

# EDEXCEL FOUNDATION

Stewart House 32 Russell Square London WC1B 5DN

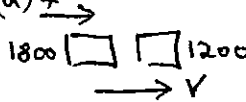
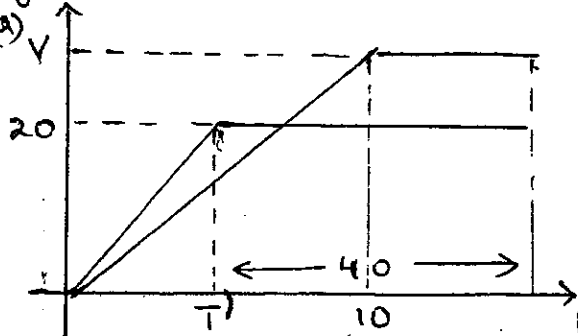
January 2002

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject MECHANICS 6677

Paper No. M1

Question number	Scheme	Marks
1.	$\text{Impulse} = \text{change in mom}^m = 0.3(8+6)$ $= \underline{4.2 \text{ N s}}$	M1 A1 A1 (3)
2.	<p>(a) </p> $1800 \cdot 4 = (1800 + 1200)v$ $v = \underline{2.4 \text{ m s}^{-1}}$ <p>(b)</p> $R \cdot 8 = 3000 \cdot 2.4$ $R = \underline{900}$	M1 A1 A1 (3) M1 A1 $\sqrt{v}$ A1 (3) (6)
3.	<p>(a) "v = u + at" : <math>60 = 12 + 4a \rightarrow a = \underline{12 \text{ m s}^{-2}}</math> *</p> <p>(b) "s = ut + <math>\frac{1}{2}at^2</math>" : <math>0A = 12 \cdot 4 + \frac{1}{2} \cdot 12 \cdot 4^2</math>  <math>= \underline{144 \text{ m}}</math></p> <p>(c) "v<sup>2</sup> = u<sup>2</sup> + 2as" : <math>v^2 = 12^2 + 2 \cdot 12 \cdot 72</math>  <math>v = \underline{43.3 \text{ m s}^{-1}}</math></p>	M1 A1 (2) M1 A1 A1 (3) M1 A1 $\sqrt{0A}$ A1 (3)
4.	<p>(a) </p> <p>One shape correct                      B1</p> <p>2nd shape correct rel. to first                      B1</p> <p>Figs (10, 20, 40)                      B1 (3)</p> <p>Contd.</p>	

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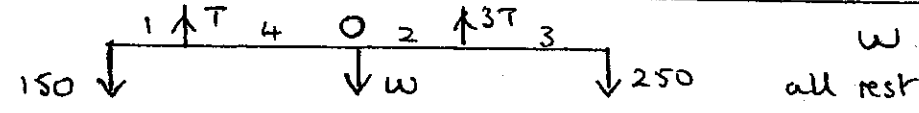
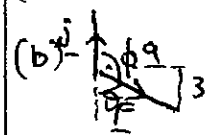
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4.	<p>(b) Scooter: dist travelled = area under graph</p> $850 = \frac{1}{2} T \cdot 20 + 20 \cdot 40$ $\Rightarrow T = \underline{5s}$ <p>(c) Van: <math>850 = \frac{1}{2} V \cdot 10 + V(40 - 5)</math></p> $\Rightarrow V = \underline{21.25 \text{ m s}^{-1}}$	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1 <math>\sqrt{(1)}</math></p> <p>A1 (3)</p> <p style="border: 1px solid black; border-radius: 50%; padding: 2px;">9</p>
5.	<p>(a) </p> <p>(b) <math>M(O): 150 \cdot 5 + 3T \cdot 2 = T \cdot 4 + 250 \cdot 5</math></p> <p>Solve <math>T = \underline{250 \text{ N}}</math></p> <p>[Allow M1 A2, 1, 0 for moments eqn<sup>s</sup> abt any pt. Then M1 A1 for complete sol<sup>n</sup> <math>\rightarrow T =</math> ]</p> <p>(c) <math>R(\uparrow) 4T = 400 + W \rightarrow W = \underline{600 \text{ N}}</math></p> <p>(M1 needs complete sol<sup>n</sup> <math>\rightarrow W/A =</math> )</p> <p>(d) By having weight act at <u>centre/mid-pt.</u></p>	<p>B1</p> <p>B1 (2)</p> <p>M1 A2, 1, 0</p> <p><math>\downarrow</math></p> <p>M1 A1 (5)</p> <p>M1 A1</p> <p>(2)</p> <p>B1 (1)</p> <p style="border: 1px solid black; border-radius: 50%; padding: 2px;">10</p>
6.	<p>(a) <math>\underline{F} = (6\underline{i} + 2\underline{j}) + (3\underline{i} - 5\underline{j}) = \underline{(9\underline{i} - 3\underline{j}) \text{ N}}</math></p> <p>(b)  <math>\tan \theta = \frac{9}{3} \Rightarrow \theta = 71.6^\circ</math></p> <p><math>\phi = \underline{108.4^\circ}</math></p> <p>(c) "<math>\underline{F} = m\underline{a}</math>" <math>\Rightarrow \underline{a} = \underline{(3\underline{i} - \underline{j}) \text{ m s}^{-2}}</math></p> <p>(d) <math>\underline{v} = (-2\underline{i} + \underline{j}) + 2(3\underline{i} - \underline{j}) = 4\underline{i} - \underline{j}</math></p> <p>Speed = <math>\sqrt{4^2 + 1^2} = \underline{4.12 \text{ m s}^{-1}}</math></p>	<p>B1 (1)</p> <p>M1 A1 <math>\sqrt{(1)}</math></p> <p>A1 (3)</p> <p>M1 A1 <math>\sqrt{(1)}</math></p> <p>(2)</p> <p>M1, M1, A1 <math>\sqrt{(2)}</math></p> <p>M1 A1 (5)</p> <p style="border: 1px solid black; border-radius: 50%; padding: 2px;">11</p>

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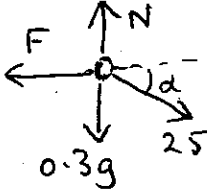
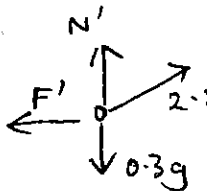
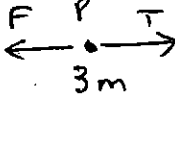
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7.	<p>(a) </p> <p>R(↑) <math>N = 0.3 \times 9.8 + 2.5 \sin \alpha</math>  <math>(= 2.94 + 1.5 = 4.44 \text{ N})</math></p> <p>R(→) <math>F = 2.5 \cos \alpha \quad (= 2 \text{ N})</math></p> <p><math>F = \mu N \rightarrow \mu = \frac{2}{4.44} \approx \underline{0.45}</math></p> <p>(b) </p> <p><math>N' = 0.3 \times 9.8 - 2.5 \sin \alpha = \underline{1.44 \text{ N}}</math></p> <p><math>F' \leq \mu N'</math>. <math>N' &lt; N \Rightarrow F'_{\text{max}}</math> less</p> <p>But <math>F'</math> must <math>= 2.5 \cos \alpha</math> for equilib.</p> <p>Hence equilib. <u>not</u> possible</p>	<p>M1 A2, 1, 0</p> <p>M1 A1</p> <p>M1 M1 A1 (8)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>A1 cso (2)</p> <p>(12)</p>
8.	<p></p> <p>(a) P: <math>T - F = 3ma</math>          Q: <math>5mg - T = 5ma</math></p> <p>(b) <math>F = 0.6 \times 3mg \quad (= 1.8mg)</math>          Hence <math>5mg - 1.8mg = 8ma</math>  <math>a = \underline{0.4g}</math></p> <p>(c) Sub: <math>T = 3ma + F</math> or <math>5mg - 5ma</math>  <math>\rightarrow T = \underline{3mg}</math></p> <p>(d) Speed when Q hits floor: <math>v^2 = 2 \times 0.4g \times h</math>  <math>= \frac{4}{5}gh</math></p> <p>Decel<sup>2</sup> of P: <math>3mf = 1.8mg \Rightarrow f = 0.6g</math></p> <p>Dist moved by P: <math>\frac{4}{5}gh = 2 \cdot \frac{3}{5}g \cdot s</math>  <math>\Rightarrow s = \underline{\frac{2}{3}h}</math></p>	<p>M1 A1</p> <p>M1 A1 (4)</p> <p>M1 A1</p> <p>M1 A1 (4)</p> <p>M1 A1 (2)</p> <p>M1 A1 ✓</p> <p>M1 A1</p> <p>M1 A1 (6)</p> <p>(16)</p>