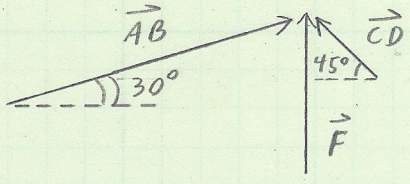
Problem 2.9

Given: Force $\vec{F} = 4\ MN = 4\times10^6\ N$, Angle $A = 30°$, Angle $C = 45°$.

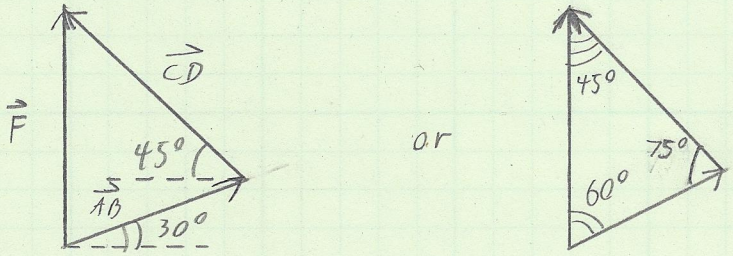
Find: Magnitude of components of $\vec{F}$ along bars AB and CD.

Solution:

Free body diagram (FBD):



We want $\vec{F} = \vec{AB} + \vec{CD}$ so from the FBD



From the law of sines, $$\frac{|\vec{F}|}{\sin(75°)} = \frac{|\vec{CD}|}{\sin(60°)} = \frac{|\vec{AB}|}{\sin(45°)}.$$

Since $\vec{F} = 4\times10^6\ N$,

$$|\vec{CD}| = \frac{\sin(60°)\,|\vec{F}|}{\sin(75°)} = \frac{\sin(60°)(4\times10^6 N)}{\sin(75°)} = 3.59\times10^6\ N$$

and

$$|\vec{AB}| = \frac{\sin(45°)\,|\vec{F}|}{\sin(75°)} = \frac{\sin(45°)(4\times10^6 N)}{\sin(75°)} = 2.93\times10^6\ N.$$

Therefore

FINAL ANSWER:

Magnitude along AB = $2.93\times10^6\ N$

Magnitude along CD = $3.59\times10^6\ N$