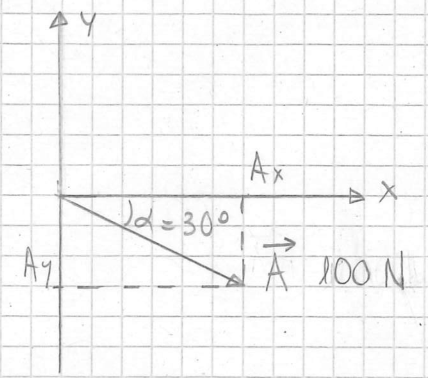
TB_SRM1 Correction Exercices Chapitre 1

Exercice 1

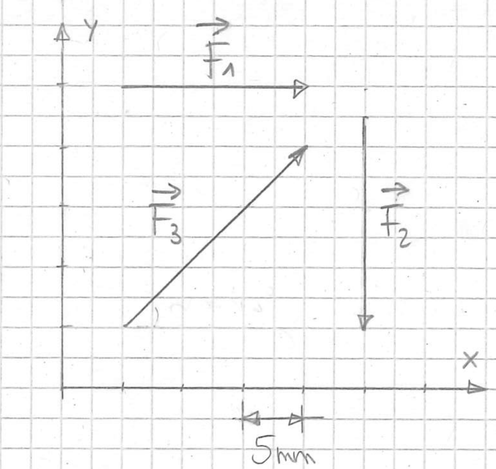


Composantes :

$A_x = \|\vec{A}\| \cos\alpha = 100 . \cos 30° = 86{,}60$ N

$A_y = -\|\vec{A}\| \sin\alpha = -100 . \sin 30° = -50$ N

Exercice 2



Modules des forces

$\vec{F_1}$: $\left.\begin{array}{l} F_{1x} = F_1 \\ F_{1y} = 0 \end{array}\right\}$ $\|\vec{F_1}\| = F_1 = 3.5.20 = 300$ N $= 30$ daN $= 0{,}30$ kN

$\vec{F_2}$: $\left.\begin{array}{l} F_{2x} = 0 \\ F_{2y} = -F_2 \end{array}\right\}$ $\|\vec{F_2}\| = F_2 = 3{,}5.5.20 = 350$ N $= 35$ daN $= 0{,}35$ kN

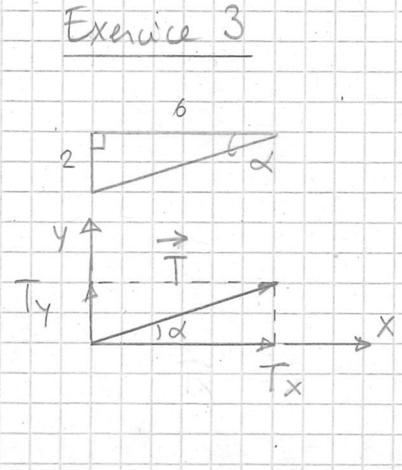
$\vec{F_3}$: $\left.\begin{array}{l} F_{3x} = 3.5.20 = 300\text{N} \\ F_{3y} = 3.5.20 = 300\text{N} \end{array}\right\}$ $\|\vec{F_3}\| = \sqrt{F_{3x}^2 + F_{3y}^2}$

$= \sqrt{300^2 + 300^2}$

$= 424{,}26$ N $= 42{,}43$ daN

$= 0{,}42$ kN

Exercice 3



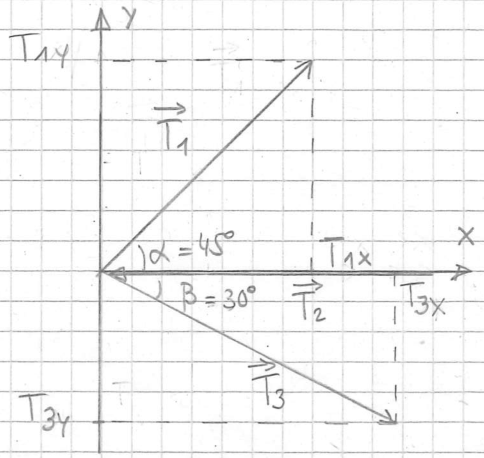
$\tan\alpha = \frac{2}{6} \Rightarrow \alpha = 18{,}43°$: angle d'application de $\vec{T}$

$T_x = \|\vec{T}\| . \cos\alpha \Rightarrow \|\vec{T}\| = \frac{T_x}{\cos\alpha} = \frac{90}{\cos 18{,}43°} = 94{,}86$ N

$T_y = \|\vec{T}\| . \sin\alpha \Rightarrow T_y = 94{,}86 . \sin 18{,}43° = 29{,}99$ N

Vérification : $\|\vec{T}\| = \sqrt{T_x^2 + T_y^2} = \sqrt{90^2 + 29{,}99^2} = 94{,}86$ N

Exercice 4



- $\vec{T_1}$: $T_{1x} = \|\vec{T_1}\| \cos \alpha = 200 . \cos 45° = 141,42 \text{ N}$

  $T_{1y} = T_{1x} = 141,42 \text{ N}$

- $\vec{T_3}$: $T_{3y} = -\|\vec{T_3}\| . \sin \beta \Rightarrow \|\vec{T_3}\| = \dfrac{-T_{3y}}{\sin \beta} = \dfrac{-(-100)}{\sin 30°} = 200 \text{ N}$

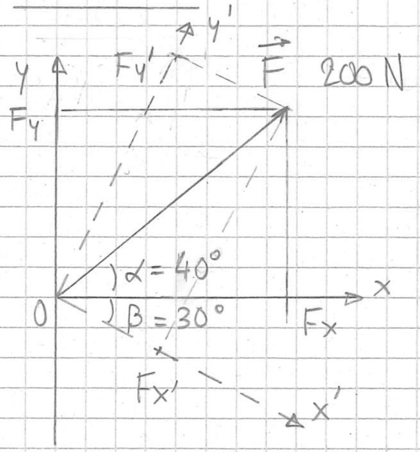
  $T_{3x} = \|\vec{T_3}\| . \cos \beta = 200 . \cos 30° = 173,21 \text{ N}$

- $\vec{T_2}$: $T_{1x} + T_{2x} + T_{3x} = 0$

  $\Rightarrow T_{2x} = -T_{1x} - T_{3x} = -141,42 - 173,21 = -314,63 \text{ N}$

  $\|\vec{T_2}\| = 314,63 \text{ N}$

Exercice 5



Repère $(0, x, y)$:

$F_x = \|\vec{F}\| . \cos \alpha = 200 . \cos 40° = 153,21 \text{ N}$

$F_y = \|\vec{F}\| . \sin \alpha = 200 . \sin 40° = 128,56 \text{ N}$

Repère $(0, x', y')$

$F_x' = \|\vec{F}\| . \cos(\alpha + \beta) = 200 . \cos 70° = 68,40 \text{ N}$

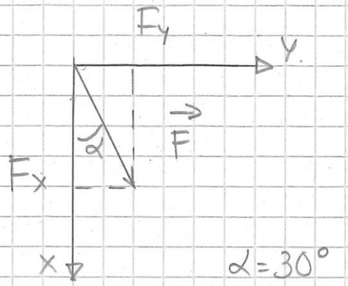
$F_y' = \|\vec{F}\| . \sin(\alpha + \beta) = 200 . \sin 70° = 187,94 \text{ N}$

Vérification :

$\|\vec{F}\| = \sqrt{F_x^2 + F_y^2} = \sqrt{153,21^2 + 128,56^2} = 200 \text{N}$

$= \sqrt{F_x'^2 + F_y'^2} = \sqrt{68,40^2 + 187,94^2} = 200 \text{N}$

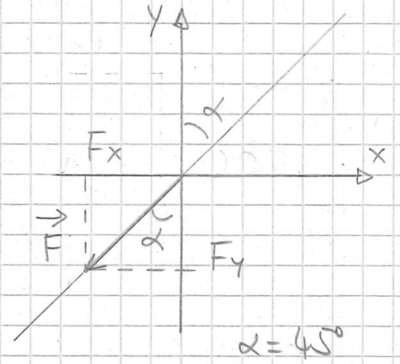
Exercice 6



Simplification notation : $F = \|\vec{F}\|$

$F_x = F.\cos\alpha = 1000.\cos 30° = 866{,}03\ N$

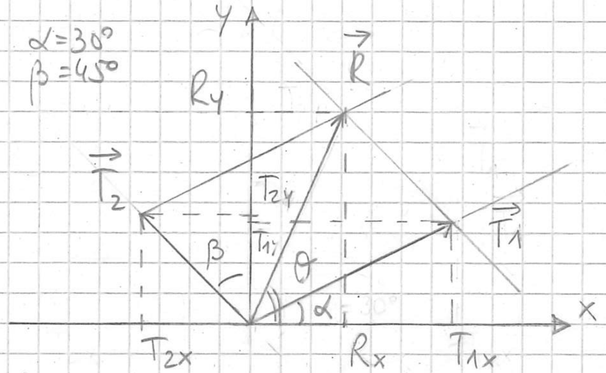
$F_y = F.\sin\alpha = 1000.\sin 30° = 500\ N$



$F_x = -F.\sin\alpha = -1000.\sin 45° = -707{,}11\ N$

$F_y = -F.\cos\alpha = -1000.\cos 45° = -707{,}11\ N$

Exercice 7



$\vec{T_1}\begin{cases} T_{1x} = T_1\cos\alpha = 60.\cos 30° = 51{,}96\ N \\ T_{1y} = T_1.\sin\alpha = 60.\sin 30° = 30\ N \end{cases}$

$\vec{T_2}\begin{cases} T_{2x} = -T_2.\sin\beta = -40.\sin 45° = -28{,}28\ N \\ T_{2y} = T_2.\cos\beta = 40.\cos 45° = 28{,}28\ N \end{cases}$

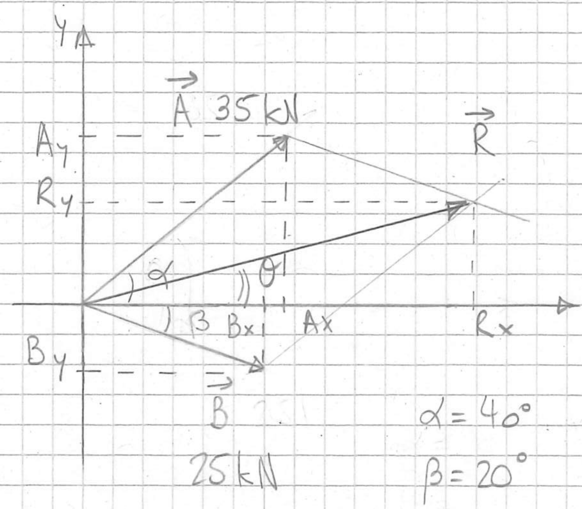
$\vec{R} = \vec{T_1} + \vec{T_2}$

$\vec{R}\begin{cases} R_x = T_{1x} + T_{2x} = T_1.\cos\alpha - T_2\sin\beta = 60.\cos 30° - 40\sin 45° = 51{,}96 - 28{,}28 = 23{,}68\ N \\ R_y = T_{1y} + T_{2y} = T_1\sin\alpha + T_2\cos\beta = 60.\sin 30° + 40.\cos 45° = 30 + 28{,}28 = 58{,}28\ N \end{cases}$

$\|\vec{R}\| = R = \sqrt{R_x^2 + R_y^2} = \sqrt{23{,}68^2 + 58{,}28^2} = 62{,}91\ N$

$\tan\theta = \dfrac{R_y}{R_x} = \dfrac{58{,}28}{23{,}68} \Rightarrow \theta = 67{,}9°$

Exercice 8



$\alpha = 40°$

$\beta = 20°$

$\vec{A} \begin{cases} A_x = A.\cos\alpha = 35 \cos 40° = 26{,}81 \text{ kN} \\ A_y = A.\sin\alpha = 35.\sin 40° = 22{,}50 \text{ kN} \end{cases}$

$\vec{B} \begin{cases} B_x = B.\cos\beta = 25.\cos 20° = 23{,}49 \text{ kN} \\ B_y = -B.\sin\beta = -25.\sin 20° = -8{,}55 \text{ kN} \end{cases}$

$\vec{R} = \vec{A} + \vec{B}$

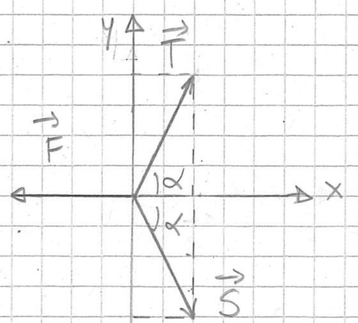
$\vec{R} \begin{cases} R_x = A_x + B_x = A\cos\alpha + B\cos\beta = 35.\cos 40° + 25.\cos 20° = 26{,}81 + 23{,}49 = 50{,}30 \text{ kN} \\ R_y = A_y + B_y = A\sin\alpha - B\cos\beta = 35.\sin 40° - 25.\sin 20° = 22{,}50 - 8{,}55 = 13{,}95 \text{ kN} \end{cases}$

$\|\vec{R}\| = R = \sqrt{R_x^2 + R_y^2} = \sqrt{50{,}30^2 + 13{,}95^2} = 52{,}20 \text{ kN}$

$\tan\theta = \frac{R_y}{R_x} = \frac{13{,}95}{50{,}30} \Rightarrow \theta = 15{,}5°$

Exercice 9.

a)



$\vec{F} \begin{cases} F_x = -F \\ F_y = 0 \end{cases}$ $\vec{T} \begin{cases} T_x = T\cos\alpha \\ T_y = T\sin\alpha \end{cases}$ $\vec{S} \begin{cases} S_x = S\cos\alpha \\ S_y = -S\sin\alpha \end{cases}$

avec $F = T = S = 50$ N

$\cos\alpha = \cos 60° = 1/2$

$\sin\alpha = \sin 60° = \sqrt{3}/2$

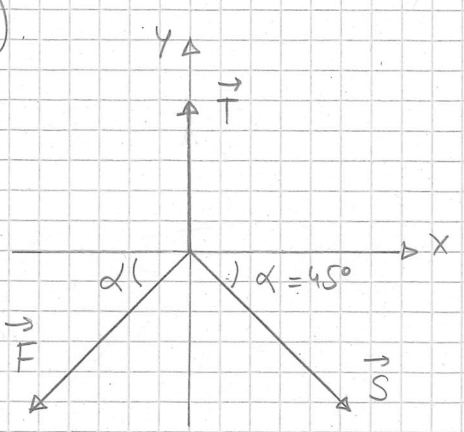
$\vec{R} = \vec{F} + \vec{T} + \vec{S}$

$\vec{R} \begin{cases} R_x = -F + T\cos\alpha + S\cos\alpha = -50 + 50\frac{1}{2} + 50\frac{1}{2} = 0 \\ R_y = 0 + T\sin\alpha - S\sin\alpha = 0 + 50\frac{\sqrt{3}}{2} - 50.\frac{\sqrt{3}}{2} = 0 \end{cases}$

$\Rightarrow$ système de forces en équilibre.

Exercice 9. (suite)

b)



$\vec{F} \begin{cases} F_x = -F\cos\alpha \\ F_y = -F\sin\alpha \end{cases}$ $\vec{T} \begin{cases} T_x = 0 \\ T_y = T \end{cases}$ $\vec{S} \begin{cases} S_x = S\cos\alpha \\ S_y = -S\sin\alpha \end{cases}$

avec $F = S = 60\ N$

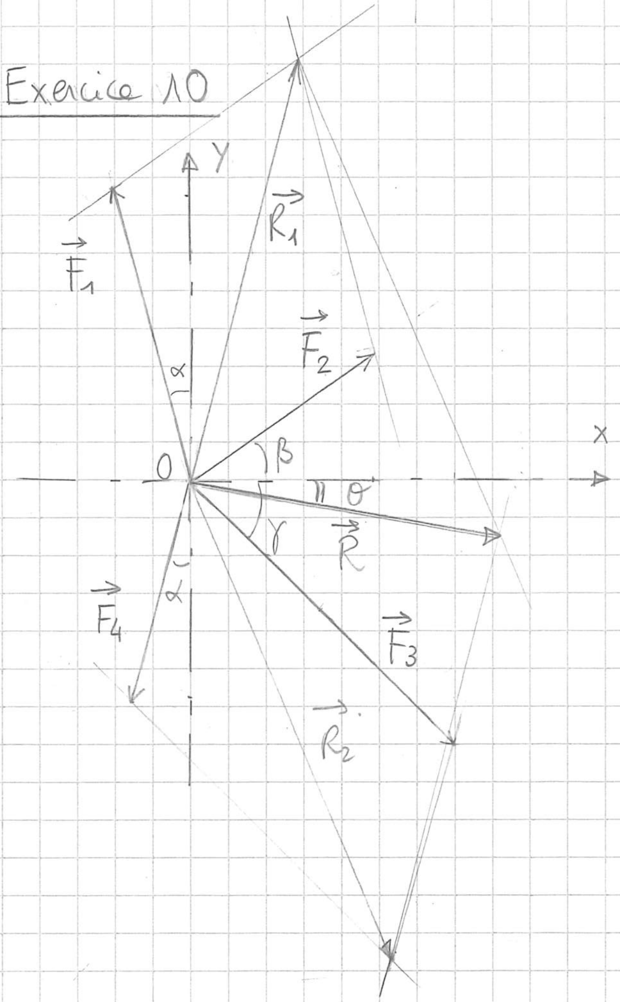
$T = 40\ N$

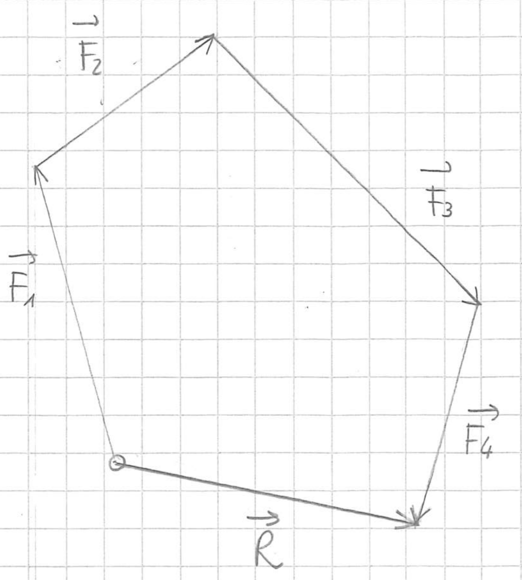
$\cos 45° = \sin 45° = \frac{\sqrt{2}}{2}$

$\vec{R} = \vec{F} + \vec{T} + \vec{S}$

$\vec{R} \begin{cases} R_x = -F\cos\alpha + 0 + S\cos\alpha = -60 . \frac{\sqrt{2}}{2} + 0 + 60 \frac{\sqrt{2}}{2} = 0\ N \\ R_y = -F\sin\alpha + T - S\sin\alpha = -60 . \frac{\sqrt{2}}{2} + 40 - 60 . \frac{\sqrt{2}}{2} = -44,85\ N \end{cases}$

Exercice 10





2) Méthode graphique - polygone des forces

1) Méthode graphique - parallélogrammes successifs : $\vec{R} = \vec{R_1} + \vec{R_2}$; $\vec{R_1} = \vec{F_1} + \vec{F_2}$ et $\vec{R_2} = \vec{F_3} + \vec{F_4}$

3) Méthode analytique :

$\vec{F_1} \begin{cases} F_{1x} = -F_1 . \sin\alpha \\ F_{1y} = F_1 . \cos\alpha \end{cases}$ $(\alpha = 35° + 70° - 90° = 15°)$

$\vec{F_2} \begin{cases} F_{2x} = F_2 . \cos\beta \\ F_{2y} = F_2 . \sin\beta \end{cases}$ $(\beta = 35°)$

$\vec{F_3} \begin{cases} F_{3x} = F_3 \cos\gamma \\ F_{3y} = -F_3 \sin\gamma \end{cases}$ $(\gamma = 45°)$

$\vec{F_4} \begin{cases} F_{4x} = -F_4 . \sin\alpha \\ F_{4y} = -F_4 . \cos\alpha \end{cases}$ $(\alpha = 45° + 60° - 90° = 15°)$

$\vec{R} \begin{cases} R_x = -F_1 \sin\alpha + F_2 . \cos\beta + F_3 \cos\gamma - F_4 \sin\alpha = 41{,}81 \text{ N} \\ R_y = F_1 \cos\alpha + F_2 \sin\beta - F_3 \sin\gamma - F_4 \cos\alpha = -8{,}48 \text{ N} \end{cases}$

$\|\vec{R}\| = \sqrt{R_x^2 + R_y^2} = \sqrt{41{,}81^2 + 8{,}48^2} = 42{,}66 \text{ N}$ | $\tan\theta = \dfrac{R_y}{R_x} = \dfrac{-8{,}48}{41{,}81} \rightarrow \theta = -11{,}5°$