

EDEXCEL - LONDON EXAMINATIONS

Stewart House 32 Russell Square London WC1B 5DN

June 2001

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject MECHANICS 6677

Paper No. M1

Question number	Scheme	Marks
1.	<p> $3 \rightarrow$ $\leftarrow 2$ Before $0.5 \circlearrowleft$ $\circlearrowright 0.2$ \rightarrow $\rightarrow v$ After 1.5 </p> <p>(a) $0.5 \times 3 - 0.2 \times 2 = 0.5 \times 1.5 + 0.2 \times v$ (Mom^m eqn. with 4 terms)</p> <p style="text-align: center;">$\Rightarrow v = \underline{1.75 \text{ ms}^{-1}}$</p> <p>(b) $I = 0.2(2 + 1.75)$</p> <p style="text-align: center;">$= \underline{0.75 \text{ N s}}$</p>	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1 ✓</p> <p>A1 (3)</p> <p style="text-align: center;">(6)</p>

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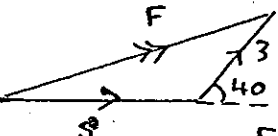
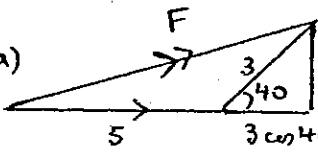
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<u>2.</u>	<u>EITHER</u>	
(a)	 <p>Vector Δ attempt Correct</p> $F^2 = 5^2 + 3^2 - 2 \cdot 5 \cdot 3 \cos 140 \quad (\text{cos rule})$ $\rightarrow F \approx \underline{7.55 \text{ N}}$	M1 A1 M1 A1 A1 (5)
(b)	$\frac{F}{\sin 140} = \frac{3}{\sin \theta} \Rightarrow \theta \approx \underline{14.8^\circ}$	M1 A1, A1 (3) (8)
or.		
(a)	 <p>Vector Δ attempt correct</p> $F^2 = (5 + 3 \cos 40)^2 + (3 \sin 40)^2$ $F \approx \underline{7.55 \text{ N}}$	M1 A1 M1 A1 ✓ A1 (5)
(b)	$\tan \theta = \frac{3 \sin 40}{5 + 3 \cos 40}, \quad \theta \approx \underline{14.8^\circ}$	M1 A1, ✓ A1 (3) (8)
or		
(a)	$\underline{P} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} \text{ or } 5\underline{i} \quad \underline{Q} = \begin{pmatrix} 3 \cos 40 \\ 3 \sin 40 \end{pmatrix} \text{ or } 3 \cos 40 \underline{i} + 3 \sin 40 \underline{j}$ $\Rightarrow \underline{F} = \begin{pmatrix} 5 + 3 \cos 40 \\ 3 \sin 40 \end{pmatrix}$	M1 A1
	$ \underline{F} = \sqrt{(5 + 3 \cos 40)^2 + (3 \sin 40)^2}$ $\approx \underline{7.55 \text{ N}}$	M1 A1 ✓ A1 (5)
(b)	$\tan \theta = \frac{3 \sin 40}{5 + 3 \cos 40}$ $\approx \underline{14.8^\circ}$	M1 A1 ✓ A1 (3) (8)

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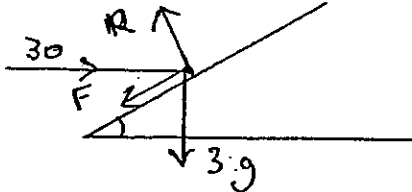
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3.	<p>(a) Distance = $\frac{1}{2} \times (30+17) \times 3, + 4 \times 17$ $= 138.5 \text{ m.}$</p> <p>[OR $\frac{1}{2} \times 3 \times (30-17) + 3 \times 17 + 4 \times 17$ $= 138.5 \text{ m}$]</p> <p>(b) Str. line graph \Rightarrow const. decel² $"F=ma" \Rightarrow F \text{ const}$</p> <p>(c) Decel² = $\frac{30-17}{3}$ Force = $1200 \times \left(\frac{30-17}{3}\right) = 5200 \text{ N}$</p>	<p>m1 A1, m1 A1 (4)</p> <p>m1 A1, m1 A1</p> <p>m1 A1 c.s.o. (2)</p> <p>m1 m1 A1 (3) (9)</p>
4.	<p>(a)  Diag. with 4 forces marked (Allow F & R combined if clear)</p> <p>(b) R(\uparrow) $R = 3g \cos 30^\circ + 30 \sin 30^\circ$ (3 terms) $= 40.46 \dots \approx 40.5 \text{ or } 40 \text{ N.}$</p> <p>(c) R($\leftarrow$) $F = 30 \cos 30^\circ - 3g \sin 30^\circ$ (3 terms) $F = \mu R, \Rightarrow \mu = \frac{F}{R} = \frac{11.28}{40.46}$ $\approx 0.28 \text{ (or } 0.279)$</p>	<p>B2 -1 e.e. (2)</p> <p>m1 A2 -1 e.e. A1 (4)</p> <p>m1 A1</p> <p>m1, m1 A1 (5)</p> <p>(11)</p>

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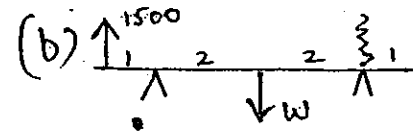
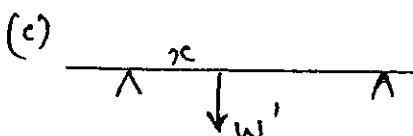
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5.	<p>(a) \circ</p> <p>(b)  $M(D): 2W = 1500 \cdot 5$ $\Rightarrow W = \underline{3750 \text{ N}}$</p> <p>[If moments about another pt: M1 for a complete method to get W, A1 for a moments eqn² correct.]</p> <p>(c)  $M(D) 1500 \cdot 5 = W'(4-x)$ $M(C) 1000 \cdot 5 = W'x$ Solve $\rightarrow W' = \underline{3125 \text{ N}}$</p> <p>(d) $x = 1.6 \text{ m}$</p> <p>(e) AB remains straight line (o.e.)</p>	<p>B1 (1)</p> <p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1</p> <p>M1 A1</p> <p>M1 A1 (6)</p> <p>M1 A1 (2)</p> <p>B1 (1)</p> <p>(13)</p>

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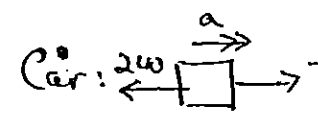

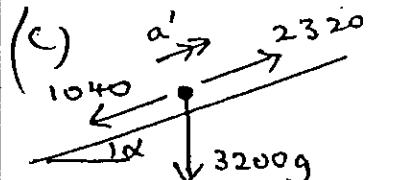
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<p><u>b.</u></p>	<p>(a) Car + Van: $3200 a = 2320 - 800 - 240$ $a = \underline{0.4 \text{ ms}^{-2}}$</p> <p>(b) Car:  $1200 a = T - 240$ $\rightarrow T = 720 \text{ N}$</p> <p>[OR Van:  $2000 a = 2320 - 800 - T$ $\rightarrow T = 720$]</p> <p><u>NB</u> If use eqn^s for car & van alone, allow M1 A2 for one eqn² involving T, then M1 A1 for a second eqn² <u>provided</u> it is part of a complete method to find a/T. Then A1 A1 for a & T.</p> <p>(c)  $3200 a' = 2320 - 1040 - 3200g \cdot \frac{1}{20}$ (4 terms) $a' = -0.09 \text{ ms}^{-2}$ \Rightarrow magn. 0.09 ms^{-2} speed decreasing</p>	<p>M1 A1 A1 (3)</p> <p>M1 A2 ✓ -1 e.e. A1 (4)</p> <p>M1 A2 -1 e.e. M1 A1 A1 ✓ (6)</p> <p>(13)</p>

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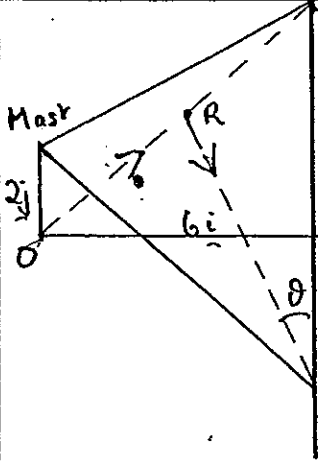
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7.	 <p>(a) $\underline{w}_1 = 2\underline{j} + 6\underline{i} + 6\underline{j}$ $= 6\underline{i} + 8\underline{j}$</p> <p>(b) $OW_1 = \sqrt{(6^2 + 8^2)} = 10 \text{ km}$ $\Sigma \text{st}^{\text{d}} \text{ time} = \frac{10}{5} = 2 \text{ hrs}$</p> <p>(c) $\underline{w}_2 = 2\underline{j} + 6\underline{i} - 6\underline{j}$ $= 6\underline{i} - 4\underline{j}$</p> <p>(d) P.v. of rescue party after 1 hour = $\underline{R} = 3\underline{i} + 4\underline{j}$ $\underline{R}\underline{w}_2 = 3\underline{i} - 8\underline{j}$ $\tan \theta = \frac{3}{8} = 20.6^\circ$ \Rightarrow Required bearing = $180^\circ - 20.6^\circ$ $= 159.4^\circ$</p>	<p>B1 B1 (2)</p> <p>M1 M1 A1 (3)</p> <p>B1, M1 A1 (3)</p> <p>M1 A1</p> <p>M1 A1</p> <p>M1</p> <p>M1</p> <p>A1 (7)</p> <p>(15)</p>