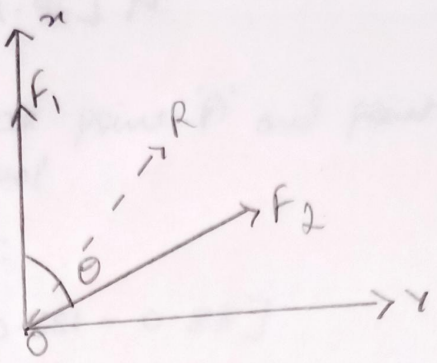
Q1>[PDF:



Resultant $R = 2000N$

$F_1 = 800N$

$F_2 = 1400N$

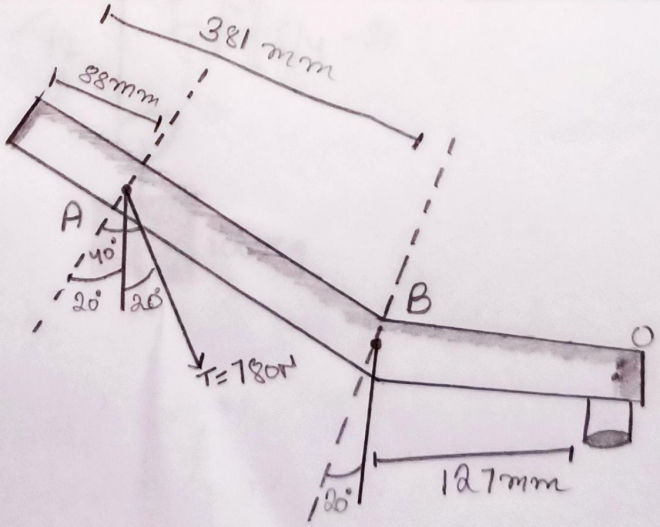
$R^2 = F_1^2 + F_2^2 + 2F_1F_2\cos\theta$ [∵ Resultant eqn.]

$\Rightarrow (2000)^2 = (800)^2 + (1400)^2 + 2(800)(1400)\cos\theta$

$\Rightarrow \cos\theta = 0.625$

$\Rightarrow$ $\underline{\theta = 51.32^\circ}$

Q2>[PDF:



$T = T\sin 20\,\hat{i} - T\cos\,\hat{j}$

$T = 266.775\,\hat{i} - 732.96\,\hat{j}$ N

The force at point 'A' and point 'B' will be equal

- Moment at 'B':

$M_B = T\sin 50°\,[0.381 - 0.83]$

$= 780\sin 50°\,[0.298]$

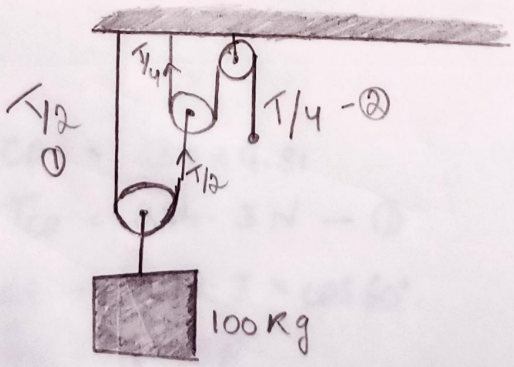
$= 178.059$ N·m CCW

- Moment at 'O':

$M_O = M_B + T\sin 50°\,[0.127]$

$= 253.94$ N·m CCW

Q3) [PDF:



The winch pulls the cable by 200 mm/s. Therefore velocity is constant.

Hence, $a = 0$

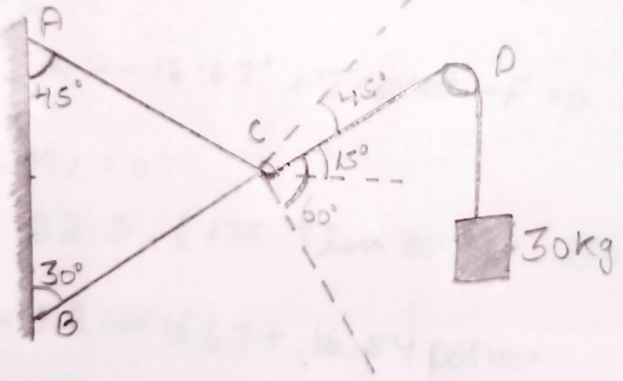
$T = 100 \times 9.81 = 981\,N$

Tension in cable ① is $T/4$

$\Rightarrow T_1 = T/4 = \frac{981}{4} = 245.25\,N$

$\Rightarrow$ Tension in cable is : 245.25 N

Q4) [PDF :



Tension in CD = 30×9.81

$T_{CD} = 294.3\,N$ — ①

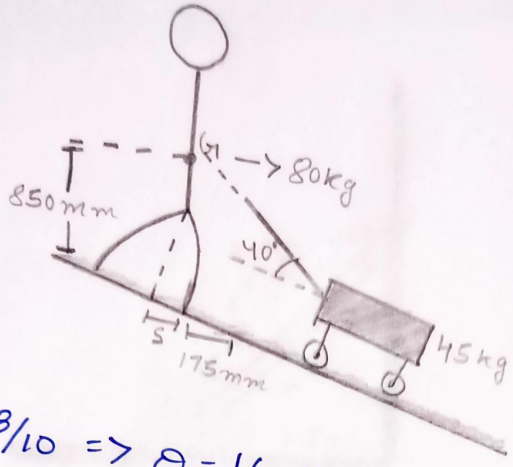
Tension in AC = $294.3 \times \cos 60°$

$T_{AC} = 147.15\,N$

Tension in BC = ~~293~~ $294.3 \times \cos 45°$

$T_{BC} = 208.101\,N$

Q5) [PDF :



$\tan\theta = 3/10 \Rightarrow \theta = 16.67°$

$+\uparrow \sum F_y = 0$:

$N - 82\cos 16.67 - T\sin 40° = 0$ — ①

$\xrightarrow{+} \sum F_x = 0$:

$82\sin 16.67° + T\cos 40° - F = 0$ — ②

$\circlearrowleft + \sum M_C = 0$:

$82 \cdot S - (175 \cdot T\sin 56.7°) - (850 \cdot T\cos 56.7°)$ — ③

$F = 82\cos 16.67 + 16.84\cos 40°$

$\Rightarrow F = 91.45\,kg$

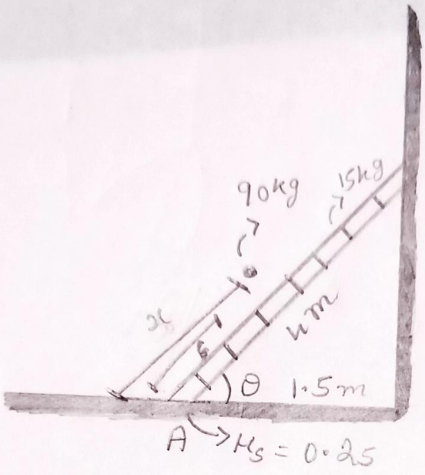
$\Rightarrow T = 16.84\,kg$

$\Rightarrow N = 36.41\,kg$

Therefore : $\mu = \frac{N}{F} = \frac{36.41}{91.46} = 0.39$

$\Rightarrow \underline{S = 124.06\,mm}$ [∵ from ③]

Q6> [PDF:



$+\uparrow \Sigma F_y = 0$:

$N_A - 90 \times 9.81 - 15 \times 9.81 = 0$

$\Rightarrow N_A = 1030.05\ N$

$\rightarrow 0.25(N_A)(3.71) - N_A(1.5) + 90(9.81)(x) + 15(9.81)(0.75) = 0$

$x = 0.543\ m$

$\Rightarrow d = 1.5 - x = 0.957\ m$

The ladder forms a triangle, Thus:

$\cos\theta = \frac{4}{1.5} \Rightarrow S = d \cdot \cos\theta \Rightarrow S = (0.957)(4/1.5)$

$\Rightarrow \underline{S = 2.55\ m}$

S -> Minimum distance the man can down.