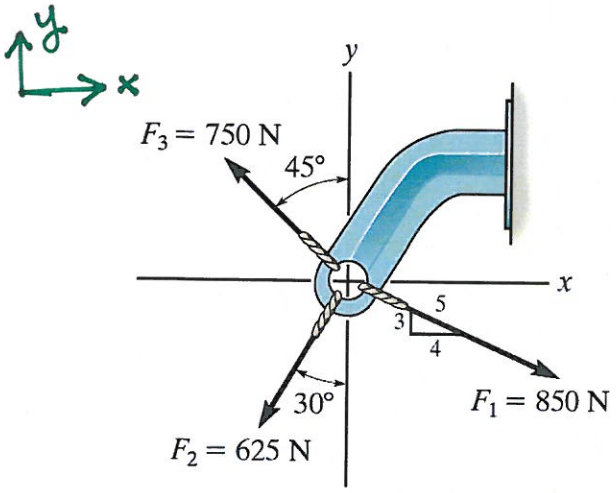
Determine the magnitude of the resultant force and its direction measured counterclockwise from the positive x axis.



$\rightarrow \Sigma F_x = (850N)\left(\frac{4}{5}\right) - (750N)\sin 45 - (625N)\sin 30$

$= -162.8\ N = 162.8\ N \leftarrow$

$\uparrow \Sigma F_y = -(850N)\left(\frac{3}{5}\right) + (750N)\cos 45 - (625N)\cos 30$

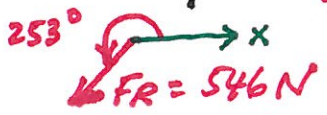
$= -520.9\ N = 520.9\ N \downarrow$

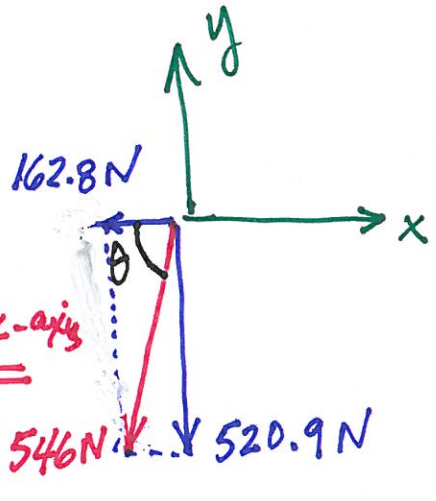
$F_R = \sqrt{(162.8)^2 + (520.9)^2} = \underline{546\ N}$

$\tan\theta = \frac{520.9N}{162.8N} = 3.1996$

$\theta = \tan^{-1}(3.1996) = 72.64^\circ$

$\phi = 180 + 72.64 = \underline{253^\circ \text{ CCW from +x-axis}}$

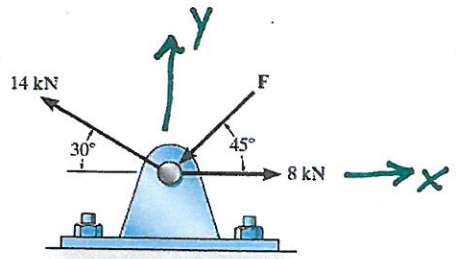




2-55

~~2-55.~~

Determine the magnitude of force **F** so that the resultant force of the three forces is as small as possible. What is the magnitude of the resultant force?



SOLUTION

$\rightarrow F_{Rx} = \Sigma F_x$ $\quad F_{Rx} = 8 - F\cos 45° - 14\cos 30°$

$= -4.12 - F\cos 45°$

$\uparrow F_{Ry} = \Sigma F_y$ $\quad F_{Ry} = -F\sin 45° + 14\sin 30°$

$= 7 - F\sin 45°$

$$F_R^2 = (-4.12 - F\cos 45)^2 + (7 - F\sin 45°)^2$$

$$F_R^2 = (16.97 + 5.8F + .5F^2) + (49 - 9.9F + .5F^2)$$

$$= F^2 - 4.1F + 66$$

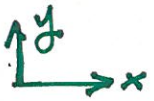
TO GET MIN TAKE DERIVATIVE SET EQUAL TO ZERO

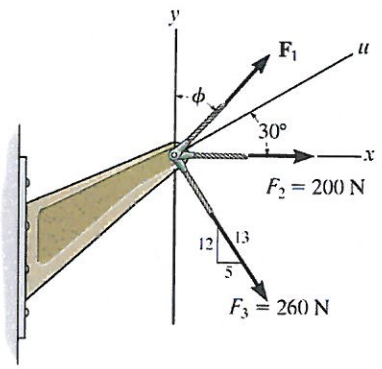
$$2F_R \frac{dF_R}{dF} = 2F - 4.1 = 0 \qquad F = 2.03 \text{ kN}$$

$$F_R^2 = 2.03^2 - 4.1(2.03) + 66 \qquad F_R = 7.86 \text{ kN}$$

F_R

If the magnitude of the resultant force acting on the bracket is to be 450 N directed along the positive u axis, determine the magnitude of $\mathbf{F}_1$ and its direction ϕ.





$F_{Rx} = \Sigma F_x = (450N)\cos 30 = 389.71\ N \rightarrow$

$F_{Ry} = \Sigma F_y = (450N)\sin 30 = 225N \uparrow$

(Note that $\Sigma F_x = F_{Rx}$, $\Sigma F_y = F_{Ry}$)

$+\rightarrow \Sigma F_x = F_1 \sin\phi + 200N + (260N)\frac{5}{13} = 389.71\ N$

$\therefore F_1 \sin\phi = 89.71\ N$ ---- (1)

$+\uparrow \Sigma F_y = F_1 \cos\phi - (260N)\left(\frac{12}{13}\right) = 225N$

$\therefore F_1 \cos\phi = 465N$ ---- (2)

Eq (1) ÷ Eq (2) $\Rightarrow \tan\phi = 0.1929247$

$\therefore \phi = \underline{10.92^\circ}$

From Eq. (1) $\Rightarrow F_1 \sin(10.92^\circ) = 89.71\ N$

$\therefore F_1 = \underline{474N}$