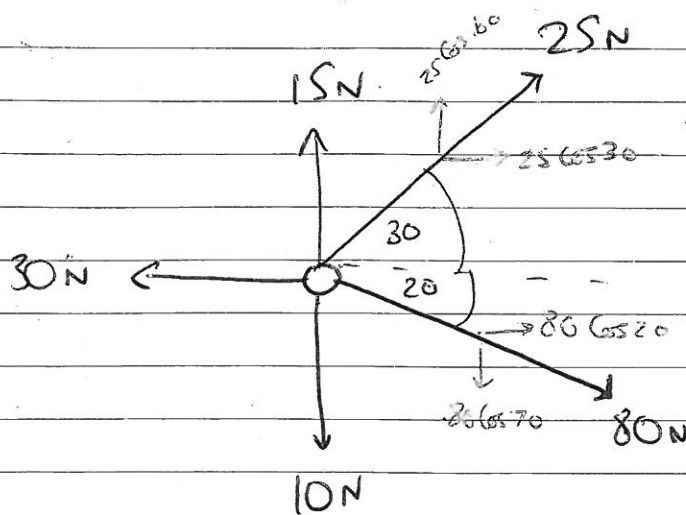


c)



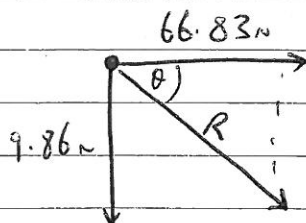
- (i) calculate resultant force & direction to horizontal.
 (ii) IF particle has mass 5kg calculate acceleration.

HOR $\leftarrow = \rightarrow$

$$\begin{aligned}
 30 &= 25 \cos 30 + 80 \cos 20 \\
 30 &= 21.65 + 75.18 \\
 30 &= 96.83 \\
 &= 66.83 \text{ N} \quad \rightarrow
 \end{aligned}$$

VER $\uparrow = \downarrow$

$$\begin{aligned}
 15 + 25 \sin 30 &= 10 + 80 \sin 20 \\
 15 + 12.5 &= 10 + 27.36 \\
 27.5 &= 37.36 \\
 &= 9.86 \text{ N} \quad \downarrow
 \end{aligned}$$



$$\begin{aligned}
 R^2 &= 66.83^2 + 9.86^2 \\
 R^2 &= 4466.25 + 97.22 \\
 R^2 &= 4563.47 \\
 R &= 67.55 \text{ N}
 \end{aligned}$$

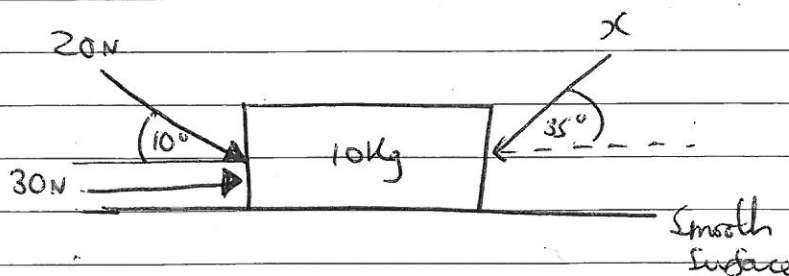
$$\tan \theta = \frac{9.86}{66.83}$$

$$\theta = \tan^{-1} \left(\frac{9.86}{66.83} \right)$$

$$\theta = 8.39^\circ \text{ below Hor.}$$



Q)



- (i) Calculate force x to keep in equilibrium.
- (ii) If the 20N & 30N is taken away, calculate the block's accel. along the surface.

(i) $\leftarrow = \rightarrow$

$$x \cos 35 = 20 \cos 10 + 30$$

$$0.82x = 19.70 + 30$$

$$0.82x = 49.70$$

$$x = 60.61 \text{ N}$$

(ii) $\leftarrow$
 $F = ma$

$$x \cos 35 = 10a$$

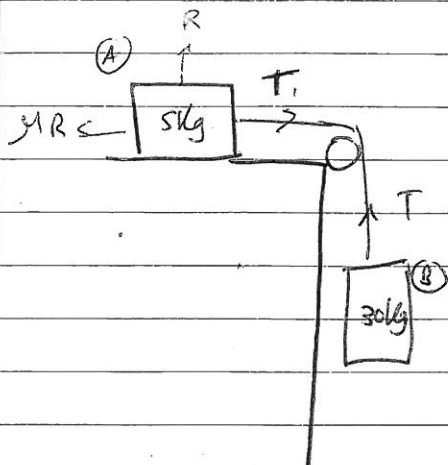
$$60.61 \cos 35 = 10a$$

$$49.65 = 10a$$

$$4.97 \text{ ms}^{-2} = a$$

$$\mu = 0.1$$

Q)



Calculate tension & accel.

$$\textcircled{A} \quad \uparrow = \downarrow$$

$$R = 5g$$

$$\therefore MR = 0.1(5g)$$

$$MR = 4.91$$

$$\underline{F = ma}$$

$$\textcircled{A} \quad T - 4.91 = 5a \quad \textcircled{1}$$

$$\textcircled{B} \quad 30g - T = 30a \quad \textcircled{2}$$

$$30g - 4.91 = 35a$$

$$289.39 = 35a$$

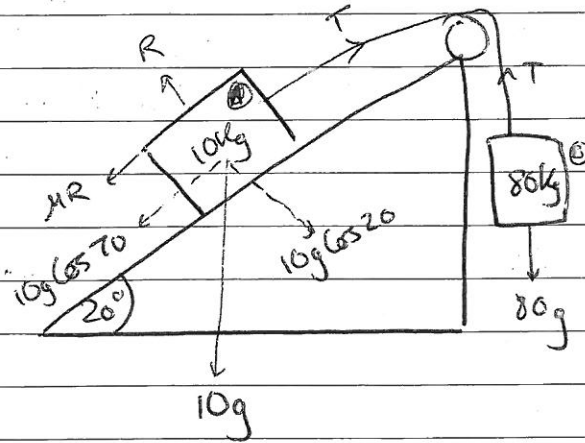
$$8.27 \text{ ms}^{-2} = a \rightarrow \ddot{u} \quad \textcircled{i}$$

$$T - 4.91 = 5(8.27)$$

$$T - 4.91 = 41.35$$

$$T = 46.26 \text{ N}$$

a) $\mu = 0.2$



calculate tension & accel.

$$R = 10g \cos 20$$

$$R = 92.18 \text{ N}$$

$$\mu R = 0.2(92.18)$$

$$\mu R = 18.44$$

$$\underline{F = ma}$$

(A)

$$T - 10g \cos 70 - \overset{\mu R}{\downarrow} 18.44 = 10a$$

$$T - 33.55 - 18.44 = 10a$$

$$T - 51.99 = 10a \quad (1)$$

+

$$(B) \quad 80g - T = 80a \quad (2)$$

$$80g - 51.99 = 90a$$

$$732.81 = 90a$$

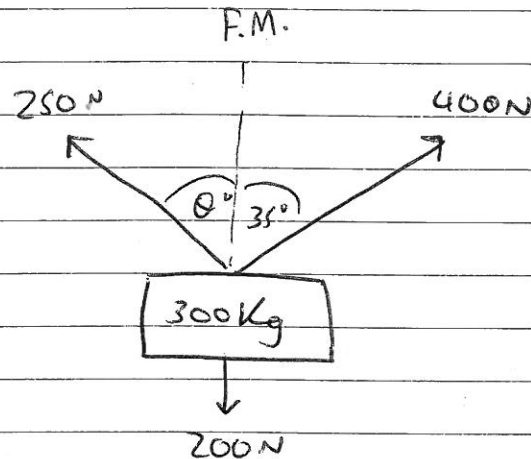
$$\boxed{8.14 \text{ ms}^{-2} = a} \rightarrow \text{in } (1)$$

$$T - 51.99 = 10(8.14)$$

$$T = 81.4 + 51.99$$

$$\boxed{T = 133.39 \text{ N}}$$

- a) Container is being pulled by 2 people, one 35° degrees east of forward motion, the other θ° West of forward motion. Resistance to motion is 200 N . Calculate θ & the accel. of the container.



In equilibrium $\leftarrow = \rightarrow$

$$\therefore 250 \cos(90 - \theta) = 400 \cos 35$$

$$250 \cos(90 - \theta) = 229.43$$

$$\cos(90 - \theta) = \frac{229.43}{250}$$

$$\cos(90 - \theta) = 0.92$$

$$90 - \theta = \cos^{-1}(0.92)$$

$$90 - \theta = 23.07$$

$$90 - 23.07 = \theta$$

$$\boxed{66.93^\circ = \theta}$$

$$F = ma$$

in direction
of motion:

$$250 \cos 66.93 + 400 \cos 35 - 200 = 300 a$$

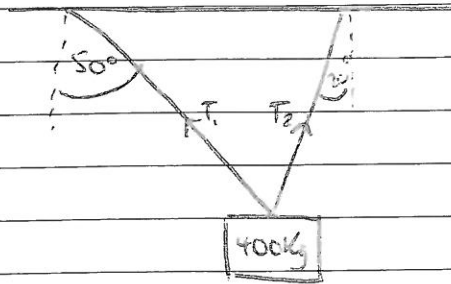
$$97.96 + 327.66 - 200 = 300 a$$

$$225.62 = 300 a$$

$$\boxed{0.75 \text{ ms}^{-2} = a}$$

Q)

Calculate tension in both ropes.



$$\uparrow = \downarrow$$

$$T_1 \cos 50 + T_2 \cos 20 = 400g$$

$$0.64T_1 + 0.94T_2 = 400g \quad (1)$$

$$\leftarrow = \rightarrow$$

$$T_1 \cos 40 = T_2 \cos 70$$

$$T_1 = \frac{T_2 \cos 70}{\cos 40}$$

$$T_1 = \frac{0.34T_2}{0.77}$$

$$(2) \quad T_1 = 0.44T_2 \rightarrow \text{in } (1)$$

$$0.164(0.44T_2) + 0.94T_2 = 400g$$

$$0.28 + 0.94T_2 = 400g$$

$$1.22T_2 = 400g$$

$$T_2 = \frac{400g}{1.22}$$

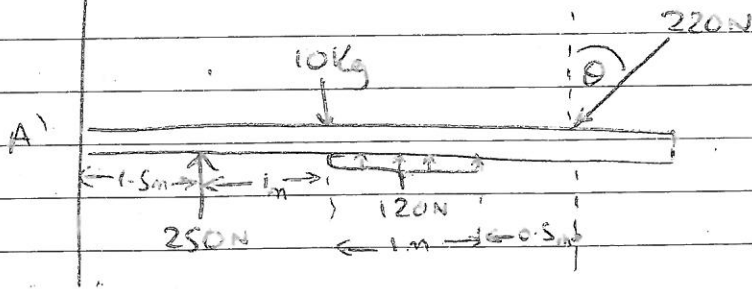
$$T_2 = 3216.4$$

$$T_2 = 3216.4 \times 9.81 = 31562.28 \text{ N}$$

$$T_1 = 0.44(3216.39)$$

$$T_1 = 1415.21 \text{ N}$$

(Q)



Calculate θ
to keep system
in equilibrium.

Moments about
A:

$$\sum M = 0$$

$$(10g \times 2.5) + (220 \cos \theta \times 4) = (250 \times 1) + (3 \times 120)$$

$$245.25 + 880 \cos \theta = 375 + 360$$

$$880 \cos \theta = 375 + 360 - 245.25$$

$$880 \cos \theta = 489.75$$

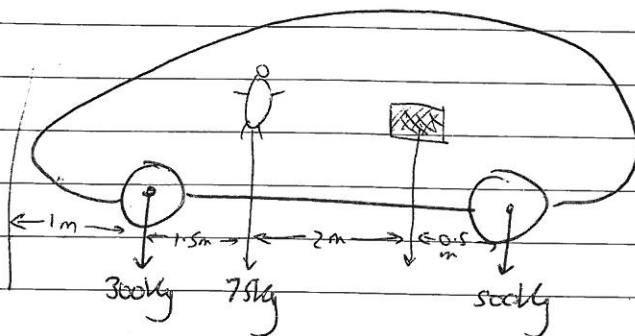
$$\cos \theta = \frac{489.75}{880}$$

$$\theta = \cos^{-1}(0.56)$$

$$\theta = 55.94^\circ$$

Calculate COG from nose:

(2)



Fuel 40 litres
@ 0.832 kg/l

$$P = \frac{m}{V}$$

~~$$P = \frac{m}{V}$$~~
$$PV = m$$

$$0.832(40) = m$$

$$33.28 = m \text{ (Fuel)}$$

$$\begin{aligned} \text{Sum masses} &= 300 + 75 + 33.28 + 500 \\ &= 908.28 \end{aligned}$$

$$\therefore \text{weight} = 908.28g$$

moments about nose:

$$(300g \times 1) + (75g \times 2.5) + (33.28g \times 4.5) + (500g \times 5) = 908.28g \times x$$

$$2943 + 1839.38 + 1469.15 + 24525 = 8910.23x$$

$$30776.53 = 8910.23x$$

$$3.45m = x$$