

21-S-6-ZA-59 Solution

Question: The truss system shown is acted upon by a force P N at point B. If a m, b m, and θ° , find the force in each member, using a negative sign if the member is in compression.

Solution:

Find the angle phi between member AC and the horizontal.

$$\phi = \arctan((a + b \tan \theta)/b)$$

Next take the sum of forces and moments of the whole system to find the reaction forces.

$$\Sigma F_x = P + A_x = 0 \Rightarrow A_x = -P$$

$$\Sigma M_A = -Pa + D_y b = 0 \Rightarrow D_y = Pa/b$$

$$\Sigma F_y = A_y + D_y = 0 \Rightarrow A_y = -D_y$$

Use the method of joints to find the force in each member, assuming each member is in tension.

$$\text{A: } \Sigma F_x = A_x - F_{AC} \cos \phi = 0 \Rightarrow F_{AC} = A_x / \cos \phi$$

$$\Sigma F_y = A_y - F_{AC} \sin \phi + F_{AB} = 0 \Rightarrow F_{AB} = -(F_{AC} \sin \phi - A_y)$$

$$\text{B: } \Sigma F_x = P - F_{BC} \cos \theta \Rightarrow F_{BC} = P / \cos \theta$$

$$\text{C: } \Sigma F_y = F_{AB} \sin \theta - F_{AC} \sin \phi + F_{CD} = 0 \Rightarrow F_{CD} = F_{AC} \sin \phi - F_{AB} \sin \theta$$