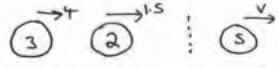
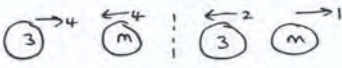


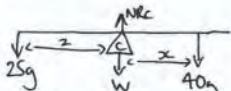
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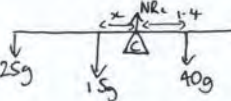
M1 JAN06

- 1) $u \uparrow = 16$ $a \uparrow = -9.8$ $t = 4$
 $S = ut + \frac{1}{2}at^2 \Rightarrow S = 16 \times 4 - 4.9 \times 16 \Rightarrow S = -14.4m$ (14.4m below point of projection).
 b) $v^2 = u^2 + 2as \Rightarrow v^2 = 16^2 - 19.6 \times -14.4$
 $\Rightarrow v^2 = 538.24 \Rightarrow v = 23.2ms^{-1} \downarrow$

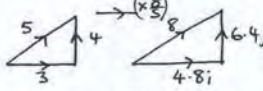
- 2)  Total mom before = $12 + 3 = 15$
 Total mom after = $5v$
 $15 = 5v \Rightarrow v = 3ms^{-1}$
 b) 

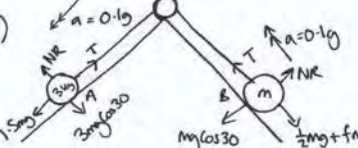
- Total mom before = $12 - 4m$ $12 - 4m = -6 + m$
 Total mom after = $-6 + m$ $18 = 5m \Rightarrow m = 3.6kg$
 c) Mom @ before = $3.6 \times 4 = 14.4Ns$ \Rightarrow Impulse = $18Ns$
 Mom @ after = $3.6 \times 1 = 3.6Ns$

- 3)  $\sum \tau = 0$
 $25g \times 2 = 40g \times x$
 $x = \frac{50g}{40g} = 1.25m$

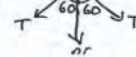
- b) Weight acts at centre of rod.
 c)  $\sum \tau = 0$
 $25g \times 2 + 15g \times x = 40g \times 1.4$
 $50g + 15gx = 56g$
 $x = \frac{6g}{15g} = 0.4m$

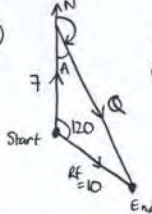
- c) $B = (-26i + 4j) + (3i + 4j)t = (-26 + 3t)i + (4 + 4t)j$ ③
 $A = (2i - 10j) + (-1i + 6j)t = (2 - t)i + (-10 + 6t)j$
 $i \Rightarrow -26 + 3t = 2 - t \Rightarrow 4t = 28 \Rightarrow t = 7sec$
 $j \Rightarrow 4 + 4t = -10 + 6t \Rightarrow 2t = 14 \Rightarrow t = 7sec$

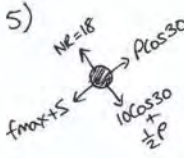
- when $t = 7$ $A = -5i + 32j$ $(-5, 32)$
 d) 
 $B = (-26i + 4j) + (4.8i + 6.4j)t, t = 7$
 $B = 7.6i + 48.8j$
 distance = $12.6i + 16.6j \Rightarrow \sqrt{12.6^2 + 16.6^2} = 20.8m$

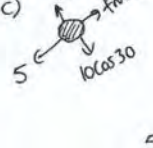
- 7)  $a = 0.1g$
 (A) $RF = ma$
 $1.5mg - T = 3m \times \frac{1}{10}g$
 $T = 1.2mgN$

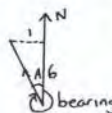
- b) (B) $RF \uparrow = 0 \Rightarrow NR = 0.866mg \Rightarrow f_{max} = \mu \times 0.866mg$
 $RF \uparrow = ma \Rightarrow T - \frac{1}{2}mg - \mu \times 0.866mg = m \times 0.1g$ $T = 1.2mg$
 $0.6mg = 0.866mg \times \mu$ $\mu = \frac{0.6}{0.866} = 0.693$

- c)  $RF = 2T \cos 60 = 1.2mg$
 act vertically downwards

- 4) 
 $Q^2 = 7^2 + 10^2 - 2(7)(10)\cos 120$
 $Q^2 = 219 \Rightarrow Q = 14.8N$
 $\frac{\sin A}{10} = \frac{\sin 120}{14.8} \Rightarrow A = 35.8^\circ$
 Bearing = 144°

- 5) 
 $RF \uparrow = 0 \Rightarrow 18 = 10 \cos 30 + \frac{1}{2}P$
 $\frac{1}{2}P = 9.3397$
 $P = 18.68N$
 b) $f_{max} = \mu NR = 18\mu$
 $RF \uparrow = 0 \Rightarrow P \cos 30 = f_{max} + S$
 $f_{max} = 11.18N$
 $M = \frac{11.18}{18} = 0.62$

- c) 
 $NR = 10 \cos 30 = 8.66N$ $f_{max} = \mu NR = 5.37$
 Since $f_{max} > 5$ it will not move.

- 6) speed = $\sqrt{1^2 + 6^2} = \sqrt{37} = 6.08ms^{-1}$
 b) 
 $A = \tan^{-1}(\frac{1}{6}) = 9.46^\circ$
 Bearing = 351°