1. The frame shown is subjected to a horizontal force $F = 300 \text{j N}$ acting at the point $B$. Determine the magnitude of the components of this force parallel and perpendicular to member $AB$.

Ans. $F_{\parallel} = 257.1 \text{ N}$

Ans. $F_{\perp} = 154.5 \text{ N}$

Ans. $F_{AB} = 35 \text{ kN} \,(c)$

$F_{EK} = 0$

$F_{DE} = 6 \text{ kN} \,(T)$

2. For the truss shown below, find the force in members $AB$, $EK$ and $DE$ and indicate whether they are in tension or compression.

3. A beam is supported by a pin and a rope over two pulleys and is loaded as shown. Draw the shear and bending moment diagrams for the beam. Label all critical points.

Ans. (Partial)

$T = 120 \text{ lb}$

$R_L = 90 \text{ lb}$

$M_{\max} = -135 \text{ ft.lbf}$
4. A block weighing 100 pounds is kept in place on a frictionless wedge by a cord suspended over a fixed peg as shown. The coefficient of static friction between the peg and the cord is 0.3. Determine the range of values for $T$ so that the block is held in equilibrium.

$$18.9 \text{ lb} \leq T \leq 71.9 \text{ lb}$$

5. Determine the horizontal and vertical components of the pin reaction at C on member AD. Neglect the weight of all members. The structure is supported by a roller at A and a pin at B. All other joints are pins.

$$\text{Ans.}$$

6. Determine the centroid of the slender rod ABC.

$$\text{Ans.}$$

7. For the shaded area find the values of $I_x$, $I_y$, and $I_{xy}$ with respect to the $x,y$ axes. Through what angle $\theta$ must the axes be rotated for the axes $x',y'$ to be the principal axes?

$$\text{Ans.}$$

8. A solid gate with a uniform triangular cross section weighs 2000 lbs. The gate is submerged in a liquid with a weight density of $\gamma = 112.4 \text{ lb/ft}^3$. If the hinge at A is smooth, determine the total force $(F)$ required to open the gate when the surface of the liquid is 3 ft above point A. The depth of the gate (into the paper) is 4 ft.

$$\text{Ans.}$$