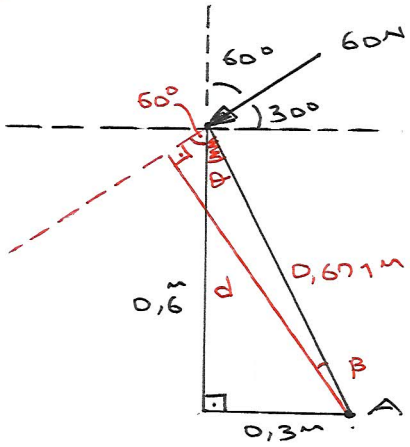
1- (i) Using the Resultant Force Given :

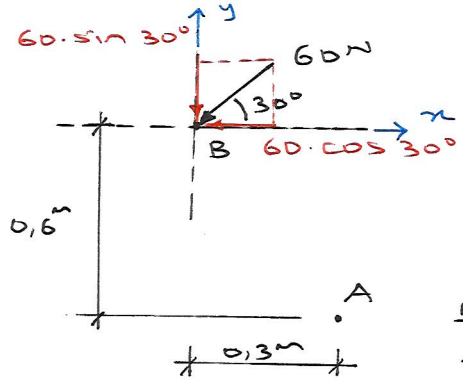


- $\theta = \tan^{-1}\left(\frac{0,3}{0,6}\right) = 26,56°$
- $\beta = 90 - \theta - 60 = 3,44°$
- $d = 0,671 \cdot \cos 3,44° = 0,67\,m$

$\Rightarrow M_A = 60^N \cdot 0,67^m = 40,187\ N\cdot m$

Answer : $M_A = 40\ N\cdot m$ ↺ (CCW)

(ii) Using the components :



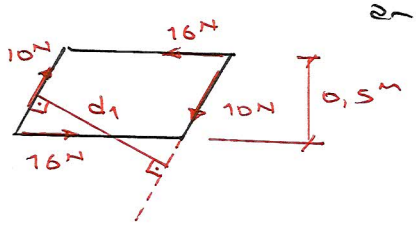
$\Rightarrow M_A = 60\cdot\cos 30 \cdot 0,6^m + 60\cdot\sin 30 \cdot 0,3$
$= 40,177\ N\cdot m$

Answer : $M_A = 40\ N\cdot m$ ↺ (CCW)

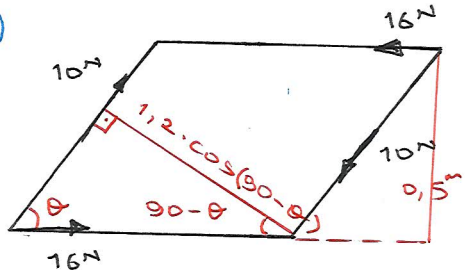
Note : components method is typically easier to apply.

2- (i) $M = 16^N \cdot 0,5^m = 8,0\ N\cdot m$ ↺ (CCW) (independent of any point)

(ii) $16^N \cdot 0,5 = 10^N \cdot d_1$
$\Rightarrow d_1 = 0,8\,m$



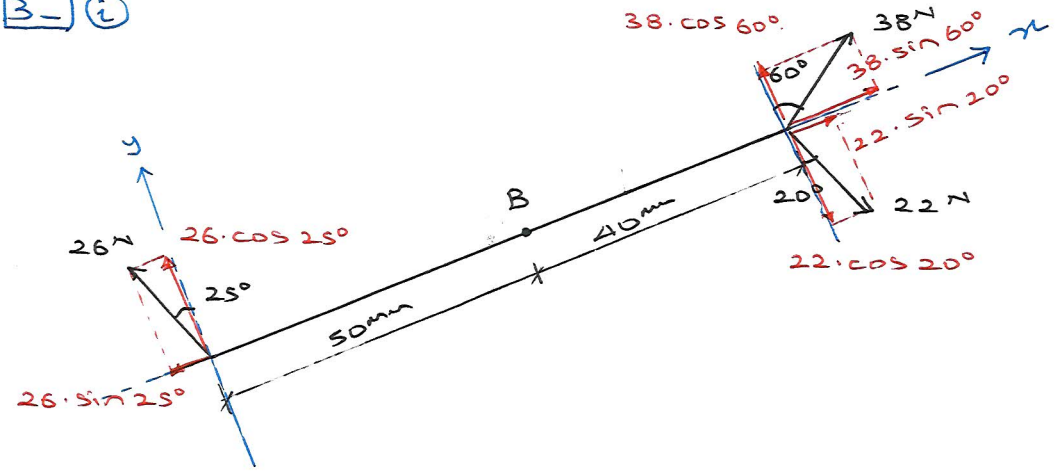
(iii)

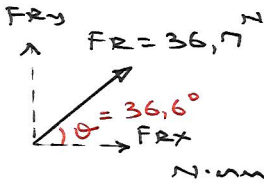


$\Rightarrow 10^N \cdot 1,2\cos(90-\theta)° - 16\cdot 0,5^m = 2,1\ N\cdot m$
$\Rightarrow \theta = 57,32°$

Answer : $\theta = 57°$

3- (i)

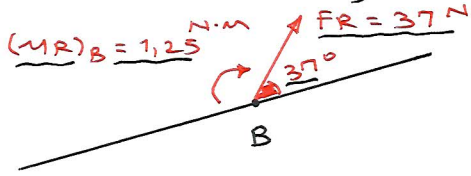




- $F_{Rx} = 38\sin 60° + 22\sin 20° - 26\sin 25° = 29,45\ N$
- $F_{Ry} = 38\cos 60° - 22\cos 20° + 26\cos 25° = 21,89\ N$
- $(M_R)_B = 38\cos 60°\cdot 40^{mm} - 22\cos 20°\cdot 40^{mm} - 26\cos 25°\cdot 50^{mm} = -1245,1\ N\cdot mm$

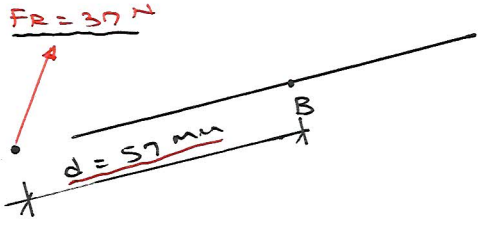
note: I selected x and y axes such that 3 components will not create moment. (only 3 components along y needed)

Answer:



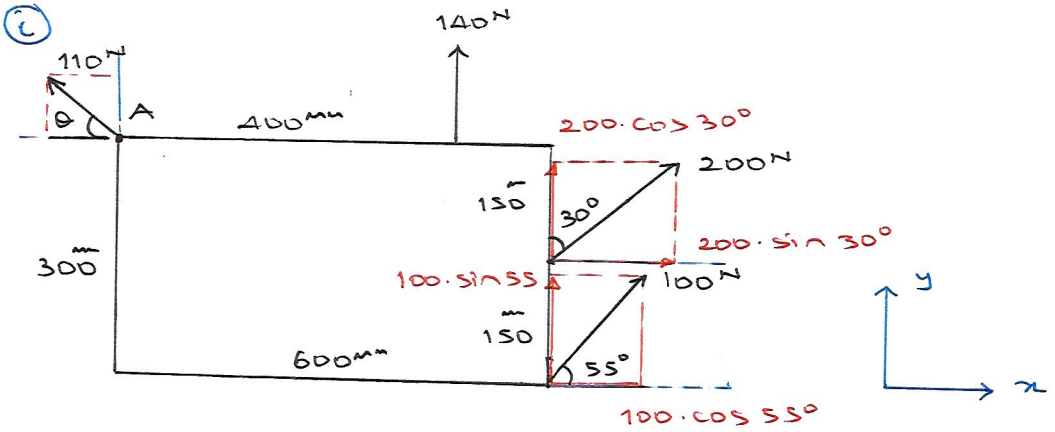
(ii) $(M_R)_B = F_{Ry}\cdot d \Rightarrow 1245,1\ N\cdot mm = 21,89^{N}\cdot d \Rightarrow d = 56,88^{mm}$

Answer:



note: to have $(M_R)_B$ CW, must place FR to the left of point B.

4- (i)

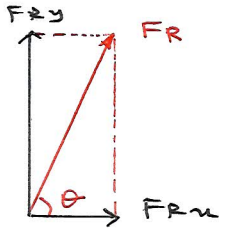


4 - i - cont'd

- $F_{Rx} = 200 \cdot \sin 30° + 100 \cdot \cos 55° - 110 \cdot \cos 30° = 62,1\ N \rightarrow$
- $F_{Ry} = 200 \cdot \cos 30° + 100 \cdot \sin 55° + 110 \cdot \sin 30° + 140 = 450,1\ N \uparrow$

$\Rightarrow F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} = 454,4\ N$

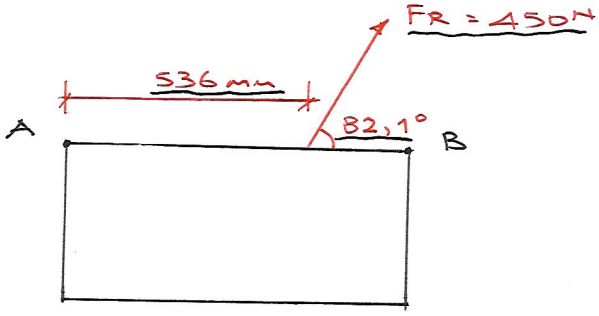
$\theta = \tan^{-1}(F_{Ry} / F_{Rx}) = 82,14°$



- $(M_R)_A = (200 \cdot \cos 30° + 100 \cdot \sin 55°) \cdot 600^{mm} + 140^{N} \cdot 400^{mm} + 200^{N} \cdot \sin 30° \cdot 150^{mm} + 100 \cdot \cos 55° \cdot 300^{mm} = 241\,279,46\ N \cdot mm$

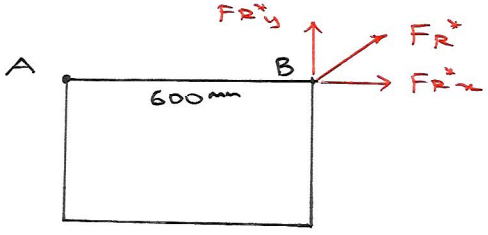
- $(M_R)_A = F_{Ry} \cdot d \Rightarrow 241\,279,46 = 450,1 \cdot d \Rightarrow d = 536,1\ mm$

Answer:



$F_R^* \neq F_R$

(ii) Changing θ will not change $(M_R)_A$. Find F_R^* at B to create the same $(M_R)_A$.



- $(M_R)_A = F_R^*{}_y \cdot 600\ mm$

$\Rightarrow F_R^*{}_y = 402,13\ N$

- In the original system, resultant vertical force must be equal to F_{Ry}^*.

- $200 \cos 30° + 100 \sin 55° + 140^{N} + 110 \cdot \sin\theta = F_{Ry}^* = 402,13^{N}$

$\Rightarrow \sin\theta = 0,06254 \Rightarrow \theta = 3,65°$

Answer: $\theta = 3,65°$

- note: F_{Rx}^* will not create any moment at A; therefore, we did not use it.