Avaliação Contínua 1 - Mecânica Geral

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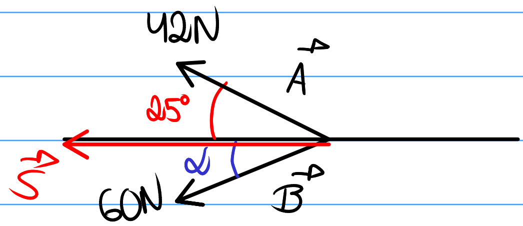
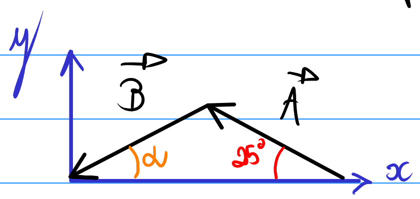
1)



a) Realizando por lei dos senos:



$$\frac{\operatorname{sen}\alpha}{A} = \frac{\operatorname{sen} 25^\circ}{B} \rightarrow$$

$$\operatorname{sen}\alpha = \frac{42 \cdot \operatorname{sen} 25^\circ}{60} \rightarrow \operatorname{sen}\alpha = 0{,}7 \operatorname{sen} 25^\circ \rightarrow$$

$$\operatorname{sen}\alpha = 0{,}2958 \rightarrow \alpha = \operatorname{arcsen}(0{,}2958) = 17{,}2055^\circ$$

b) Para encontrar a resultante, usa-se a regra do paralelogramo:

ângulo entre os vetores

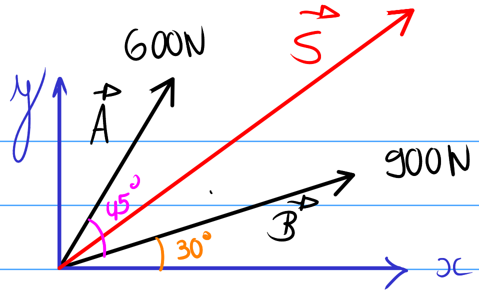
$$S^2 = A^2 + B^2 + 2AB\cos\theta \rightarrow$$

$$S^2 = (42)^2 + (60)^2 + 2(42)(60) \cdot \cos(25 + 17{,}2055) \rightarrow$$

$$S^2 = 5364 + 5040 \cdot \cos(42{,}2055) \rightarrow$$

$$S^2 = 9097{,}33 \rightarrow S = 95{,}3799\ N$$

2)



- Encontrando primeiramente o módulo de $\vec{S}$ (magnitude):

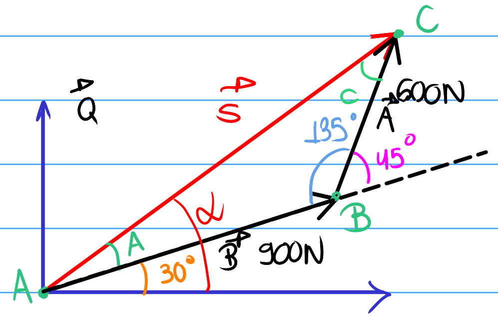
$$S^2 = A^2 + B^2 + 2AB\cos\theta \Rightarrow$$

$$S^2 = (600)^2 + (900)^2 + 2 \cdot 600 \cdot 900 \cdot \cos 45° \Rightarrow$$

$$S^2 = 1170000 + 763675{,}3 \Rightarrow$$

$$S = 1390{,}5665\ N$$

- Agora encontrando a direção α:



Por lei dos senos.

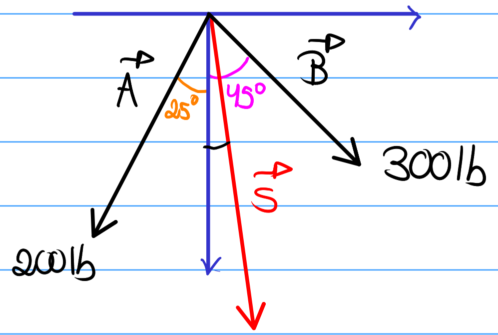
$$\frac{\operatorname{sen} A}{Q} = \frac{\operatorname{sen} B}{R} \Rightarrow \operatorname{sen} A = \frac{600 \cdot \operatorname{sen} 135°}{1390{,}5665} \Rightarrow$$

$$\operatorname{sen} A = \frac{424{,}2641}{1390{,}5665} \Rightarrow \operatorname{sen} A = 0{,}3051 \Rightarrow$$

$$A = \operatorname{arcsen}(0{,}3051) = 17{,}7643°$$

$$\therefore \alpha = A + 30 \Rightarrow \alpha = 47{,}7643°$$

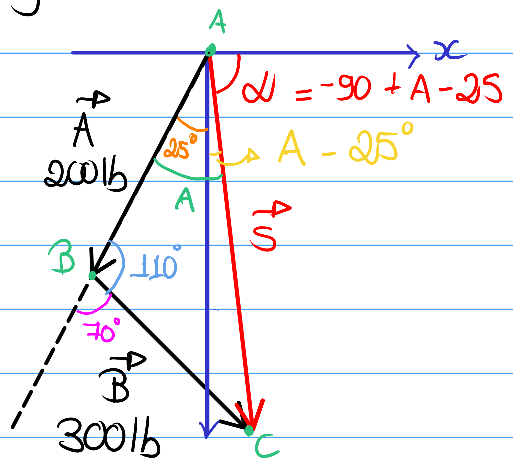
3)



- Encontrando primeiramente o módulo de $\vec{S}$ (magnitude):

$$S^2 = A^2 + B^2 + 2AB\cos\theta \rightarrow$$
$$S^2 = (200)^2 + (300)^2 + 2 \cdot 200 \cdot 300 \cdot \cos 70° \rightarrow$$
$$S^2 = 130000 + 41042{,}4172 \rightarrow$$
$$S^2 = 171{,}0424 \rightarrow \boxed{S = 413{,}5727 \text{ lb}}$$

- Agora encontrando a direção α:

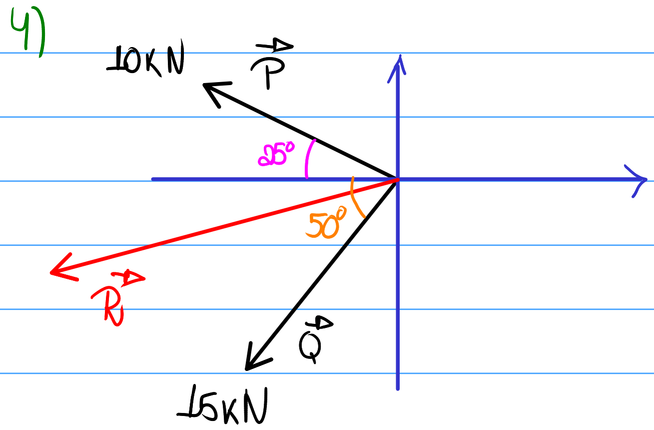


Por lei dos senos.

$$\frac{\operatorname{sen} A}{300} = \frac{\operatorname{sen} B}{413{,}5727} \rightarrow \operatorname{sen} A = 0{,}7254 \cdot \operatorname{sen} 110° \rightarrow$$
$$\operatorname{sen} A = 0{,}6817 \rightarrow A = \operatorname{arcsen}(0{,}6817) \rightarrow$$
$$A = 42{,}973°$$

$$\therefore \alpha = -90 + A - 25 \rightarrow \boxed{\alpha = -72{,}03°}$$

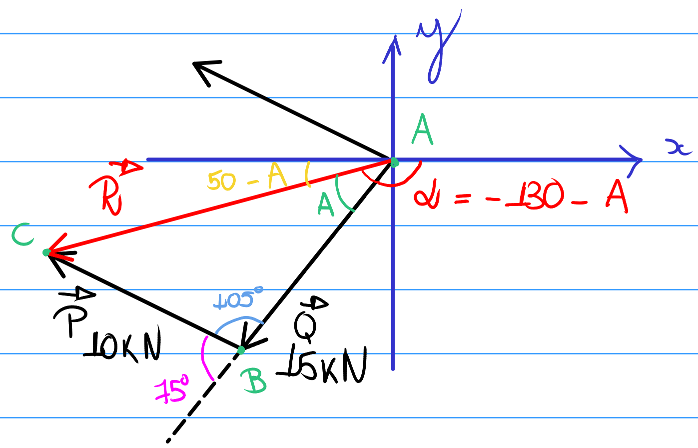
4)



- Encontrando primeiramente o módulo de $\vec{R}$ (magnitude):

$$R^2 = Q^2 + P^2 + 2PQ\cos\theta \rightarrow$$
$$R^2 = (15\cdot10^3)^2 + (10\cdot10^3)^2 + 2(15\cdot10^3)(10\cdot10^3)\cdot\cos 75° \rightarrow$$
$$R^2 = 325\cdot10^6 + 77{,}6457\cdot10^6 \rightarrow$$
$$\boxed{R = 20066{,}0338\ N}$$

- Agora encontrando a direção α:



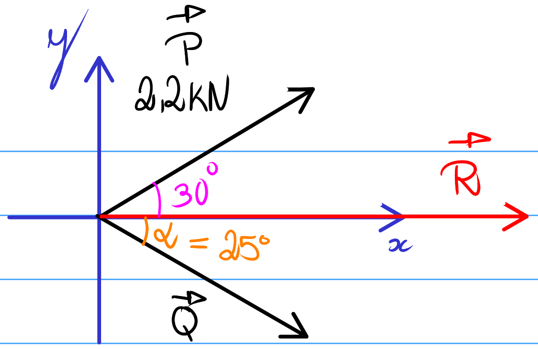
Utilizando lei dos senos.

$$\frac{\text{sen}\,A}{P} = \frac{\text{sen}\,B}{R} \rightarrow \text{sen}\,A = \frac{10k\cdot\text{sen}\,105°}{20066{,}0338} \rightarrow$$

$$\text{sen}\,A = 0{,}4814 \rightarrow A = 28{,}78°$$

$$\therefore \alpha = -130 - A \rightarrow \boxed{\alpha = -158{,}78°}$$

5)



$\operatorname{sen}\alpha = \dfrac{\vec{Q}_y}{Q}$

$\operatorname{sen}\alpha = \dfrac{\vec{P}_y}{\vec{P}}$

- Como a componente resultante é apenas na direção x, sabemos que $\vec{R}_y = 0$, então:

$$\vec{R}_y = |\vec{P}_y + \vec{Q}_y| \rightarrow 0 = 2{,}2K \cdot \operatorname{sen}30° + Q \cdot \operatorname{sen}(-25°) \rightarrow$$

$$Q = \left| \frac{2{,}2K \cdot \operatorname{sen}30°}{\operatorname{sen}(-25°)} \right| \rightarrow Q = 2{,}6028\ kN$$

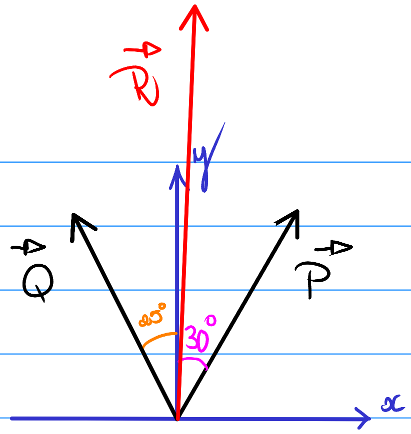
- Agora encontrando a $\vec{R}_x$:

$$\vec{R}_x = |\vec{P}_x + \vec{Q}_x| \rightarrow \vec{R}_x = |\vec{P}\cos 30° + \vec{Q}\cos(-25°)|$$

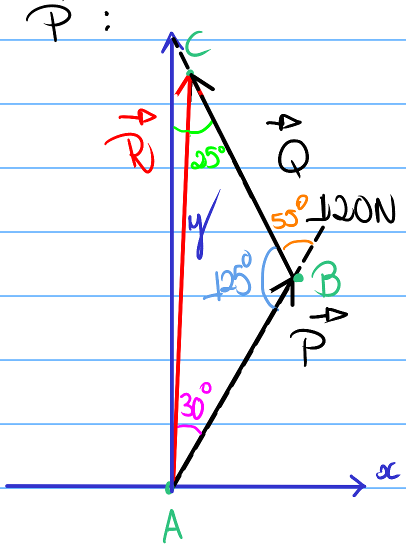
$$\vec{R}_x = |2{,}2K \cdot \cos 30° + 2{,}6028K \cdot \cos(-25°)| \rightarrow$$

$$R_x = 4{,}2642 \cdot 10^3\ N$$

6)



a) Utilizando lei dos senos para encontrar o módulo de $\vec{P}$:



$$\frac{\text{sen } A}{\vec{Q}} = \frac{\text{sen } C}{\vec{P}} \rightarrow$$

$$\vec{P} = \frac{120 \cdot \text{sen } 25°}{\text{sen } 30°} \rightarrow$$

$$\boxed{\vec{P} = 101,4284 \text{ N}}$$

b) Encontrando o módulo da força $\vec{R}$, usando a regra do paralelogramo:

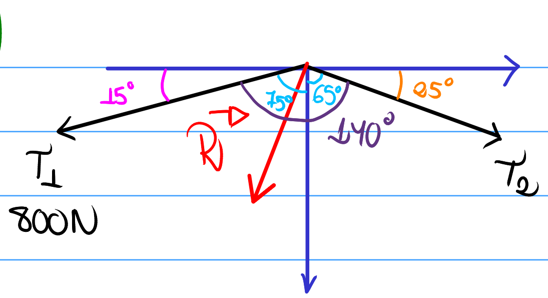
$$R^2 = P^2 + Q^2 + 2PQ \cos\theta \rightarrow$$

$$R^2 = (101,4284)^2 + (120)^2 + 2 \cdot 101,4284 \cdot 120 \cdot \cos 55° \rightarrow$$

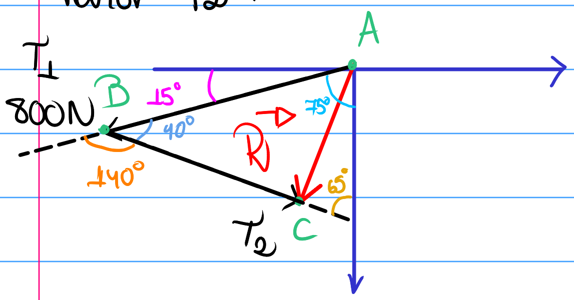
$$R^2 = 10,2877K + 14,4K + 13,9625K \rightarrow$$

$$\boxed{R = 196,5965 \text{ N}}$$

7)



a) Por trigonometria e lei dos senos, é possível encontrar o valor T_2:



$$\frac{\operatorname{sen} A}{T_2} = \frac{\operatorname{sen} C}{T_1} \rightarrow$$

$$T_2 = \frac{800 \cdot \operatorname{sen} 75^\circ}{\operatorname{sen} 65^\circ} \rightarrow$$

$$T_2 = 852{,}625 \text{ N}$$

b) Utilizando a regra do paralelogramo para encontrar o valor de $\vec{R}$:

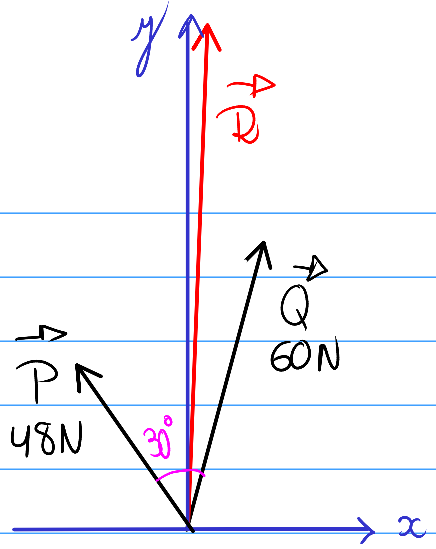
$$R^2 = T_1^2 + T_2^2 + 2\, T_1 \cdot T_2 \cdot \cos\theta \rightarrow$$

$$R^2 = (800)^2 + (852{,}625)^2 + 2 \cdot 800 \cdot 852{,}625 \cdot \cos 140^\circ \rightarrow$$

$$R^2 = 1{,}367 \cdot 10^6 - 1{,}045 \cdot 10^6 \rightarrow$$

$$R = 567{,}4504 \text{ N}$$

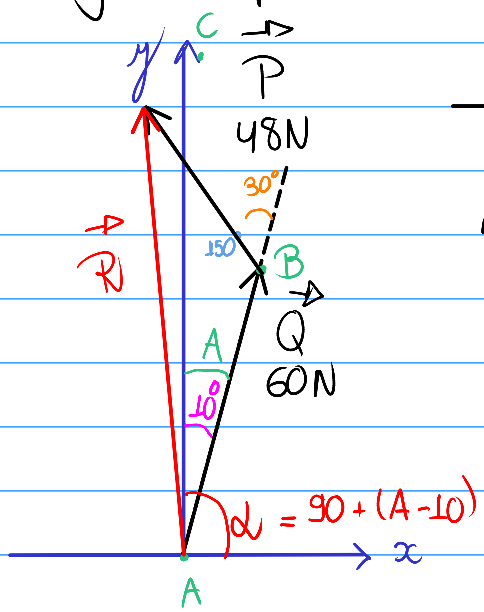
8)



a) Encontrando primeiramente o módulo de $\vec{R}$, utilizando a regra do paralelogramo:

$$R^2 = P^2 + Q^2 + 2PQ\cos\theta \rightarrow$$
$$R^2 = (48)^2 + (60)^2 + 2 \cdot 48 \cdot 60 \cdot \cos 30° \rightarrow$$
$$R^2 = 5{,}904k + 4{,}9883k \rightarrow$$
$$R = 104{,}3662 \text{ N}$$

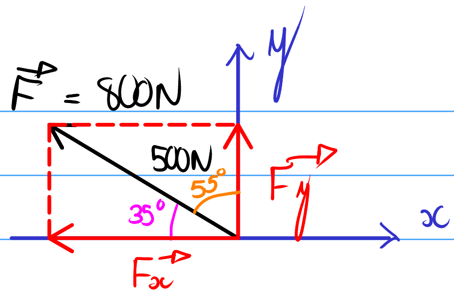
b) Agora, por lei dos senos, encontrando o α:



$$\frac{\operatorname{sen} A}{P} = \frac{\operatorname{sen} B}{R} \rightarrow$$
$$\operatorname{sen} A = \frac{48 \cdot \operatorname{sen} 150°}{104{,}3662} \rightarrow$$
$$\operatorname{sen} A = 0{,}23 \rightarrow$$
$$A = 13{,}29°$$

$\therefore \alpha = 90 + (A - 10) \rightarrow$ $\alpha = 93{,}29°$

g)



- Determinando as componentes $\vec{F_x}$ e $\vec{F_y}$:

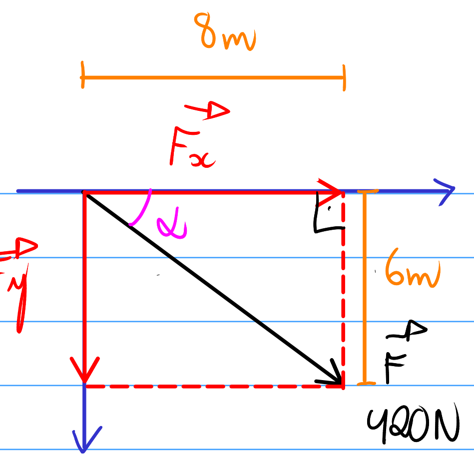
$$\cos 35° = \frac{Fx}{F} \Rightarrow F_x = 800 \cdot \cos 35° \Rightarrow$$

$$Fx = 655,3216 \, N$$

$$\operatorname{sen} 35° = \frac{Fy}{F} \Rightarrow Fy = 800 \cdot \operatorname{sen} 35° \Rightarrow$$

$$Fy = 458,8611 \, N$$

10)



• Encontrando o α e determinando as componentes x e y de $\vec{F}$:

$$tg\,\alpha = \frac{6}{8} \Rightarrow tg\,\alpha = 0{,}75 \Rightarrow$$

$$\alpha = 36{,}87°$$

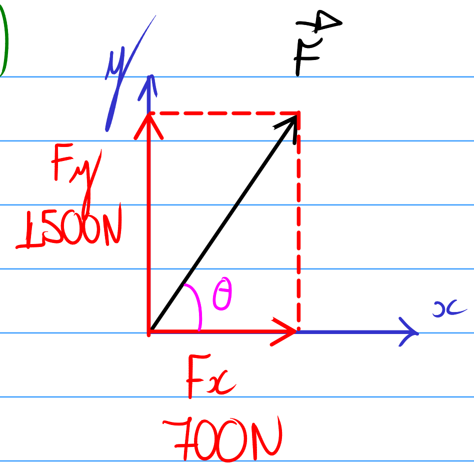
$$\cos\alpha = \frac{F_x}{F} \Rightarrow F_x = 420 \cdot \cos 36{,}87 \Rightarrow$$

$$F_x = 335\,N$$

$$sen\,\alpha = \frac{F_y}{F} \Rightarrow F_y = 420 \cdot sen\,36{,}87 \Rightarrow$$

$$F_y = 252\,N$$

11)

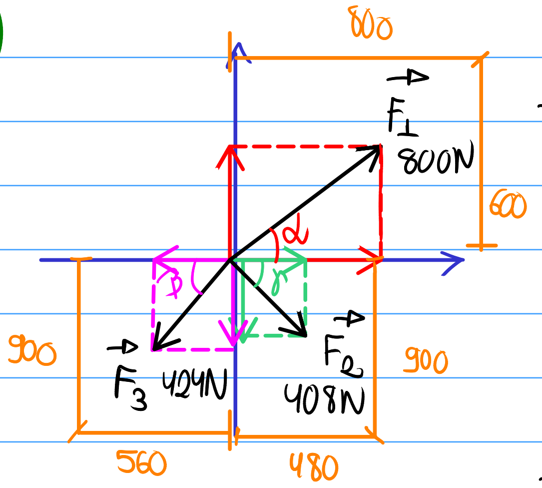


- Encontrando o ângulo θ e encontrando $\vec{F}$:

$$tg\theta = \frac{150\cancel{0}}{70\cancel{0}} \Rightarrow \theta = tg^{-1}(2,14) = 64,98^\circ$$

$$sen\,64,98^\circ = \frac{F_y}{F} \Rightarrow F = \frac{1500}{sen\,64,98^\circ} = 1655,2945\ N$$

12)



$$tg\,\alpha = \frac{60\cancel{0}}{80\cancel{0}} \rightarrow \alpha = 36,87^\circ$$

$$tg\,\gamma = \frac{90\cancel{0}}{48\cancel{0}} \rightarrow \gamma = 61,93^\circ$$

$$tg\,\beta = \frac{90\cancel{0}}{56\cancel{0}} \rightarrow \beta = 58,11^\circ$$

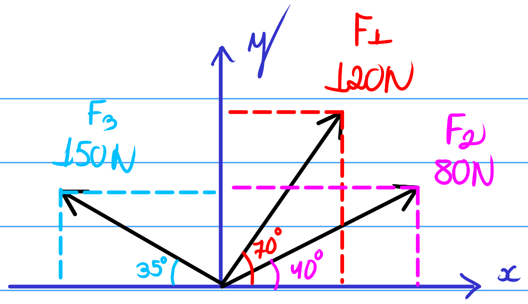
- Após encontrar os ângulos, agora decompondo as componentes em x e y:

$$F_{1y} = 800 \text{ sen } 36,87^\circ \rightarrow F_{1y} = \oplus\ 480N$$
$$F_{1x} = 800 \cos 36,87^\circ \rightarrow F_{1x} = \oplus\ 640N$$

$$F_{2y} = 408 \cdot \text{sen } 61,93^\circ \rightarrow F_{2y} = \ominus\ 360\ N$$
$$F_{2x} = 408 \cdot \cos 61,93^\circ \rightarrow F_{2x} = \oplus\ 191,9844N$$

$$F_{3y} = 424 \cdot \text{sen } 58,11^\circ \rightarrow F_{3y} = \ominus\ 360\ N$$
$$F_{3x} = 424 \cdot \cos 58,11^\circ \rightarrow F_{3x} = \ominus\ 224\ N$$

13)



- Encontrando as componentes x e y de cada vetor:

$F_{1y} = 120 \cdot \text{sen } 70° \to F_{1y} = \oplus\ 112{,}7631\ N$

$F_{1x} = 120 \cdot \cos 70° \to F_{1x} = \oplus\ 41{,}0424\ N$

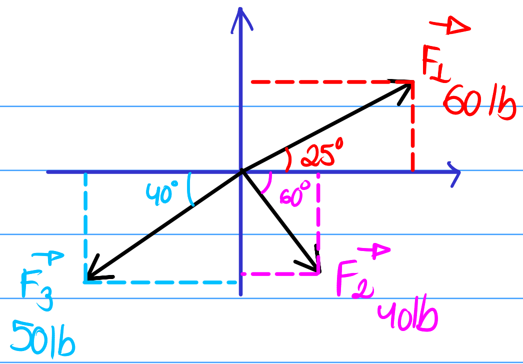
$F_{2y} = 80 \cdot \text{sen } 40° \to F_{2y} = \oplus\ 51{,}423\ N$

$F_{2x} = 80 \cdot \cos 40° \to F_{2x} = \oplus\ 61{,}2836\ N$

$F_{3y} = 150 \cdot \text{sen } 35° \to F_{3y} = \oplus\ 86{,}0365\ N$

$F_{3x} = 150 \cdot \cos 35° \to F_{3x} = \ominus\ 122{,}8728\ N$

14)



- Encontrando as componentes x e y de cada vetor:

$F_{1y} = 60 \cdot \operatorname{sen} 25° \rightarrow F_{1y} = \oplus\ 25,3571\ lb$

$F_{1x} = 60 \cdot \cos 25° \rightarrow F_{1x} = \oplus\ 54,3785\ lb$

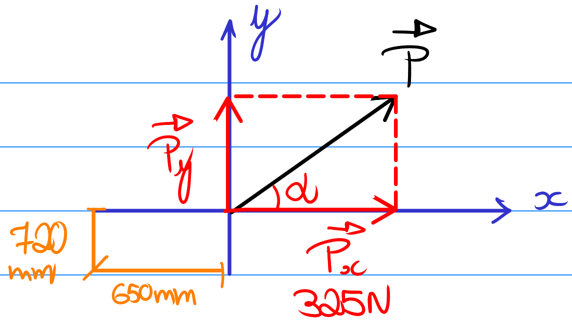
$F_{2y} = 40 \cdot \operatorname{sen} 60° \rightarrow F_{2y} = \ominus\ 34,641\ lb$

$F_{2x} = 40 \cdot \cos 60° \rightarrow F_{2x} = \oplus\ 20\ lb$

$F_{3y} = 50 \cdot \operatorname{sen} 40° \rightarrow F_{3y} = \ominus\ 32,1394\ lb$

$F_{3x} = 50 \cdot \cos 40° \rightarrow F_{3x} = \ominus\ 38,3022\ lb$

15)



$$tg\,\alpha = \frac{720\cancel{m}}{650\cancel{m}} \rightarrow \alpha = 47{,}95°$$

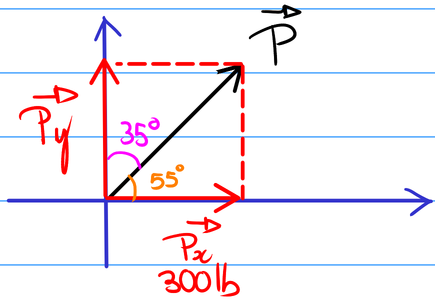
a) Sabendo a componente $\vec{P_x}$, é possível encontrar o valor de $\vec{P}$:

$$\cos\alpha = \frac{P_x}{P} \rightarrow P = \frac{325}{\cos 47{,}95°} = 485{,}23N$$

b) Da mesma forma, encontrando o $\vec{P_y}$:

$$tg\,\alpha = \frac{P_y}{P_x} \rightarrow P_y = 325 \cdot tg\,47{,}95° = 360{,}3162\ N$$

16)



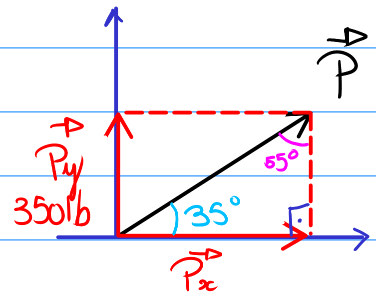
a) Sabendo a componente $\vec{P_x}$, é possível encontrar o módulo de $\vec{P}$:

$$\cos 55° = \frac{P_x}{P} \Rightarrow P = \frac{300}{\cos 55°} = 523,034 \text{ lb}$$

b) Da mesma forma, encontrando o $\vec{P_y}$:

$$tg\, 55° = \frac{P_y}{P_x} \Rightarrow P_y = 300\, tg\, 55° = 428,4444 \text{ lb}$$

17)



a) Sabendo a componente $\vec{P_y}$, é possível encontrar o módulo de $\vec{P}$:

$$\text{sen } 35° = \frac{P_y}{P} \rightarrow P = \frac{P_y}{\text{sen } 35°} = 610{,}2064 \text{ lb}$$

b) Do mesmo jeito, encontrando $\vec{P_x}$:

$$\text{tg } 35° = \frac{P_y}{P_x} \rightarrow P_x = \frac{350}{\text{tg } 35°} = 499{,}8518 \text{ lb}$$