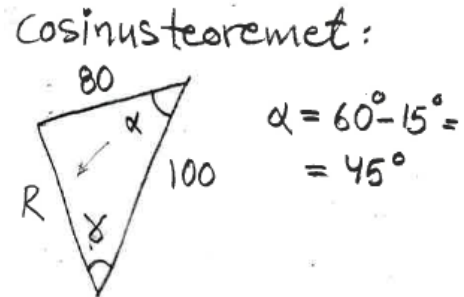
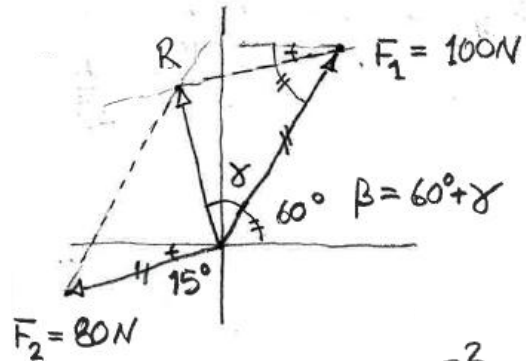


# Sp1: Lösning uppgift 1

a) Vektor addition - parallelogramlagen vs komposant uppdelning



$$R^2 = 100^2 + 80^2 - 2 \cdot 100 \cdot 80 \cdot \cos 45^\circ$$

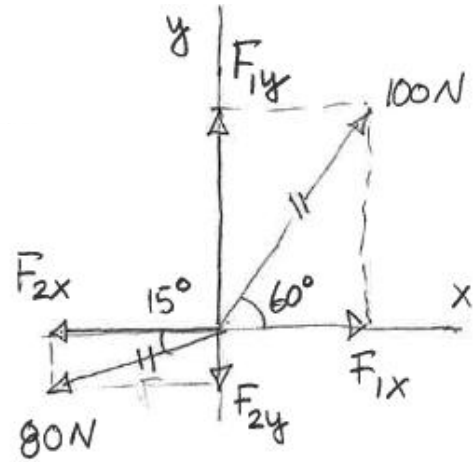
$$\Rightarrow R = \underline{71 \text{ N}}$$

sinusteoremet:

$$\frac{80}{\sin \gamma} = \frac{R}{\sin \alpha}; \quad \frac{\sin \gamma}{80} = \frac{\sin 45^\circ}{71}; \quad \sin \gamma = 80 \cdot \frac{1}{\sqrt{2}} \cdot \frac{1}{71}$$

$$\Rightarrow \gamma = 52^\circ \quad \Rightarrow \underline{\beta = 112^\circ}$$

b)

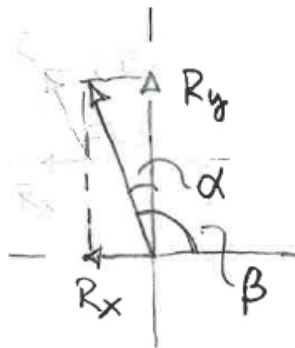


$$\rightarrow \begin{cases} F_{1x} = 100 \cos 60^\circ = 50 \text{ N} \\ F_{2x} = -80 \cos 15^\circ = -77 \text{ N} \end{cases}$$

$$\uparrow \begin{cases} F_{1y} = 100 \sin 60^\circ = 87 \text{ N} \\ F_{2y} = -80 \sin 15^\circ = -21 \text{ N} \end{cases}$$

$$R_x = 50 - 77 = -27 \text{ N}, \quad R_y = 66 \text{ N}$$

$$R = \sqrt{R_x^2 + R_y^2} = \sqrt{(-27)^2 + 66^2} = \underline{71 \text{ N}}$$

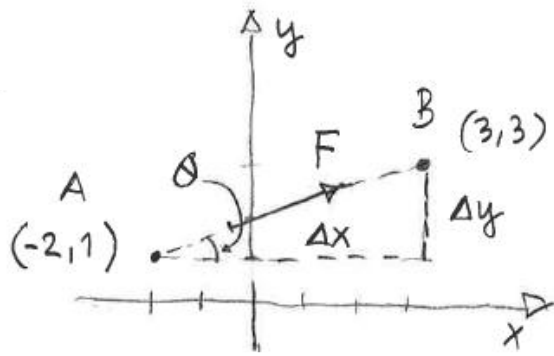


$$\tan \alpha = \frac{R_x}{R_y}; \quad \tan \alpha = \frac{27}{66}$$

$$\Rightarrow \alpha = 22^\circ \Rightarrow$$

$$\beta = 90 + 22 = 112^\circ$$

Sp1: Lösning uppgift 2



Geometri:

$$\begin{cases} \Delta x = 3 - (-2) = 5 \\ \Delta y = 3 - 1 = 2 \end{cases}$$

$$\tan \theta = \frac{\Delta y}{\Delta x} = \frac{2}{5} \Rightarrow$$

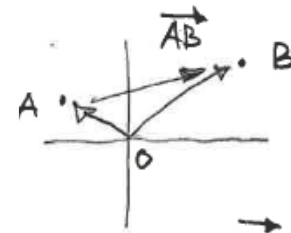
$$\theta = 21.80^\circ$$

$$\begin{cases} F_x = F \cos \theta = \underline{F \cdot 0.928} = 1485 \text{ N} \\ F_y = F \sin \theta = \underline{F \cdot 0.371} = 594 \text{ N} \end{cases}$$

Vektor form:  $\vec{F} = (F_x, F_y) = F \underbrace{(0.928, 0.371)}_{\vec{e}_{AB}}$

Alt.

Bestäm riktningsvektorn  $\vec{e}_{AB}$  först.



Geom. vektor:  $\vec{AB} = \vec{OB} - \vec{OA} =$   
 $= (3, 3) - (-2, 1) = (5, 2)$

$$\vec{e}_{AB} = \frac{\vec{AB}}{|\vec{AB}|} = \frac{(5, 2)}{\sqrt{5^2 + 2^2}} = \frac{1}{\sqrt{29}} \cdot (5, 2) = (0.928, 0.371)$$

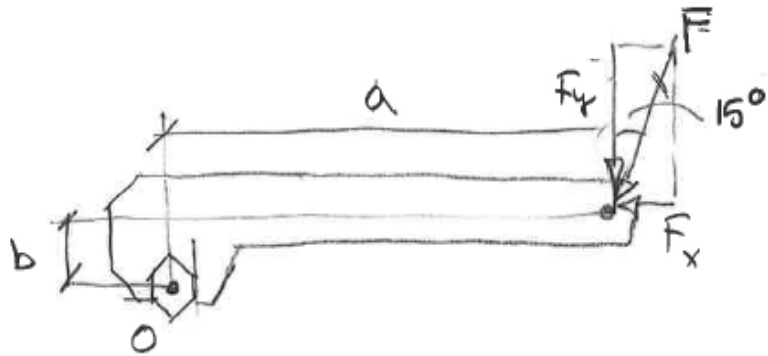
dim. lös

$$\vec{F} = F \cdot \vec{e}_{AB} = F(0.928, 0.371)$$

↑  
 L samma som ovan.

# Sp1: Lösning uppgift 3

Momentberäkning:



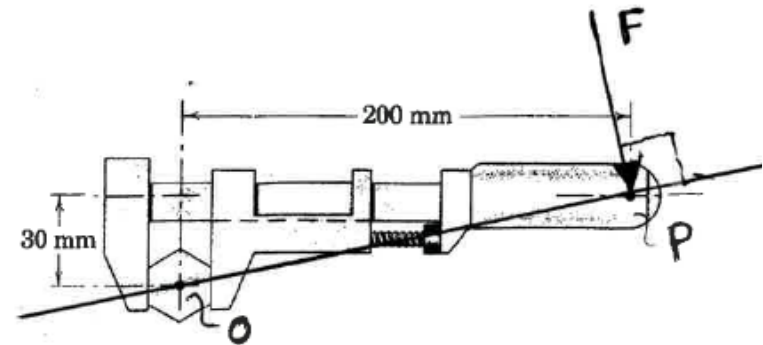
Komponent-  
uppdelning  
enklast

$$\begin{aligned} \curvearrow \quad F_y \cdot a - F_x \cdot b &= 250 \cos 15^\circ \cdot 0.2 - 250 \sin 15^\circ \cdot 0.03 \\ &= 241 \cdot 0.2 - 65 \cdot 0.03 = \underline{\underline{46 \text{ Nm}}} \end{aligned}$$

Extra:

Hur skall kraften riktas för att ge maximalt moment?

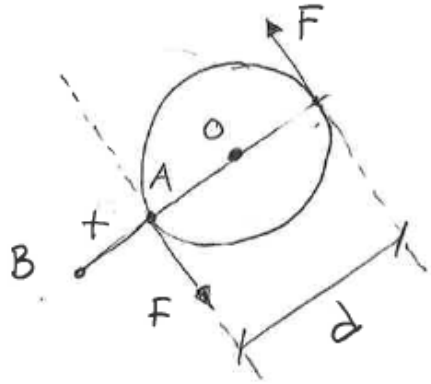
Maximalt moment - bästa ut-  
nyttjandet av kraften:



Kraften  $F$  skall vara vinkelrät  
mot linjen  $OP$

## Sp1: Lösning uppgift 4

Kraftpar - fritt moment eller rent moment:



$$F = 6\text{ N} \quad d = 0,4\text{ m}$$

Moment av två krafter  
med kraftsumman = 0

$$a) \quad \hat{O} \quad M = F \cdot \frac{d}{2} + F \cdot \frac{d}{2} = F \cdot d$$

$$b) \quad \hat{A} \quad M = F \cdot d$$

$$c) \quad \hat{B} \quad M = F(d+x) - F \cdot x = F \cdot d$$

Samma moment oavsett momentpunkt:

$$M = 6 \cdot 0,4 = \underline{\underline{2,4\text{ Nm}}}$$