Problem 1 (10 points)

1) Force at F

\[ |T_1| = |T_2| = 2600 \text{ lb} \]

\[ T_1 + T_2 = 200 (-8\hat{i} - 12\hat{j}) \]

\[ = -800 (2\hat{i} + 3\hat{j}) \text{ lb} \]

\[ = (-1600\hat{i} - 2400\hat{j}) \text{ lb} \]

2) Member CDEG

\[ \Sigma M_C = -E_x \times 8 + 2600 \times 5 = 0 \]

\[ E_x = \frac{2600 \times 5}{8} = 1625 \text{ lb} \]

3) Member BEF

\[ \Sigma M_E = 6 \times B_y + 6 \times 2400 \text{ lb} = 0 \]

\[ B_y = -2400 \text{ lb} \]

\[ \Sigma F_x = B_x + E_x = 1600 \text{ lb} = 0 \]

\[ B_x = -25 \text{ lb} \]
Problem 2 (10 points)

For the beam and loading shown, (a) draw the shear and bending-moment diagrams, (b) determine the magnitude and location of the maximum absolute value of the bending moment.

1) Whole beam

\[ \sum F_x \rightarrow A_x = 0 \]

\[ \sum F_y \rightarrow A_y = 0 \]

2) From A to B

\[ \sum M_A \rightarrow 2250 \text{lb} - V = 0 \]

\[ V = 2250 \text{lb} \]

\[ \sum M_B \rightarrow M - 2250x = 0 \]

\[ M = 2250x \text{ (lb*ft)} \]

3) From B to C

\[ \sum M_C \rightarrow 1500(10-x) \]

\[ V + 6000 - 1500(10-x) = 0 \]

\[ V = 1500(10-x) - 6000 \text{ lb} \]

\[ \sum M_J \rightarrow \frac{1}{2}(10-x)^2 + 1500 - (10-x)^2 + 6000 = 0 \]

\[ M = \frac{-750(10-x)^2 + 6000(10-x)}{2} \]

4) Consider \[ V(x) = 0 \]

\[ 1500(10-x) - 6000 = 0 \]

\[ 10 - x = 4 \]

\[ x = 6 \]

\[ M(6) = -750 \cdot 4^2 + 6000 \cdot 4 = 12000 \text{ lb*ft} \]

\[ M_{max} = 12000 \text{ lb*ft} \]
**Problem 3** (10 points)

1) By symmetry or
   by \( M_H \) for entire truss
   \( A_y = 3000 \text{ lb} \)

2) **Part ABE**
   \( \sum M_A \): 
   \[ 9 \times \frac{8}{\sqrt{73}} \times F_{BC} + 14 \times 3000 - 8 \times 2000 = 0 \]
   \[ F_{BC} = \frac{\sqrt{73}}{72} (-26000) = 3085 \text{ lb (comp)} \]

3) **Part CBE**
   \( \sum M_B \) 
   \[ 6 \times EF - 6 \times 3000 = 0 \]
   \[ F_{EF} = 3000 \text{ lb (tension)} \]