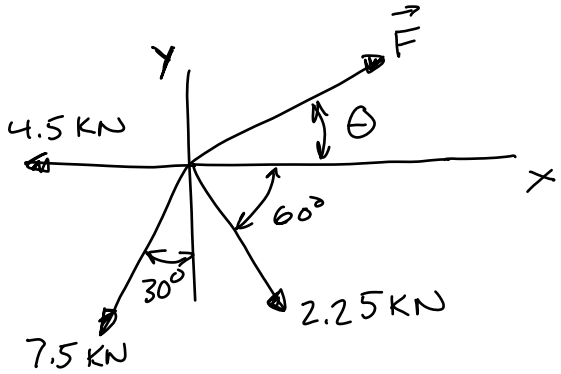
Equilibrium in 2-D

Problem Statement: Determine F and θ such that the force system is in static equilibrium.



1.) Draw the FBD.

Already provided

2.) Resolve each force into x and y components.

$F_{4.5x} = -4.5\ KN$

$F_{7.5x} = -(7.5KN)\sin 30° = -3.75\ KN$

$F_{2.25x} = (2.25KN)\cos 60° = 1.125\ KN$

$F_x = F\cos\theta$

$F_{4.5y} = 0$

$F_{7.5y} = -(7.5KN)\cos 30° = -6.5\ KN$

$F_{2.25y} = -(2.25KN)(\sin 60°) = -1.95\ KN$

$F_y = F\sin\theta$

3.) Enforce equilibrium and solve for the unknowns.

$\pm\rightarrow \Sigma F_x = 0 \Rightarrow -4.5\ KN - 3.75\ KN + 1.125\ KN + F\cos\theta = 0$

$F\cos\theta = 7.125\ KN$

$+\uparrow \Sigma F_y = 0 \Rightarrow 0 - 6.5\ KN - 1.95\ KN + F\sin\theta = 0$

$F\sin\theta = 8.45\ KN$

$$\frac{F\sin\theta}{F\cos\theta} = \frac{8.45\ KN}{7.125\ KN}$$

$\tan\theta = 1.186$

$\theta = 49.86°$

$F = 11.05\ KN$