Jämvikt 2-dim

Föreläsning3

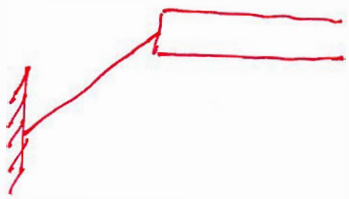
Villkor: $\boxed{\Sigma \bar{F} = 0}$ $R = 0$ Krafter

ΣF_x

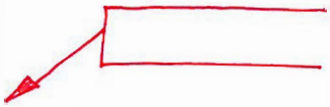
ΣF_y

$\boxed{\Sigma M = 0}$

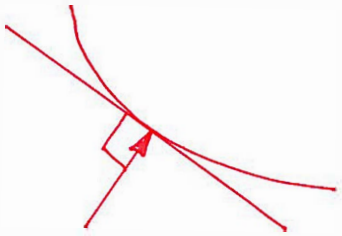
Symboler

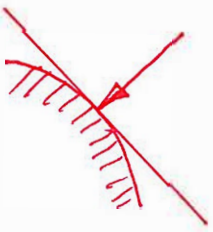


Kraft i linans riktning



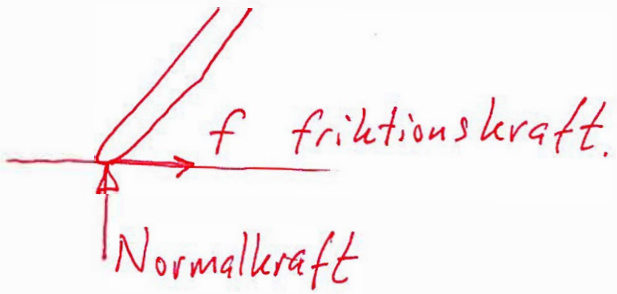
Glatt Kontaktyta





Normalkraft

Strav yta



Glidled

Vridled (gängjärn)

Fast inspänning

Beräkningsgång:

1) Vad är givet

Sökt inför symboler

2) Frilägg och sätt ut krafter (alla)

moment

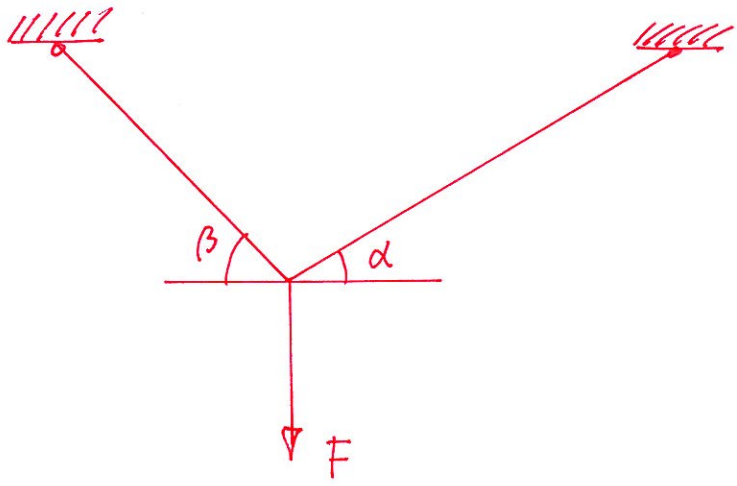
Koordinat system

3) Jämvikts ekvationerna: Lika många som obekanta. (välställt)

4) Lösning

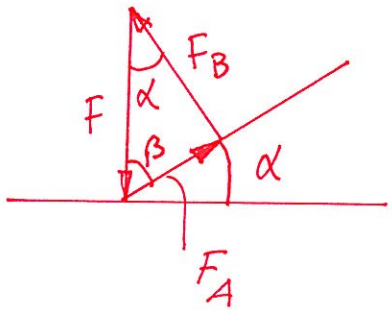
5) Kontrollera svaret rimligt?

Ex) 1



3 krafter i jämvikt ⇒ verkningslinjerna skär varandra i en punkt.

a)

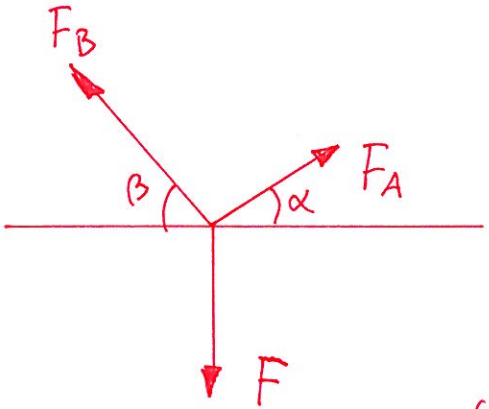


Kraftpolygon Sluten

$F_A = F \cdot \sin\alpha$

$F_B = F \cdot \cos\alpha$

b)



$\rightarrow: F_A \cdot \cos\alpha - F_B \cdot \cos\beta = 0$ (I)

$\uparrow: F_A \cdot \sin\alpha + F_B \sin\beta - F = 0$

ur (I) $\Rightarrow F_B = \dfrac{F_A \cdot \cos\alpha}{\cos\beta}$ ins i 2

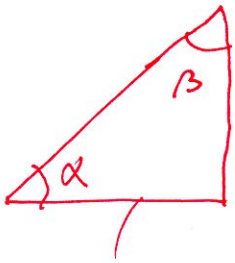
$$F_A \cdot \sin\alpha + F_A \frac{\cos\alpha}{\cos\beta} \cdot \sin\beta = F$$

$$F_A = \frac{F}{\sin\alpha + \frac{\cos\alpha}{\cos\beta} \cdot \sin\beta} = \left[\text{Förl med } \cos\beta\right]$$

$$= \frac{F\cos\beta}{\sin\alpha \cdot \cos\beta + \cos\alpha \cdot \sin\beta} =$$

Ex)

$$= \frac{F \cdot \sin\alpha}{\underbrace{\sin^2\alpha + \cos^2\alpha}_{1}}$$



$c \sin\beta = c \cos\alpha$

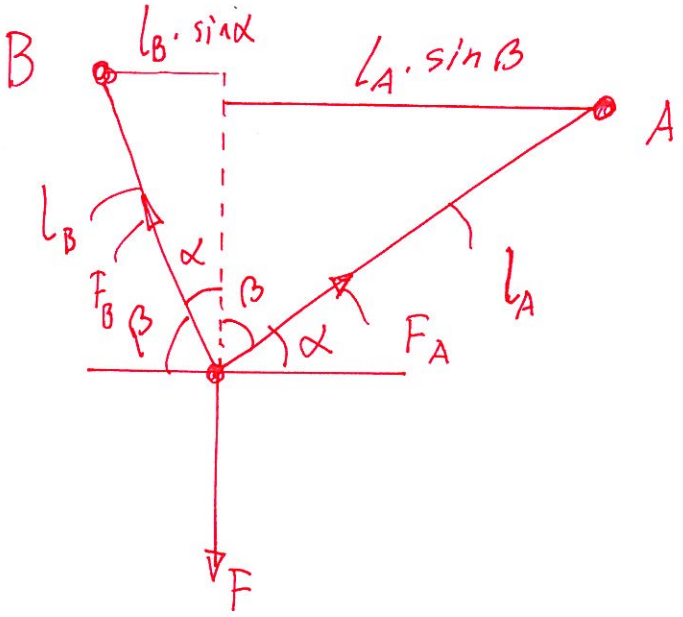
$$F_A = F \sin\alpha$$

$$F_B = \frac{F \sin\alpha \cdot \cos\alpha}{\cos\beta}$$

$$\left(\begin{array}{l} \sin\alpha = \cos\beta \\ \alpha + \beta = 90° \end{array}\right)$$

$$F_B = \frac{F \cdot \cancel{\sin\alpha} \cdot \cos\alpha}{\cancel{\sin\alpha}} = F \cdot \cos\alpha$$

c)



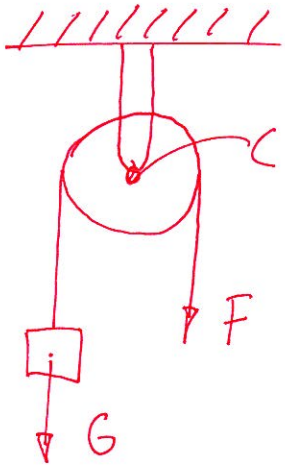
$$\curvearrowright A: \quad F_B \cdot l_A - F \cdot l_A \cdot \sin\beta = 0$$

$$F_B = F \cdot \sin\beta = \underline{F\cos\alpha}$$

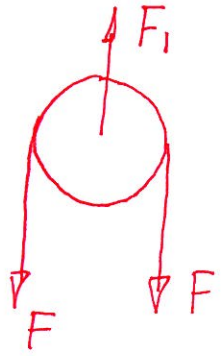
$$\curvearrowright B: \quad F \cdot l_B \cdot \sin\alpha - F_A \cdot l_B = 0$$

$$F_A = \underline{F \cdot \sin\alpha}$$

Ex 2 | Block



$F = G$

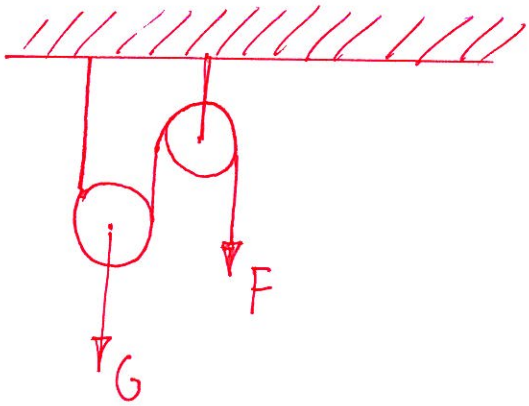


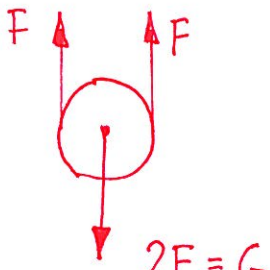
$\circlearrowright_C : F \cdot R - G \cdot R = 0$

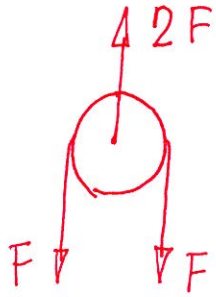
$F = G$

$\uparrow : F_1 - 2F = 0$

$F_1 = 2F$

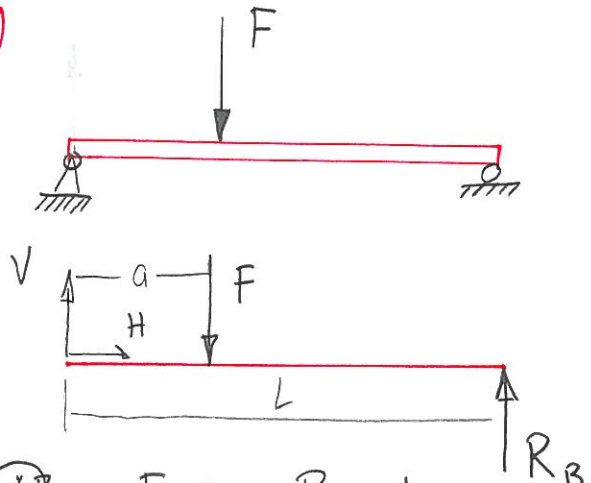






/

Ex 3)



$\curvearrowright A$: $F \cdot a - R_B \cdot L = 0$

$$R_B = \frac{F \cdot a}{L}$$

$\rightarrow$: $H = 0$

$\uparrow$: $V - F + R_B = 0$

$$V = R_A = F - R_B = F - \frac{F \cdot a}{L} = \frac{F \cdot L - F \cdot a}{L} = \frac{F(L-a)}{L}$$

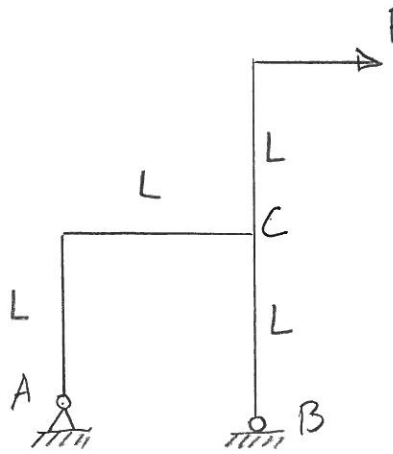
Kontroll: $\curvearrowright B$ $V \cdot L - F \cdot (L-a) = 0$

$$V = \frac{F \cdot (L-a)}{L}$$ OK!

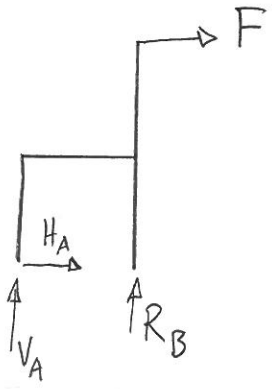
Ex 4)

Givet : F och L

Sök : R_A R_B, M_C



Frilägg



$\curvearrowright A$: $F \cdot 2L - R_B \cdot L = 0$

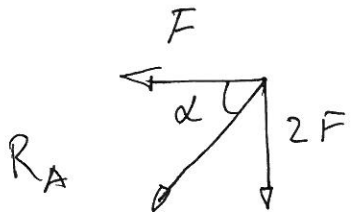
$R_B = \frac{F \cdot 2L}{L} = 2F$

$\rightarrow$: $H_A + F = 0$

$H_A = -F$ (åt vänster)

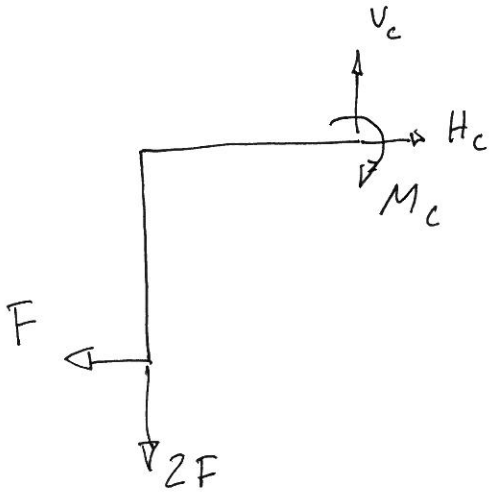
$\uparrow$: $V_A + R_B = 0$

$V_A = -R_B = -2F$ (neråt)



$R_A = \sqrt{F^2 + 2F^2} = \sqrt{5F^2} = \sqrt{5} \cdot F$

$\tan \alpha = \frac{2F}{F} = 2$



$\rightarrow$ $H_c - F = 0$

$H_c = F$

$\uparrow$: $V_c - 2F = 0$

$V_c = 2F$

$\curvearrowright C$: $M_c + F \cdot L - 2 \cdot F \cdot L = 0$

$M_c = F \cdot L$