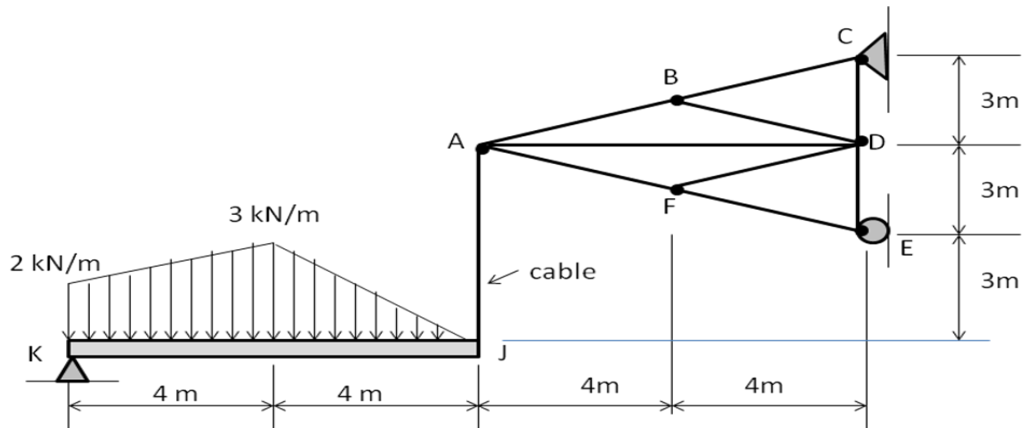
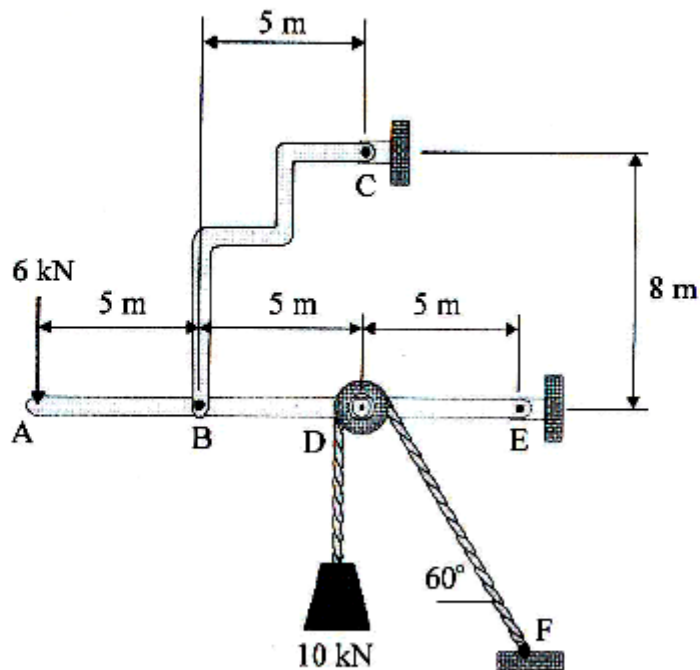


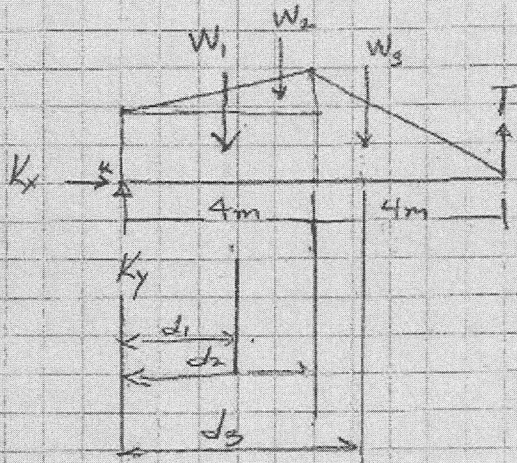
- 1) For the structure shown below, compute
- The reactions at support K
  - The force in the cable AJ
  - The reactions at supports C and E



**S2-420** A pulley is attached to the frame as shown. Neglecting the radius of the pulley. Determine:

- The reactions at C and E, and
- The forces at B and D on member ABDE.





$$W_1 = 2 \times 4 = 8 \text{ kN}$$

$$W_2 = \frac{1}{2} (4) (1) = 2 \text{ kN}$$

$$W_3 = \frac{1}{2} (4) (3) = 6 \text{ kN}$$

$$d_1 = 2 \text{ m}$$

$$d_2 = \frac{2}{3} (4) = 2.67 \text{ m}$$

$$d_3 = 4 + \frac{1}{3} (4) = 5.33 \text{ m}$$

a)

$$(\sum F_x = 0) \quad K_x = 0$$

$$(\sum F_y = 0) \quad K_y - W_1 - W_2 - W_3 + T = 0 \quad \therefore K_y = 16 - T$$

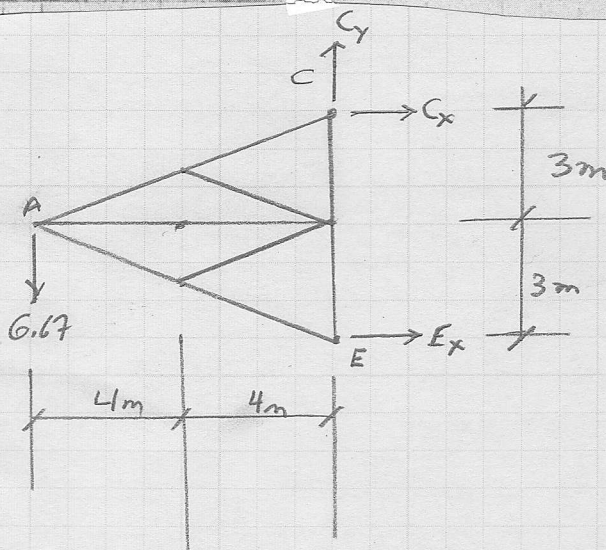
$$(\sum M_K = 0) \quad -d_1 W_1 - d_2 W_2 - d_3 W_3 + 8T = 0$$

$$-2(8) - 2.67(2) - 5.33(6) + 8T = 0$$

b)

$$T = 6.67 \text{ kN}$$

$$\therefore K_y = 9.33 \text{ kN}$$



$$[\sum F_x = 0] \quad C_x + E_x = 0$$

$$[\sum F_y = 0] \quad C_y - 6.67 = 0$$

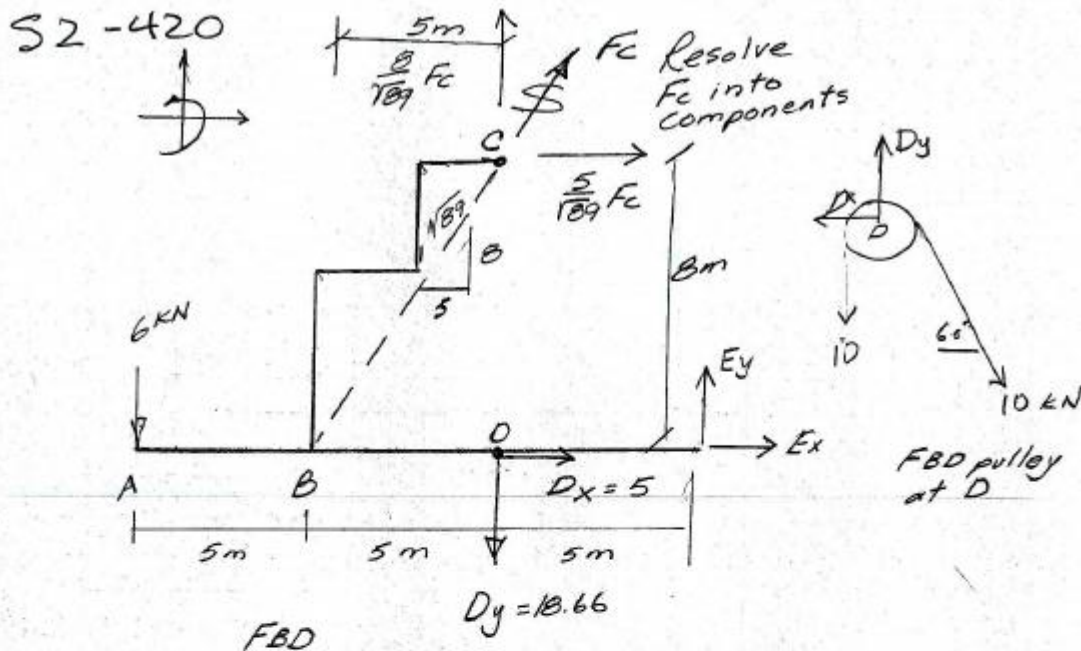
$$C_y = 6.67 \text{ kN} \uparrow$$

$$[\sum M_C = 0] \quad 8(6.67) + 6E_x = 0$$

$$E_x = -8.89 \text{ kN}$$

$$E_x = 8.89 \text{ kN} \leftarrow$$

$$\therefore C_x = 8.89 \text{ kN} \rightarrow$$



For pulley at D:  $\sum F_x = 0 \rightarrow -D_x + 10 \cos 60^\circ = 0$

$$D_x = +5 \text{ kN}$$

$\vec{D}_x = 5 \text{ kN} \leftarrow$  on the pulley

$\therefore \vec{D}_x = 5 \text{ kN} \rightarrow$  on the frame

$$\sum F_y = 0 \uparrow$$

$$-10 + D_y - 10 \sin 60^\circ = 0 \quad D_y = 18.66 \text{ kN}$$

$\therefore \vec{D}_y = 18.66 \text{ kN} \uparrow$  on the pulley

$\vec{D}_y = 18.66 \text{ kN} \downarrow$  on the frame

$\therefore$  From FBD of frame:

$$\sum M_E = 0 \curvearrowleft \quad 6(15) - \frac{8}{189} F_c (5) - \frac{5}{189} F_c (8) + 18.66(5) = 0$$

$$-8.48 F_c = -183.3 \quad \therefore F_c = +21.62 \text{ kN}$$

$$\therefore \vec{F}_c = 21.62 \text{ kN} \nearrow$$

$$\sum F_x = 0 \rightarrow \frac{5}{189} (21.62) + 5 + E_x = 0 \quad E_x = -16.46 \text{ kN}$$

$$\therefore \vec{E}_x = 16.46 \text{ kN} \leftarrow$$

$$\sum F_y = 0 \uparrow \quad -6 + \frac{8}{189} (21.62) - 18.66 + E_y = 0$$

$$E_y = +6.33 \text{ kN} \quad \therefore \vec{E}_y = 6.33 \text{ kN} \uparrow$$