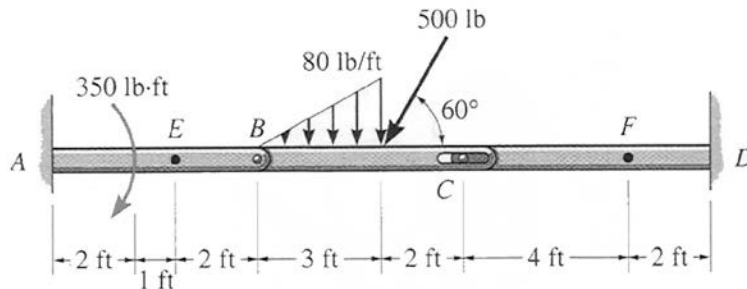


EGM 3420C - Engineering Mechanics

Statics Review Problems

Fa14

Problem 1: Determine the internal forces at points E and F . Member BC is pinned at B and there is a smooth slot at C . The pin at C is fixed to member CD .



Free Body Diagrams (FBDs):

- Segment AB (2 ft):**
 - At A: Reaction moment M_A (CCW), reaction forces A_x (right), A_y (up).
 - At B: Reaction forces B_x (left), B_y (down).
 - Applied: 350 lb-ft moment at A.
- Segment BC (3 ft):**
 - At B: Reaction forces B_x (right), B_y (up).
 - At C: Reaction forces C_x (left), C_y (down).
 - Applied: Triangular distributed load (0 to 80 lb/ft), 500 lb force at 60 degrees.
- Segment CD (4 ft):**
 - At C: Reaction forces C_x (right), C_y (up).
 - At D: Reaction forces D_x (left), D_y (down).

Using BC:

$$\sum \mathcal{M}_B = 0 = \left(\frac{1}{2} \cdot 3 \cdot 80\right)(2) - (500 \sin 60^\circ)(3) + 3C_y$$

$$C_y = 307.8 \text{ lb } \uparrow \text{ on BC}$$

$$\uparrow \sum F_y = 0 = B_y - \left(\frac{1}{2} \cdot 3 \cdot 80\right) - (500 \sin 60^\circ) + C_y \Rightarrow B_y = 245.2 \text{ lb } \uparrow \text{ on BC}$$

$$\rightarrow \sum F_x = 0 = B_x - (500 \cos 60^\circ) \Rightarrow B_x = 250 \text{ lb } \rightarrow \text{ on BC}$$

Cut AB @ E: FBD EB

$$\sum F_x = 0 \Rightarrow N_E = 250 \text{ lb } \rightarrow \text{ on EB}$$

$$\sum F_y = 0 \Rightarrow V_E = 245.2 \text{ lb } \uparrow \text{ on EB}$$

$$\sum \mathcal{M}_E = 0 = (245.2)(2) - M_E$$

$$M_E = 490 \text{ lb-ft } \uparrow \text{ on EB}$$

Cut CD @ F: FBD CF

$$\sum F_x = 0 \Rightarrow N_F = 0$$

$$\sum F_y = 0 \Rightarrow V_F = 307.8 \text{ lb } \uparrow \text{ on CF}$$

$$\sum \mathcal{M}_F = 0 = M_F - 4(307.8)$$

$$M_F = 1231 \text{ lb-ft } \downarrow \text{ on CF}$$

ANSWER: $C_y = 308 \text{ lb } \uparrow$, $B_y = 245 \text{ lb } \uparrow$, $B_x = 250 \text{ lb } \rightarrow$ all on BC
 $N_e = 250 \text{ lb } \rightarrow$ on EB, $V_e = 245 \text{ lb } \uparrow$ on EB, $M_e = 490 \text{ lb-ft CCW}$ on EB
 $N_f = 0$, $V_f = 308 \text{ lb } \uparrow$ on CF, $M_f = 1231 \text{ lb-ft CW}$ on CF