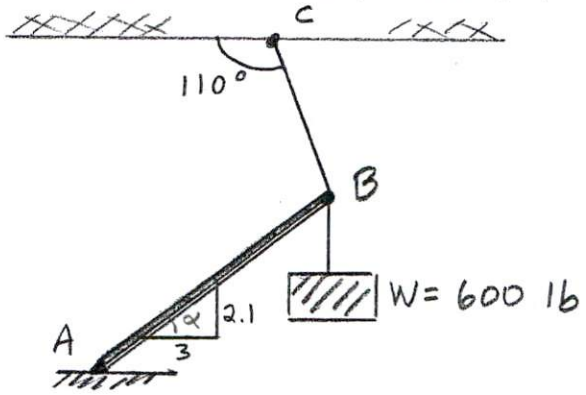
CMGT 350 QUIZ #4 Fall 2022

SHOW ALL WORK FOR FULL CREDIT

NAME: Solution

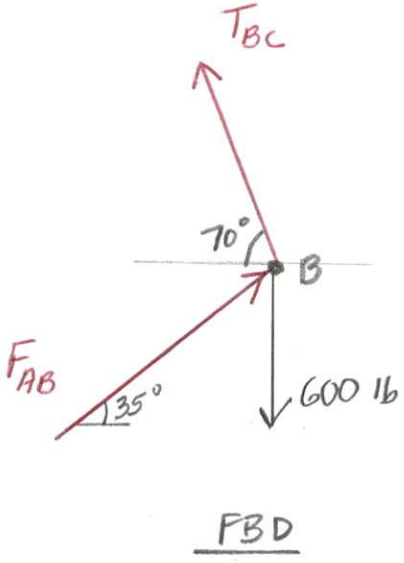
1. For the concurrent coplanar force system shown determine the force in the boom (F_{AB}) and the tension in cable (T_{BC}) by completing the following:



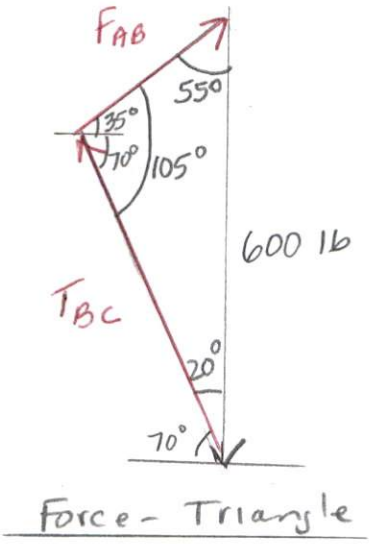
$$\alpha = \tan^{-1}\frac{2.1}{3} = 35°$$

A. Force-Triangle Method.

Step 1: Draw the FBD



Step 2: Draw the Force Triangle



Step 3: Solve for F_{AB} and T_{BC} using the force-triangle and trig.

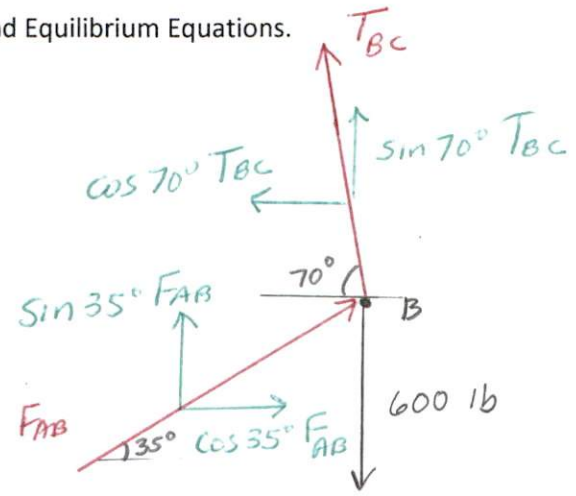
$$\frac{F_{AB}}{\sin 20°} = \frac{T_{BC}}{\sin 55°} = \frac{600\text{ lb}}{\sin 105°}$$

$$F_{AB} = \frac{\sin 20°\,(600\text{ lb})}{\sin 105°} = 212\text{ lb}$$

$$T_{BC} = \frac{\sin 55°\,(600\text{ lb})}{\sin 105°} = 509\text{ lb}$$

B. Rectangular Components and Equilibrium Equations.

Step 1: Draw the FBD



FBD

Step 2: Equilibrium Equations

$[\Sigma Fx = 0]$ $\cos 35^\circ F_{AB} - \cos 70^\circ T_{BC} = 0$ (1)

$[\Sigma Fy = 0]$ $\sin 35^\circ F_{AB} + \sin 70^\circ T_{BC} - 600\ lb = 0$ (2)

Step 3: Solve for F_{AB} and T_{BC} (use any method for solving two-equations and two-unknowns)

From (1) $$F_{AB} = \frac{\cos 70^\circ T_{BC}}{\cos 35^\circ} \quad (3)$$

Subst (3) into (2)

$$\sin 35^\circ \left[\frac{\cos 70^\circ T_{BC}}{\cos 35^\circ}\right] + \sin 70^\circ T_{BC} = 600\ lb$$

$$T_{BC} = \frac{600\ lb}{\frac{\sin 35^\circ \cos 70^\circ}{\cos 35^\circ} + \sin 70^\circ} = 509\ lb$$

From (3)

$$F_{AB} = \frac{\cos 70^\circ (509\ lb)}{\cos 35^\circ} = 212\ lb$$