BE 50 Statics
Final Examination

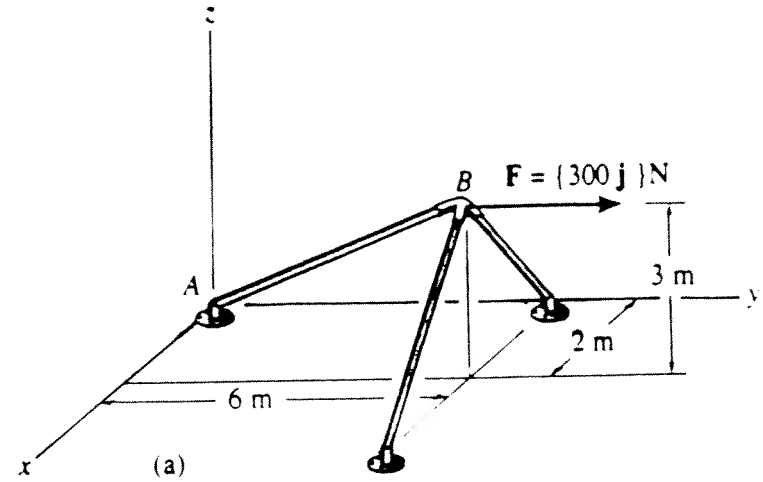
Winter Semester, 1996

AVG = 62.3 %

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

ANS. $F_{\parallel} = 257.1\ N$

$F_{\perp} = 154.5\ N$

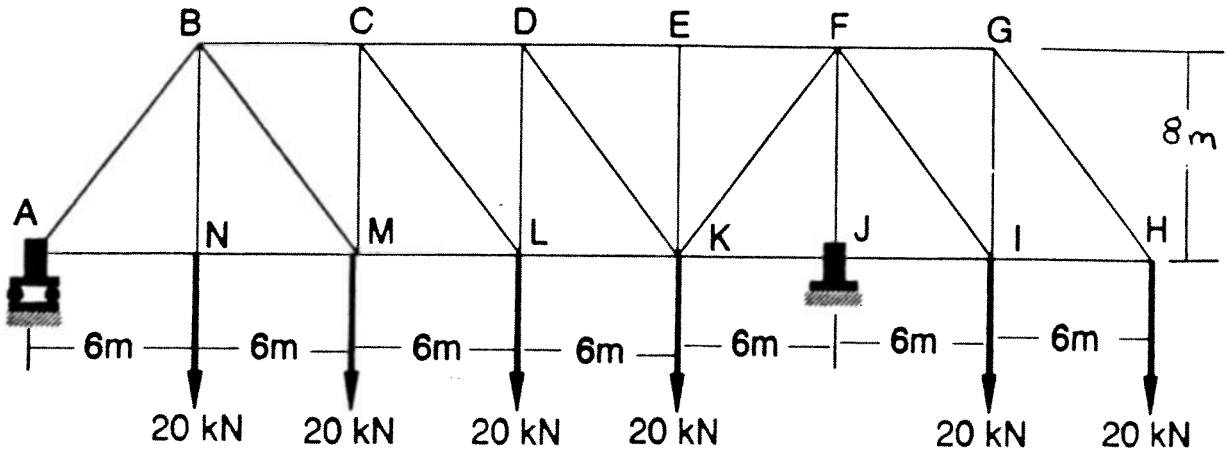


ANS. $F_{AB} = 35\ kN\ (C)$

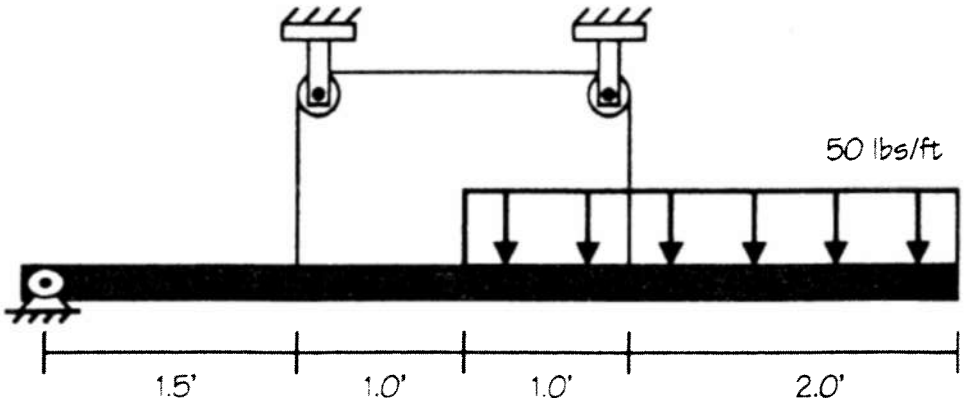
$F_{EK} = 0$

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

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)

$T = 120\ Lb$

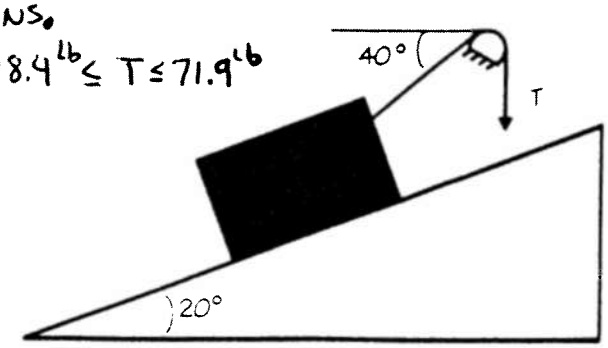
$R_L = 90\ Lb$

$M_{max} = -135\ ft.Lb$

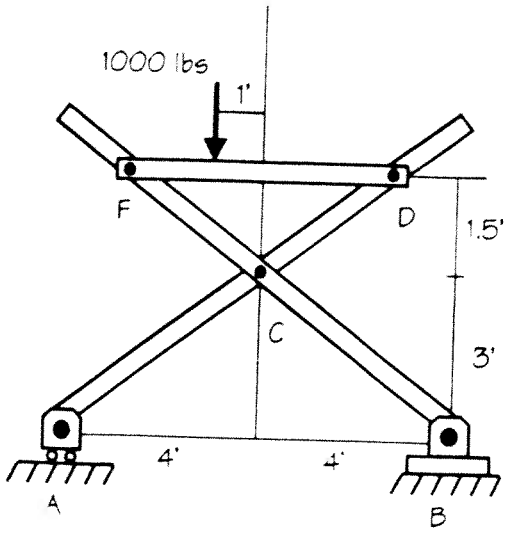
4. A block weighing 100 pounds is kept in place on a frictionless wedge by a cord suspended over a fixed peg as shown. The coefficient of static friction between the peg and the cord is 0.3. Determine the range of values for T so that the block is held in equilibrium.

ANS.

$18.4^{lb} \le T \le 71.9^{lb}$



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.



ANS. $C_x = 2000\,Lb \rightarrow$ on AD

$C_y = 375\,Lb \downarrow$ on AD

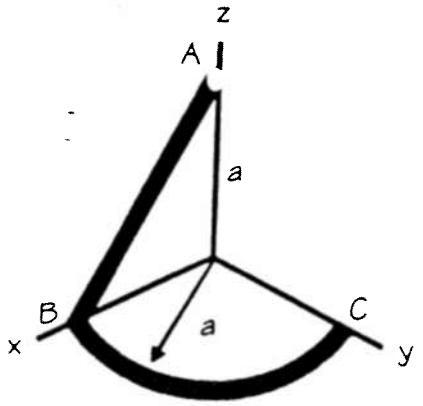
6. Determine the centroid of the slender rod ABC.

ANS.

$$\bar{x} = \frac{a(\sqrt{2}+2)}{2\sqrt{2}+\pi}$$

$$\bar{y} = \frac{2a}{2\sqrt{2}+\pi}$$

$$\bar{z} = \frac{a\sqrt{2}}{2\sqrt{2}+\pi}$$



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 θ must the axes be rotated for the axes x',y' to be the principal axes?

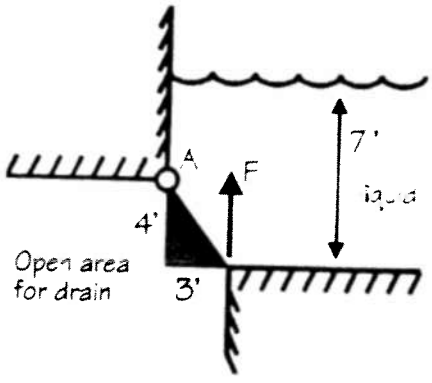
ANS.

$I_x = 981.3$

$I_y = 149.3$

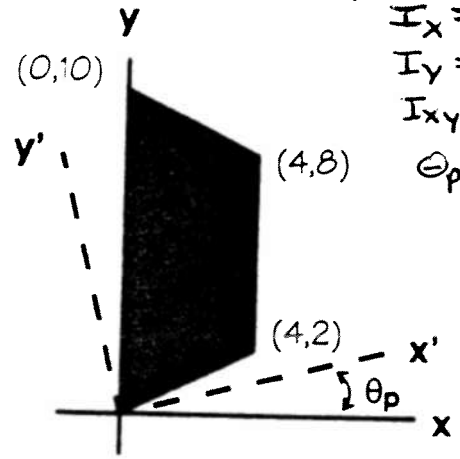
$I_{xy} = 293.3$

$\theta_p = -17.6°$



ANS.

$F = 11.28\,kip$



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 $\gamma = 112.4\ lb/ft^3$. 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.