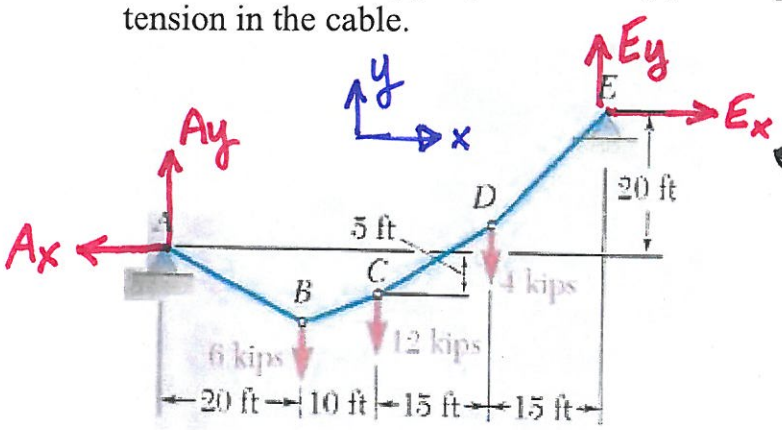
Problem 3: Cables - Concentrated Loads

The cable ***AE*** supports three vertical loads from the points indicated. If point ***C*** is 5 ft below the left support, determine (a) the sag at points ***B*** and ***D***, (b) the maximum tension in the cable.

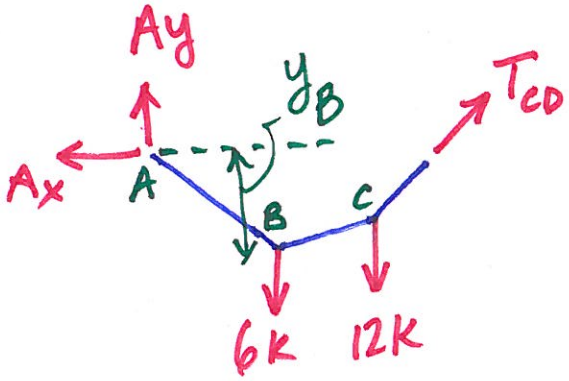


EQUIL. OF WHOLE Structure

$\circlearrowleft \Sigma M_E = 0 = A_y(60) + A_x(20) - 6(40) - 12(30) - 4(15)$

$3A_y + A_x = 33 \quad \cdots (1)$

CUT CD Left Side



$\circlearrowleft \Sigma M_c = 0 = A_y(30) - A_x(5) - 6(10)$

$6A_y - A_x = 12 \quad \cdots (2)$

Solving (1) & (2)

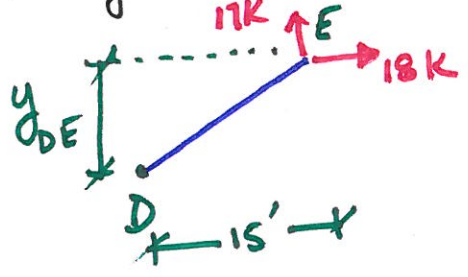
$A_y = 5 \text{ Kips} \uparrow \qquad A_x = 18 \text{ Kips} \leftarrow$

$\frac{A_y}{A_x} = \frac{5K}{18K} = \frac{y_B}{20} \Rightarrow y_B = 5.56 \text{ ft}$ Sag at point B

EQ. OF WHOLE STRUCTURE

$\rightarrow \Sigma F_x = 0 = -18 + E_x \Rightarrow E_x = 18 \text{ Kips} \rightarrow$

$+\uparrow \Sigma F_y = 0 = 5 - 6 - 12 - 4 + E_y \Rightarrow E_y = 17 \text{ Kips} \uparrow$



$\frac{17 \text{ Kip}}{18 \text{ Kip}} = \frac{y_{DE}}{15} \Rightarrow y_{DE} = 14.17 \text{ ft}$

$y_D = 20 - 14.17$

$y_D = 5.83 \text{ ft}$

Max Tension $= T_{ED} = \sqrt{(18)^2 + (17)^2} = 24.8 \text{ Kips (T)}$