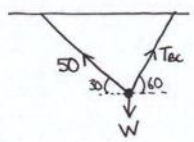
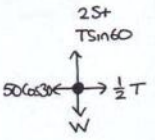
M1 JUNE 04 ①

1)





$\vec{Rf}=0 \Rightarrow \frac{1}{2}T = 50\cos 30 \Rightarrow T = \underline{86.6N}$

$Rf\uparrow=0 \Rightarrow W = 25 + 86.6\sin 60 \Rightarrow W = \underline{100N}$

2) $u=5 \quad v=9.5 \quad t=1.5$

$v=u+at \Rightarrow 9.5 = 5 + 1.5a \Rightarrow 4.5 = 1.5a \Rightarrow a = \underline{3ms^{-2}}$

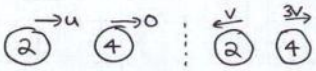
$u=5 \quad s=24 \quad a=3$

$v^2 = u^2 + 2as \Rightarrow v^2 = 25 + 2(3)(24) \Rightarrow v^2 = 169 \Rightarrow v = \underline{13ms^{-1}}$

b) Momentum at C $= 2\times 13 = 26Ns$
Impulse = change in momentum $= 30Ns$ ←
Momentum after $= -4Ns$

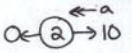
$-4 = 2\times v \quad v = \underline{-2ms^{-1}}$ $\underline{2ms^{-1}}$ direction changes.

3)



Total mom before $= 2u$
Total mom after $= -2v + 12v = 10v$
$\Big\} \; 2u = 10v \quad v = \frac{1}{5}u$

b)



$\overleftarrow{Rf} = ma \Rightarrow -10 = 2a \Rightarrow a = \underline{-5ms^{-2}}$

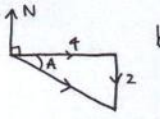
$s=1.6 \quad a=-5 \quad v=0 \quad v^2 = u^2 + 2as \Rightarrow 0 = u^2 - 16 \Rightarrow u^2 = 16$

(*) $4 = \frac{1}{5}u \Rightarrow u = 20ms^{-1}$ $\Rightarrow \underline{u = 4ms^{-1}}$

6) ③

Change $= 3i + 1.5j$ in 45min

Vel = direction $= \frac{3i + 1.5j}{0.75} = \underline{4i - 2j \text{ km/h}}$



bearing $= 90 + A = 90 + \tan^{-1}\left(\frac{2}{4}\right)$

bearing $= \underline{116.6°}$

b) $s = (4i - 6j) + t(4i - 2j) = (4 + 4t)i + (-6 - 2t)j$

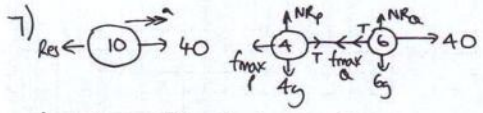
c) at 10:15 $t = 1.25 \quad s = (4 + 4(1.25))i + (-6 - 2(1.25))j$

$s = 9i - 8.5j$

Motor boat travels $9i - 8.5j$ in 15min

Vel $= \frac{9i - 8.5j}{0.25} = \underline{36i - 34j \text{ km/h}}$

7)

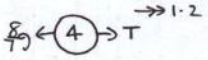


$fmax\,Q = \mu NR = \frac{2}{7}\times 6g = \frac{12}{7}gN$

$fmax\,P = \mu NR = \frac{2}{7}\times 4g = \frac{8}{7}gN$

$\Big\} \; Res = \frac{20}{7}g$

$\vec{Rf} = 40 - \frac{20}{7}g = 10a \Rightarrow a = \frac{12}{10} = \underline{1.2ms^{-2}}$

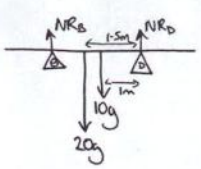


$\vec{Rf} = ma \Rightarrow T - \frac{8}{7}g = 4a$

$T = 4.8 + \frac{8}{7}g$

$T = \underline{16N}$

4) ⑫



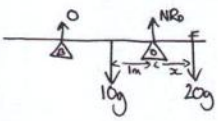
D↻ $10g\times 1 + 20g\times 1.5 = NR_B \times 3$

$40g = 3NR_B$

$NR_B = \frac{40}{3}g\,N$

$NR_B = \underline{13\frac{1}{3}g\,N}$

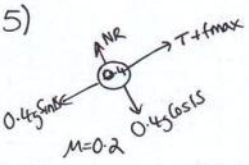
$Rf\uparrow=0 \Rightarrow 30g = 13\frac{1}{3}g + NR_D \Rightarrow NR_D = \underline{16\frac{2}{3}g\,N}$



D↻ $20g\times x = 10g\times 1$

$x = \frac{10g}{20g} = \underline{0.5m}$

5)



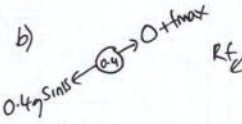
$Rf\uparrow=0 \Rightarrow NR = 0.4g\cos 15 = 3.79_N$

$fmax = \mu NR = 0.2\times 3.79 = 0.757_N$

$Rf\nearrow=0 \Rightarrow T + 0.757 = 0.4g\sin 15$

$T = \underline{0.257_N}$

b)



$Rf\swarrow = ma \Rightarrow 0.4g\sin 15 - fmax = 0.4a$

$0.257 = 0.4a \Rightarrow a = \underline{0.64}$

$a = 0.643 \quad u = 0 \quad s = 50$

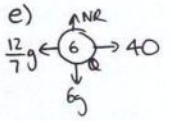
$s = ut + \frac{1}{2}at^2 \Rightarrow 50 = \frac{1}{2}(0.643)t^2 \Rightarrow t^2 = 155.47$

$t = \underline{12.5sec}$

d) after 7sec $u=0 \quad t=7 \quad a=1.2$ ④

$v = u + at \Rightarrow v = 0 + 1.2\times 7 = \underline{8.4ms^{-1}}$

e)



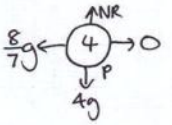
$\vec{Rf} = ma \Rightarrow 40 - \frac{12}{7}g = 6a$

$\Rightarrow a = \underline{3.86\,ms^{-2}}$

$u = 8.4 \quad a = 3.86 \quad t = 3$

$v = u + at \Rightarrow v = 8.4 + 3.86\times 3 \Rightarrow \underline{v = 20ms^{-1}}$

* d) $u = 8.4 \quad v = 0$



$\vec{Rf} = ma \Rightarrow -\frac{8}{7}g = 4a \Rightarrow a = \underline{-2.8ms^{-2}}$

$v = u + at \Rightarrow 0 = 8.4 - 2.8(t)$

$t = \frac{8.4}{2.8} = \underline{3sec}$