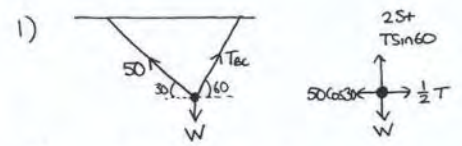


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1)  $\vec{R}_F = 0 \Rightarrow \frac{1}{2}T = 50 \cos 30 \Rightarrow T = 86.6 \text{ N}$   
 $R_F \uparrow = 0 \Rightarrow W = 2S + 86.6 \sin 60 \Rightarrow W = 100 \text{ N}$

2)  $u = 5 \quad v = 9.5 \quad t = 1.5$   
 $v = u + at \Rightarrow 9.5 = 5 + 1.5a \Rightarrow 4.5 = 1.5a \Rightarrow a = 3 \text{ ms}^{-2}$   
 $u = 5 \quad s = 24 \quad a = 3$   
 $v^2 = u^2 + 2as \Rightarrow v^2 = 25 + 2(3)(24) \Rightarrow v^2 = 169 \Rightarrow v = 13 \text{ ms}^{-1}$

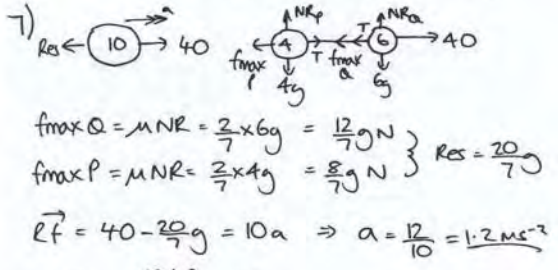
b) Momentum at c =  $2 \times 13 = 26 \text{ N s}$   
 Impulse = change in momentum =  $30 \text{ N s}$   
 Momentum after =  $-4 \text{ N s}$   
 $-4 = 2 \times v \quad v = -2 \text{ ms}^{-1}$  direction changes.

3)  $\begin{matrix} \rightarrow u & \rightarrow 0 & \dots & \leftarrow v & \rightarrow 3v \\ \textcircled{2} & \textcircled{4} & & \textcircled{2} & \textcircled{4} \end{matrix}$   
 Total mom before =  $2u$   
 Total mom after =  $-2v + 12v = 10v$   
 $\left. \begin{matrix} 2u = 10v \\ v = \frac{1}{5}u \end{matrix} \right\}$

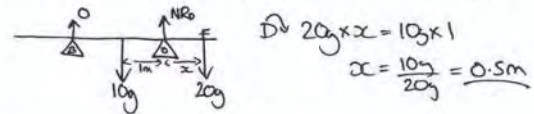
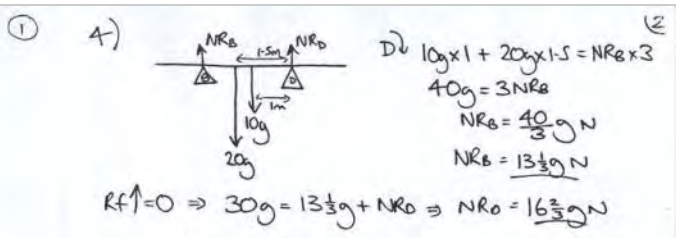
b)  $a \leftarrow \textcircled{2} \rightarrow 10 \quad R_F = ma \Rightarrow -10 = 2a \Rightarrow a = -5 \text{ ms}^{-2}$   
 $s = 1.6 \quad a = -5 \quad v = 0 \quad v^2 = u^2 + 2as \Rightarrow 0 = u^2 - 16 \Rightarrow u^2 = 16$   
 $\Rightarrow u = 4 \text{ ms}^{-1}$   
 $\textcircled{4} = \frac{1}{2}u \Rightarrow u = 20 \text{ ms}^{-1}$

6) Change =  $3i + 5j$  in 45 min  
 Vel = direction =  $\frac{3i - 1.5j}{0.75} = 4i - 2j \text{ km/h}$   
  
 bearing =  $90 + A = 90 + \tan^{-1}(\frac{2}{4})$   
 bearing =  $116.6^\circ$

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



$\frac{8}{7}g \leftarrow \textcircled{4} \rightarrow T \quad \vec{R}_F = ma \Rightarrow T - \frac{8}{7}g = 4a$   
 $T = 4.8 + \frac{8}{7}g$   
 $T = 16 \text{ N}$



b)  $R_F \uparrow = 0 \Rightarrow NR = 0.4g \cos 15 = 3.79 \text{ N}$   
 $f_{\max} = \mu NR = 0.2 \times 3.79 = 0.757 \text{ N}$   
 $R_F \uparrow = 0 \Rightarrow T + 0.757 = 0.4g \sin 15$   
 $T = 0.257 \text{ N}$

b)  $R_F \uparrow = ma \Rightarrow 0.4g \sin 15 - f_{\max} = 0.4a$   
 $0.257 = 0.4a \Rightarrow a = 0.643$   
 $a = 0.643 \quad u = 0 \quad s = 50$   
 $s = ut + \frac{1}{2}at^2 \Rightarrow 50 = \frac{1}{2}(0.643)t^2 \Rightarrow t^2 = 155.47$   
 $t = 12.5 \text{ sec}$

d) after 7 sec  $u = 0 \quad t = 7 \quad a = 1.2$   
 $V = u + at \Rightarrow V = 0 + 1.2 \times 7 = 8.4 \text{ ms}^{-1}$   
 e)  $\frac{12}{7}g \leftarrow \textcircled{6} \rightarrow 40 \quad \vec{R}_F = ma \Rightarrow 40 - \frac{12}{7}g = 6a$   
 $\Rightarrow a = 3.86 \text{ ms}^{-2}$   
 $u = 8.4 \quad a = 3.86 \quad t = 3$   
 $V = u + at \Rightarrow V = 8.4 + 3.86 \times 3 \Rightarrow V = 20 \text{ ms}^{-1}$

\* d)  $u = 8.4 \quad v = 0$   
  
 $\vec{R}_F = ma \Rightarrow -\frac{8}{7}g = 4a \Rightarrow a = -2.8 \text{ ms}^{-2}$   
 $V = u + at \Rightarrow 0 = 8.4 - 2.8(t)$   
 $t = \frac{8.4}{2.8} = 3 \text{ sec}$