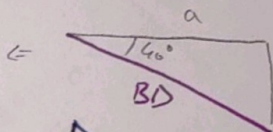
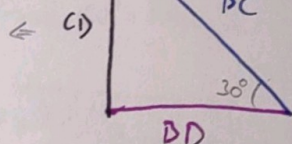


eg 32a) Two ropes are attached to the end of the rod. $F = 2500 \text{ N}$ - z direction
Define the inner forces in the ropes

$$BD = \frac{a}{\cos 40^\circ}$$



$$BC = \frac{BD}{\cos 30^\circ}$$



$$CD = BC = \frac{CD}{\sin 30^\circ}$$

- waste of time

$$\begin{aligned} \rightarrow \sum F_x = 0: & F_B \cos 30^\circ \cos 40^\circ - F_A \cos 60^\circ = 0 \\ + \uparrow \sum F_y = 0: & 0 \\ \leftarrow \sum F_z = 0: & F_B \cos 30^\circ \sin 40^\circ - F = 0 \end{aligned}$$

$$F_{BD} = F_B \cos 30^\circ$$

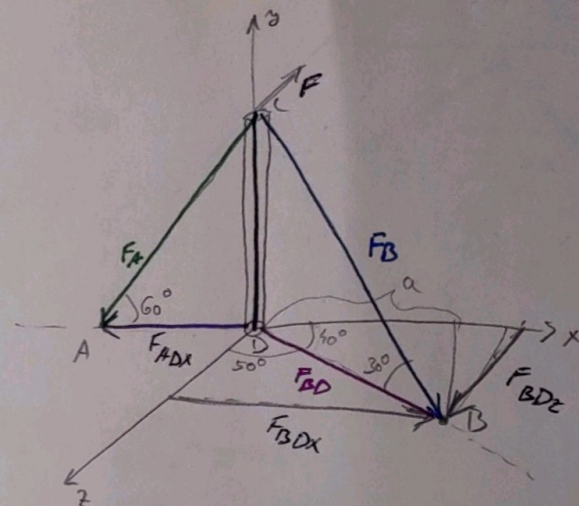
$$F_{BDx} = F_B \cos 30^\circ \cos 40^\circ$$

$$F_{ADx} = F_A \cos 60^\circ$$

$$F_{BDe} = F_B \cos 30^\circ \sin 40^\circ$$

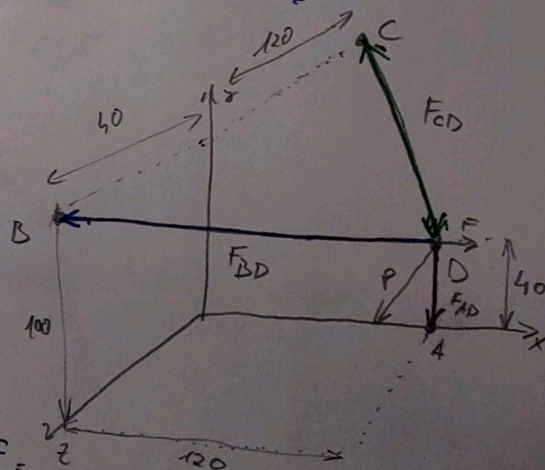
$$F_B = \frac{2500}{\cos 30^\circ \sin 40^\circ} = 4491 \text{ N}$$

$$F_A = \frac{F_B \cos 30^\circ \cos 40^\circ}{\cos 60^\circ} = \frac{4491 \cdot \cos 30^\circ \cos 40^\circ}{\cos 60^\circ} = 5959 \text{ N}$$



eg 32) Define the inner forces of the ropes on point D. $P = 150 \text{ N}$, $F = 350 \text{ N}$

	F_{AD}	F_{BD}	F_{CD}	F	P
d_x	0	-120	-120	350	-
d_y	40	60	60	-	-
d_z	0	40	40	-	150
d	40	140	180	-	-



$$d = \sqrt{d_x^2 + d_y^2 + d_z^2}$$

$$\begin{aligned} \sum F_x = 0: & F_{BD} \frac{-120}{140} + F_{CD} \frac{-120}{180} + F = 0 \\ \uparrow \sum F_y = 0: & F_{BD} \frac{40}{140} + F_{CD} \frac{40}{180} + F_{AD} \frac{40}{40} = 0 \\ \leftarrow \sum F_z = 0: & F_{BD} \frac{40}{140} + F_{CD} \frac{-120}{180} + P = 0 \end{aligned}$$

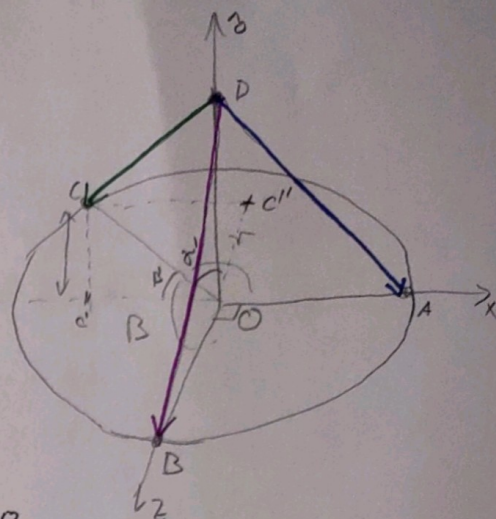
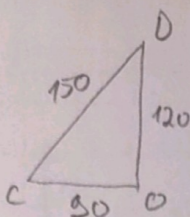
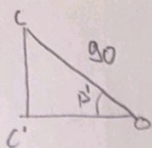
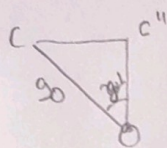
$$\left(\frac{2}{7} F_{BD} + 150 \right) \frac{2}{3} = F_{CD}$$

$$F_{CD} = \left(F_{BD} \frac{4}{7} + 150 \right) \frac{3}{2}$$

$$F_{CD} = 300 \text{ N}$$

$$-\frac{6}{7} F_{BD} - \frac{2}{7} F_{BD} + 500 = 0 \Rightarrow F_{BD} = 175 \text{ N} \rightarrow F_{AD} = 175 \text{ N}$$

eg 37) Weight is 600N; $d = 180 \text{ mm}$; $L_{\text{rope}} = 150 \text{ mm}$
Define inner forces



$$CC'' = \cos r' \cdot 90 = \cos 30 \cdot 90$$

$$CC' = \sin B' \cdot 100 = \sin 60 \cdot 90$$

$$CC'' = 78 \text{ mm} \quad 45 \text{ mm} \quad CC' = 78 \text{ mm}$$

	F_{AD}	F_{BD}	F_{CD}	F
d_x	90	0	-78	-
d_y	-120	-120	-120	600N
d_z	0	90	-45	-
d	150	150	150	-

$$\rightarrow \sum F_x = 0: \frac{90}{150} F_{AD} - \frac{78}{150} F_{CD} = 0$$

$$\uparrow \sum F_y = 0: -\frac{120}{150} F_{AD} - \frac{120}{150} F_{BD} - \frac{120}{150} F_{CD} + 600 = 0$$

$$\downarrow \sum F_z = 0: \frac{90}{150} F_{BD} - \frac{45}{150} F_{CD} = 0$$

$$d = \sqrt{d_x^2 + d_y^2 + d_z^2}$$

$$F_{BD} = \frac{150 \cdot 45}{90 \cdot 150} F_{CD} = \frac{1}{2} F_{CD}$$

$$F_{AD} = \frac{78}{90} F_{CD}$$

$$-\frac{24}{5} \cdot \frac{78}{90} F_{CD} - \frac{4}{5} \cdot \frac{1}{2} F_{CD} - \frac{4}{5} F_{CD} = -600 \quad (\cdot (-1)) \quad \left(\frac{150}{150} \right)$$

$$+ 156 F_{CD} + 36 F_{CD} + 72 F_{CD} = 5400$$

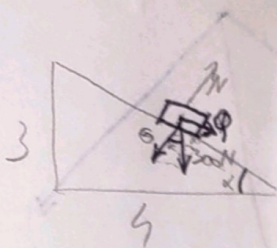
$$456 F_{CD} + 90 F_{CD} + 144 F_{CD} = 10800 \quad \cdot 1.350$$

$$F_{CD} = 277N \Rightarrow F_{BD} = 138.5N \Rightarrow F_{AD} = 210N$$

$$(156 + 90 + 180) F_{CD} = 125000$$

$$F_{CD} = 316.9N \Rightarrow F_{BD} = 158.5N \Rightarrow F_{AD} = 274.5N$$

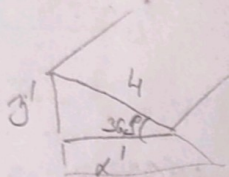
g3) Box B = 300N is supported by the plane and rope AB and force F. Define Hem



$$\alpha = 36,9^\circ$$

Q gets canceled by N

$$Q = \sin 36,9 \cdot 300 = \underline{180,1N}$$



$$x' = \cos 36,9 \cdot 4 = 3,2m$$

$$y' = \sin 36,9 \cdot 4 = 2,4m$$

	F_{AB}	Q	F
d_x	-3,2	0,8	0
d_y	4,4	-0,6	0
d_z	+3	0	-3
d	6,2	1	3

$$\rightarrow \sum F_x = 0: -\frac{3,2}{6,2} F_{AB} + \frac{0,8}{1} Q = 0$$

$$\uparrow \sum F_y = 0: \frac{4,4}{6,2} F_{AB} - \frac{0,6}{1} Q = 0$$

