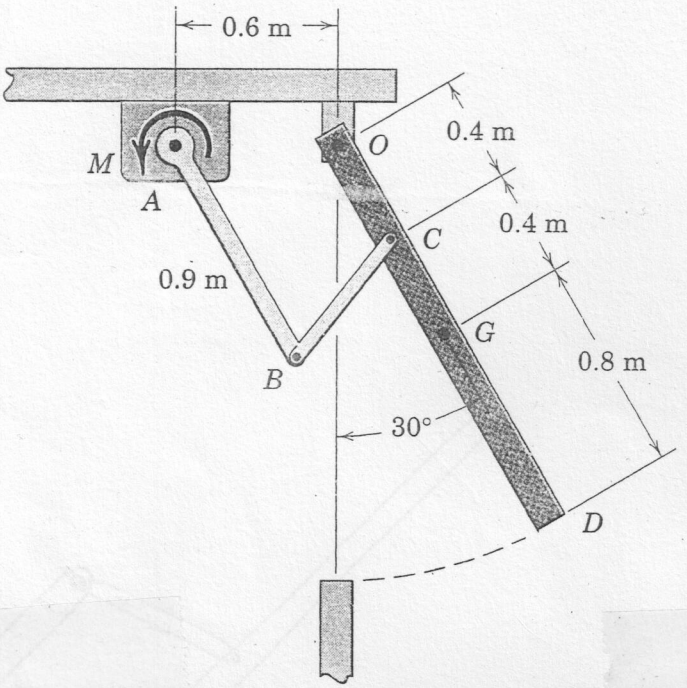
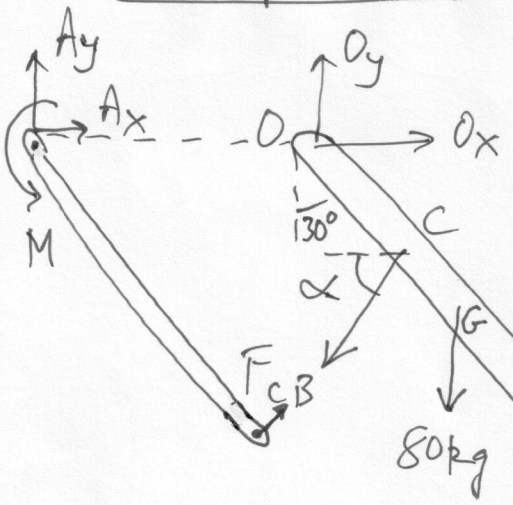
Example 1

The 80-kg ventilation door *OD* with mass center at *G* is held in the open position shown by means of a moment *M* applied at *A* to the opening linkage. Member *AB* is parallel to the door for the 30° position shown. Determine *M*.



Example 1



CB is 2-Force member.

$$\underline{CB} = \underline{CO} + \underline{OA} + \underline{AB}$$

$$= 0.4(-\sin 30\,\underline{i} + \cos 30\,\underline{j}) - 0.6\,\underline{i} + 0.9(-\cos 30\,\underline{j} + \sin 30\,\underline{i})$$

$$= -0.35\,\underline{i} - 0.5\cos 30\,\underline{j}$$

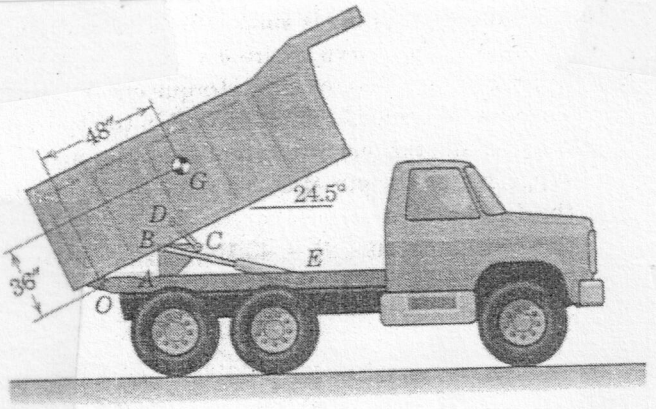
$$\alpha = \tan^{-1}\left(0.35/(0.5\cos 30)\right) = 38.948^\circ$$

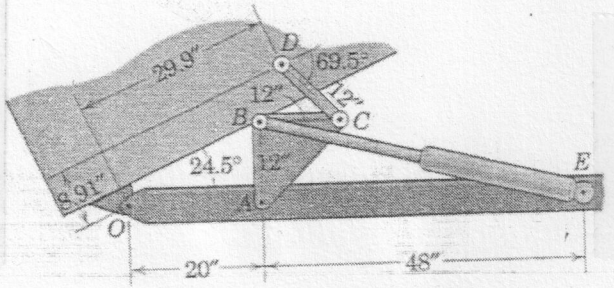
$$\sum_{OD} M_O = 0 \Rightarrow F_{CB}\cos(\alpha - 30) * 0.4 + 80 * 9.81 * 0.8\sin 30 = 0.$$

$$\Rightarrow F_{CB} = -794.47\,N$$

$$\sum_{AB} M_A = 0 \Rightarrow M = -F_{CB}(\cos\alpha - 30) * 0.9 = 706.32\,N.m.$$

Example 2



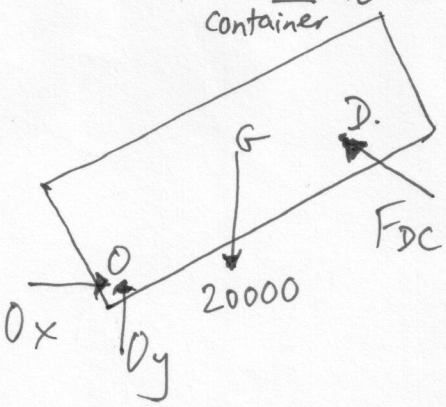


Detail of hoisting mechanism

The design of a hoisting mechanism for the dump truck is shown in the enlarged view. Determine the compression P in the hydraulic cylinder BE and the magnitude of the force supported by the pin at A for the particular position shown, where BA is perpendicular to OAE and link DC is perpendicular to AC. The dump and its load together weigh 20,000 lb with center of mass at G. All dimensions for the indicated geometry are given on the figure.

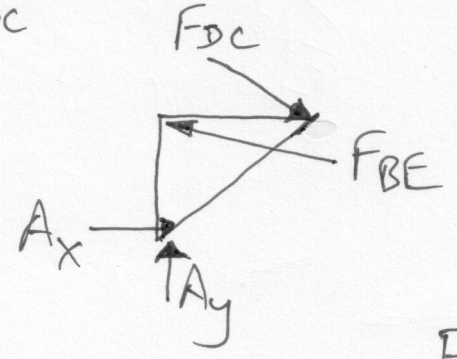
Example 2.

container



$$\sum M_O = 0 \Rightarrow F_{DC}\cos 69.5 * 8.91 + F_{DC}\sin 69.5 * 29.9 + 20000\sin 24.5 * 36 - 20000\cos 24.5 * 48 = 0$$

$$F_{DC} = 18472.28$$



$$\sum_{\triangledown} M_A = 0 \Rightarrow F_{BE}\frac{48}{\sqrt{48^2+12^2}} * 12 = F_{DC} * 12\left(\frac{2}{\sqrt{2}}\right)$$

$$F_{BE} = 26927.7$$

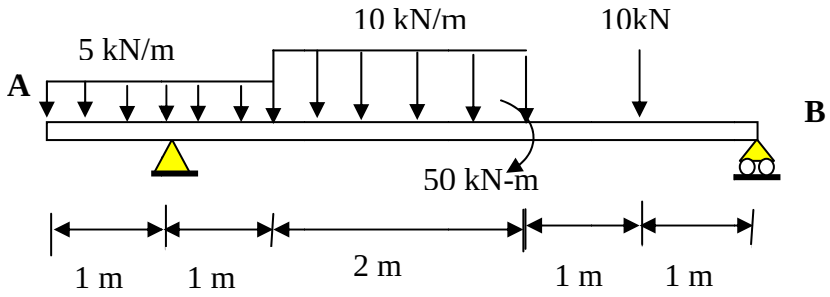
$$\sum_{\triangledown} F_x = 0 \Rightarrow A_x - F_{BE}\frac{48}{\sqrt{48^2+12^2}} + \frac{F_{DC}}{\sqrt{2}} = 0 \Rightarrow A_x = 13061.87$$

$$\sum_{\triangledown} F_y = 0 \Rightarrow A_y + F_{BE}\cdot\frac{12}{\sqrt{48^2+12^2}} - \frac{F_{DC}}{\sqrt{2}} = 0 \Rightarrow A_y = 6530.9$$

$$A = \sqrt{A_x^2 + A_y^2} = 14603.6$$

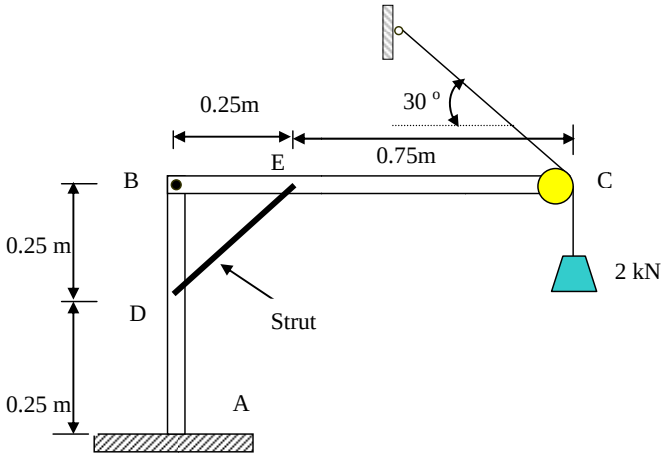
CEE 221: SOLID MECHANICS
Engineering Mechanics Review
(Lecture Problems)

Prob 1.
Determine the reactions at the supports of the beam shown in Figure 1

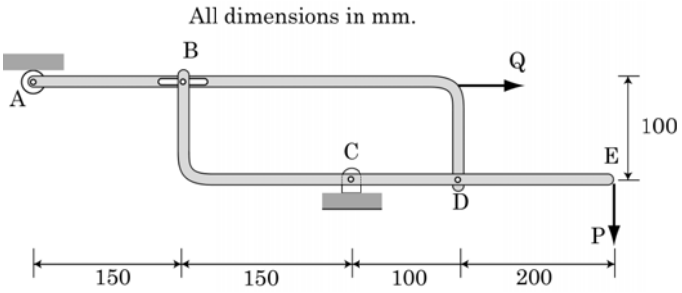


Prob 2

Two beams, AB and BC of circular cross sections, are pinned (hinged) at B. DE is a strut (carries only axial force) that connects the two beams. Beam AB is fixed at A. The structure is loaded by a pulley pinned at C as shown in figure 2. Calculate the reactions at A (fixed end) and the axial force in the strut.



Prob 3
Determine the components of all forces acting on member *BCDE* of the assembly shown in Figure 3. Take *P = 450* N, and *Q = 300* N.



Prob 4: For the given loading , determine the zero force member in the truss shown in Figure 4.

Prob 5: A Fink roof truss is loaded as shown in Fig 5. Use method of section to determine the force in members (a) *BD*, *CD*, and *CE* (b) FH, FG, GH. You may verify your answer by using method of joints.