ $W(1 - x) = 60$ $W = \frac{60}{1 - x}$ (b) $W > 0 \Rightarrow x < 1$	M1 A2, 1, 0 M1 A1 M1 A1 M1 A1cso (8) M1 A1 (2) (10 marks)

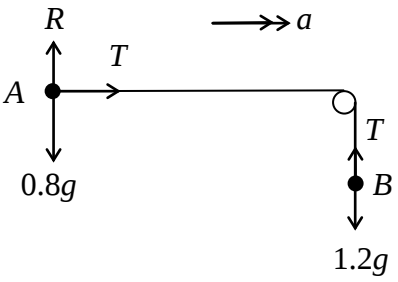
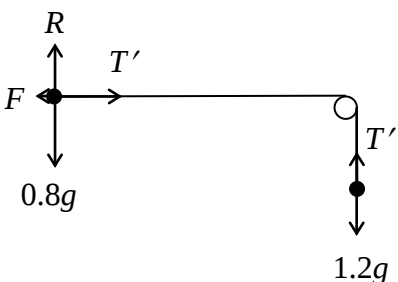
EDEXCEL MECHANICS M1 (6677)

JANUARY 2003 PROVISIONAL MARK SCHEME

Question Number	Scheme	Marks
7.	(a) $v^2 = u^2 + 2as$: $0 = u^2 - 2 \times 9.8 \times 25.6$ $u^2 = 501.76 \Rightarrow u = 22.4$ (★) (b) $-1.5 = 22.4T - 4.9T^2$ $4.9T^2 - 22.4T - 1.5 = 0$ $T = \frac{22.4 \pm \sqrt{22.4^2 + 4 \times 1. \times 4.9}}{9.8}$ $= 4.64$ s (c) Speed at ground $v = 22.4 - 9.8 \times 4.64$ $v = -23.07$ (or $v^2 = 22.4^2 + 2 \times 9.8 \times 1.5$, $v = 23.05$) $v^2 = u^2 + 2as$: $0 = 23.07^2 + 2 \times a \times 0.025$ $(\rightarrow a = -10644.5)$ $F - 0.6g = 0.6a$ $F = 6390$ N (3 sf) (d) Air resistance; variable F;	M1 A1 A1cso (3) M1 A1 M1 A1 (4) M1 A1 M1 A1ft M1 A1 (6) B1 (1) (14 marks)

EDEXCEL MECHANICS M1 (6677)

JANUARY 2003 PROVISIONAL MARK SCHEME

Question Number	Scheme	Marks
8. (a)  (b) $a = 0.6g = 5.88$ Hence $0.6 = \frac{1}{2} \times 0.6g \times t^2$ $t = 0.45$ or 0.452 s  Solve: $a' = 0.52g$ $0.6 = \frac{1}{2} \times 0.52g \times t^2$ $t = 0.49$ or 0.485 s	$A: T = 0.8a$ $B: 1.2g - T = 1.2a$ Solve: $T = 0.48g = 4.7$ N $F = \mu R = \frac{1}{5} \times 0.8g$ $A: T' - F = 0.8a'$ $B: 1.2g - T' = 1.2a'$	B1 M1 A1 M1 A1 (5) M1 M1 A1 (3) B1 M1 A1 B1 M1 A1 M1 A1 (8) (16 marks)