Q23

A sphere of mass m_s rests on the smooth parabolic surface. Determine the normal force it exerts on the surface and the mass m_B of block B needed to hold it in the equilibrium position shown.

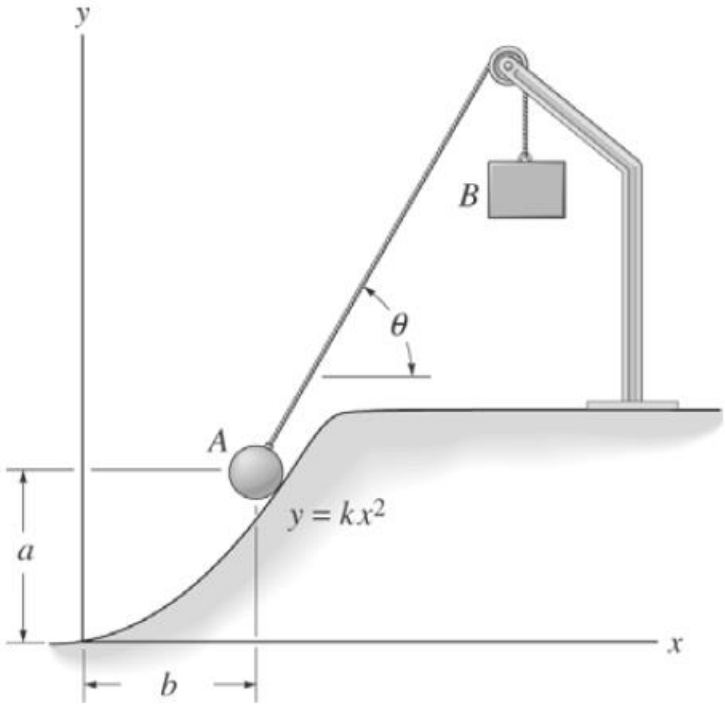
$m_S = 4$ kg

$a = 0.4$ m

$b = 0.4$ m

$\theta = 60$ deg

$g = 9.81 \dfrac{\text{m}}{\text{s}^2}$



Q24

The lamp has mass m_l and is supported by pole AO and cables AB and AC. If the force in the pole acts along its axis, determine the forces in AO, AB, and AC for equilibrium.

$m_l = 15$ kg

$a = 6$ m

$b = 1.5$ m

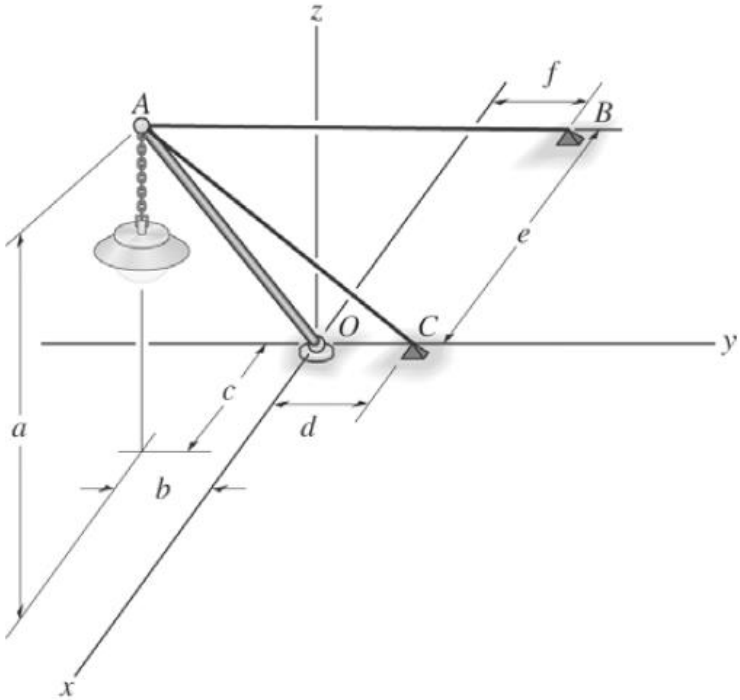
$c = 2$ m

$d = 1.5$ m

$e = 4$ m

$f = 1.5$ m

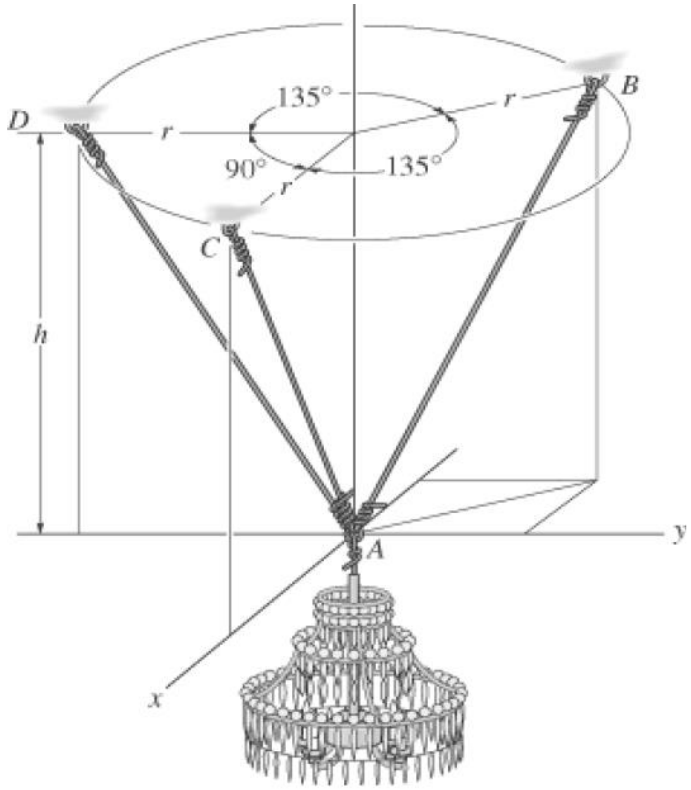
$g = 9.81 \dfrac{\text{m}}{\text{s}^2}$



Q25

The chandelier of weight W is supported by three wires as shown. Determine the force in each wire for equilibrium.

W=200 N
r=0.4 m
h=1 m



Q26

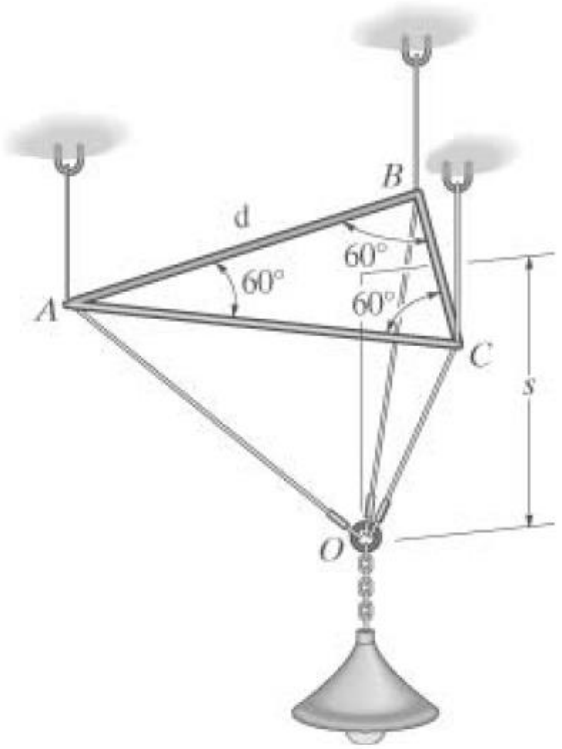
The triangular frame ABC can be adjusted vertically between the three equal-length cords. If it remains in a horizontal plane, determine the required distance s so that the tension in each of the cords, OA, OB, and OC, equals $\mathbf{F}$. The lamp has a mass M.

$F = 20$ N

$M = 5$ kg

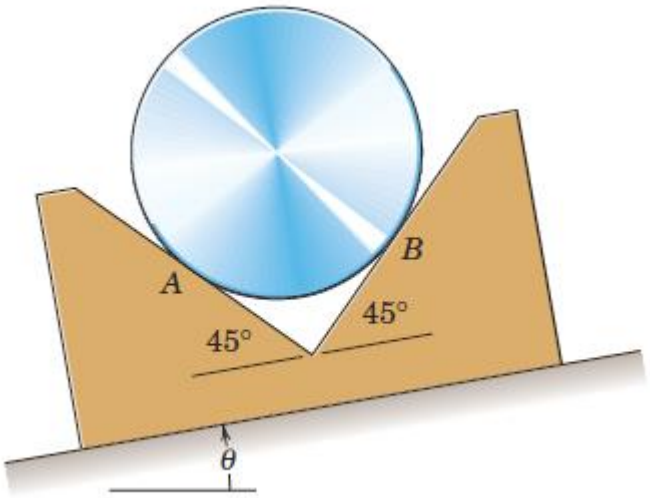
$g = 9.81 \frac{\text{m}}{\text{s}^2}$

$d = 0.5$ m



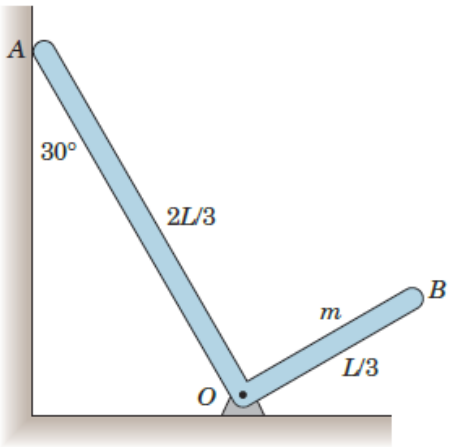
Q27

Find the angle of tilt θ with the horizontal so that the contact force at B will be one-half that at A for the smooth cylinder.



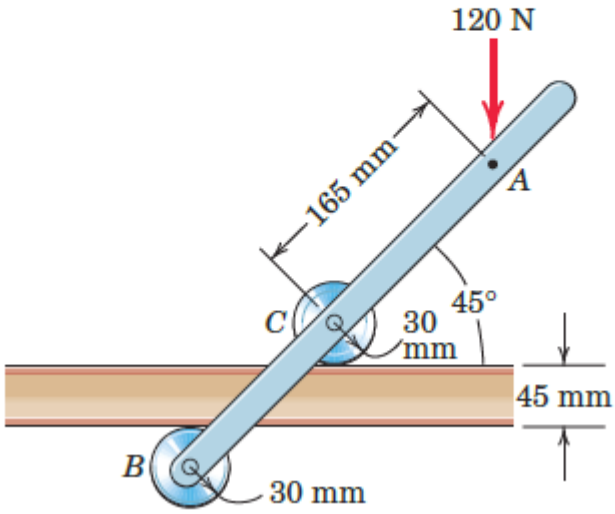
Q28

The right-angle uniform slender bar AOB has mass m. If friction at the pivot O is neglected, determine the magnitude of the normal force at A and the magnitude of the pin reaction at O.

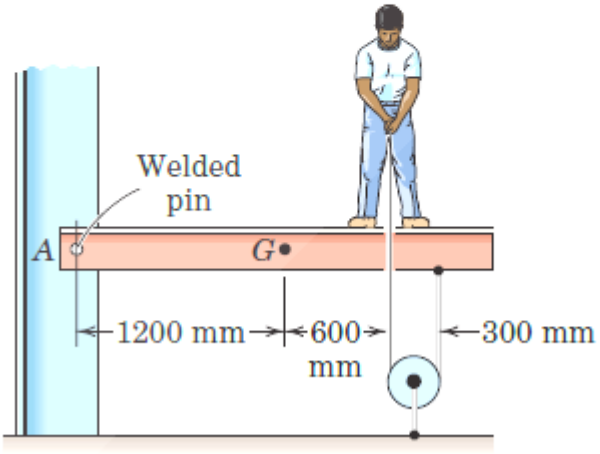


Q29

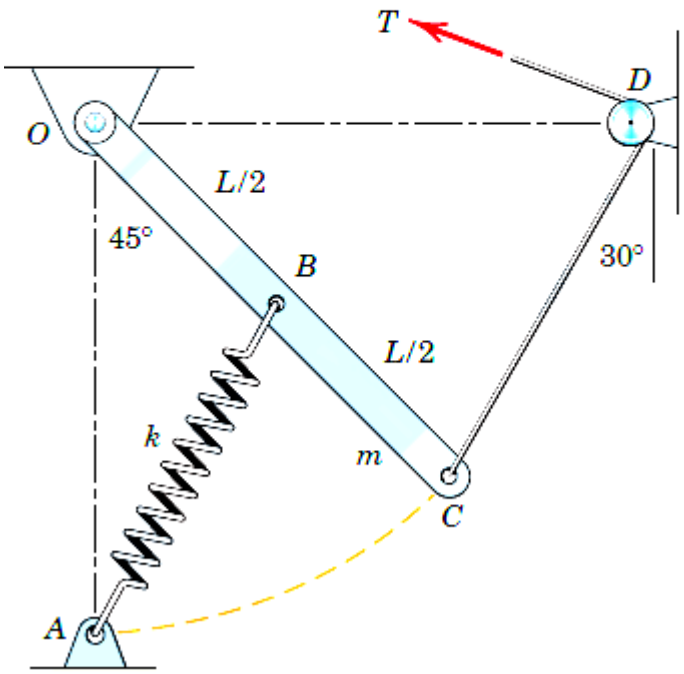
The device shown is designed to apply pressure when bonding laminate to each side of a countertop near an edge. If a 120-N force is applied to the handle, determine the force which each roller exerts on its corresponding surface.



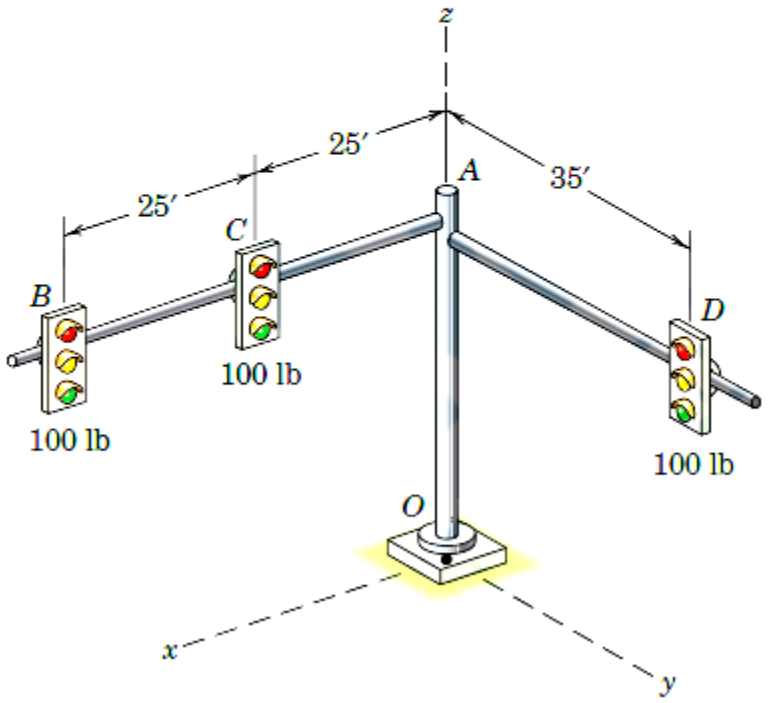
Q30 The pin A, which connects the 200-kg steel beam with center of gravity at G to the vertical column, is welded both to the beam and to the column. To test the weld, the 80-kg man loads the beam by exerting a 300-N force on the rope which passes through a hole in the beam as shown. Calculate the torque (couple) M supported by the pin.



Q31 The uniform bar OC of length L pivots freely about a horizontal axis through O. If the spring of modulus k is unstretched when C is coincident with A, determine the tension T required to hold the bar in the 45° position shown. The diameter of the small pulley at D is negligible.



Q32 The vertical and horizontal poles at the traffic-light assembly are erected first. Determine the additional force and moment reactions at the base O caused by the addition of the three 100-lb traffic signals B, C, and D. Report your answers as a force magnitude and a moment magnitude.



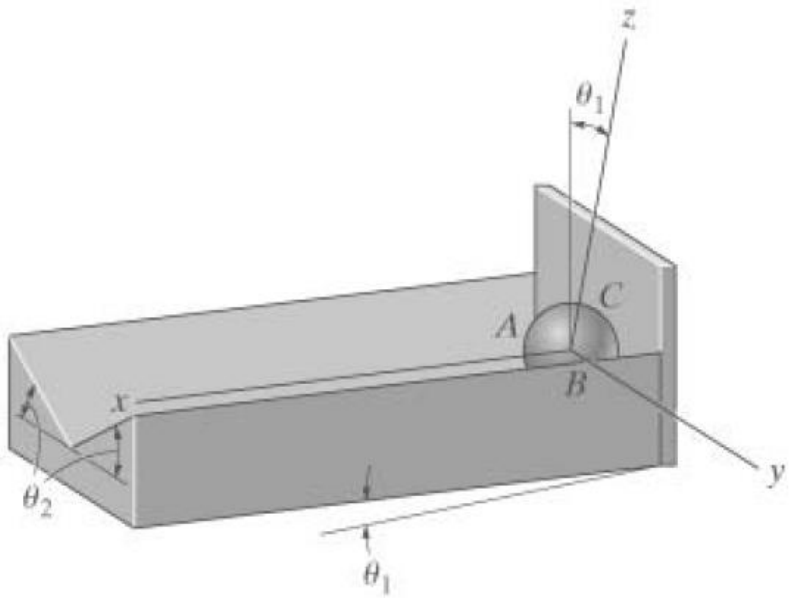
Q33

A ball of mass M rests between the grooves A and B of the incline and against a vertical wall at C. If all three surfaces of contact are smooth, determine the reactions of the surfaces on the ball. *Hint:* Use the x, y, z axes, with origin at the center of the ball, and the z axis inclined as shown.

$M = 2$ kg

$\theta_1 = 10$ deg

$\theta_2 = 45$ deg



Q34

Determine the tension in cables *BD* and *CD* and the *x*, *y*, *z* components of reaction at the ball-and-socket joint at *A*.

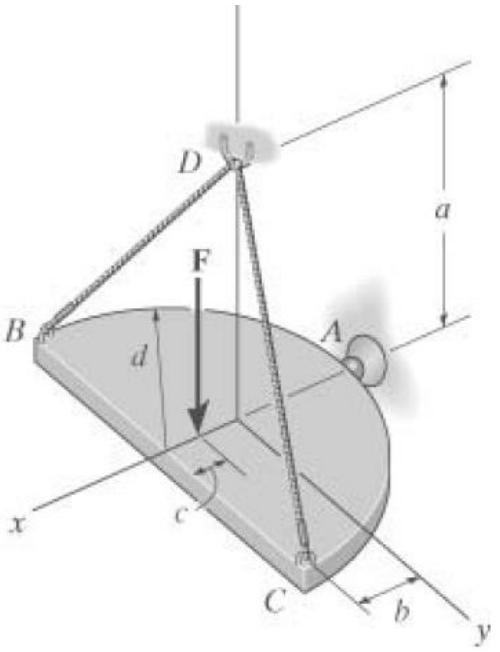
$F = 300$ N

$a = 3$ m

$b = 1$ m

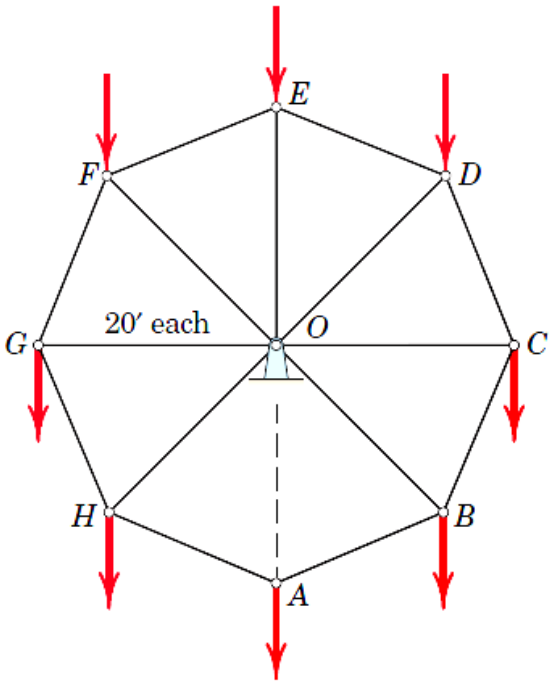
$c = 0.5$ m

$d = 1.5$ m



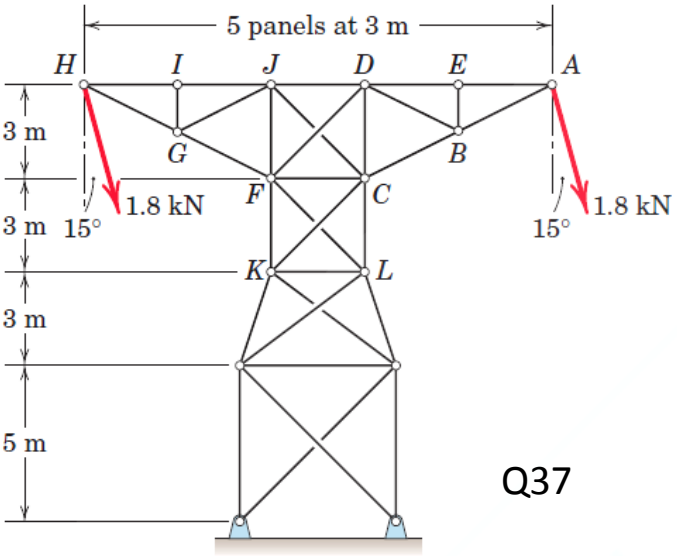
Q35

A small Ferris wheel is constructed of two identical trusses, one of which is shown. Member *AO* is temporarily removed for replacement. If the weight of the chairs and structural members results in a 100-lb load at each joint of the truss shown, determine the force in each member of the structure. With member *AO* replaced, could you repeat the analysis?



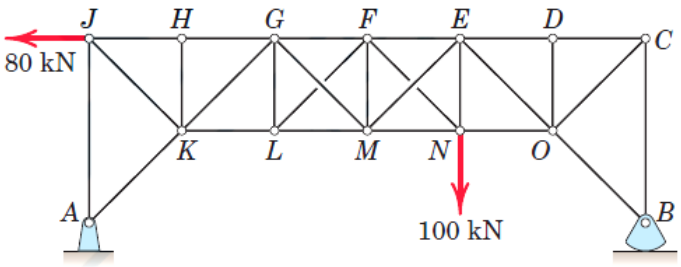
100-lb vertical force on each joint

Q36 The tower for a transmission line is modeled by the truss shown. The crossed members in the center sections of the truss may be assumed to be capable of supporting tension only. For the loads of 1.8 kN applied in the vertical plane, compute the forces induced in members *AB*, *DB*, and *CD*.



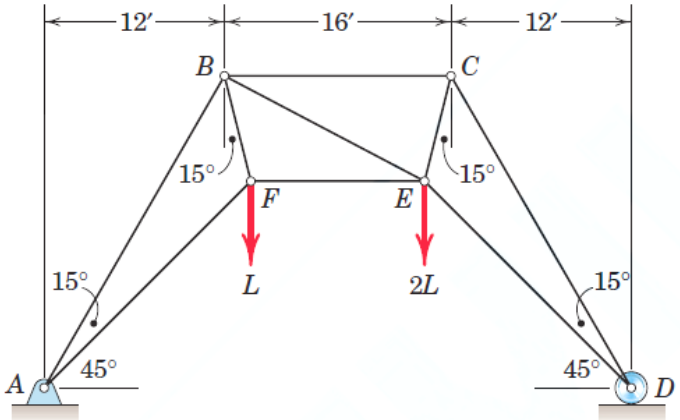
Q37

The truss shown is composed of 45° right triangles. The crossed members in the center two panels are slender tie rods incapable of supporting compression. Retain the two rods which are under tension and compute the magnitudes of their tensions. Also find the force in member *MN*.

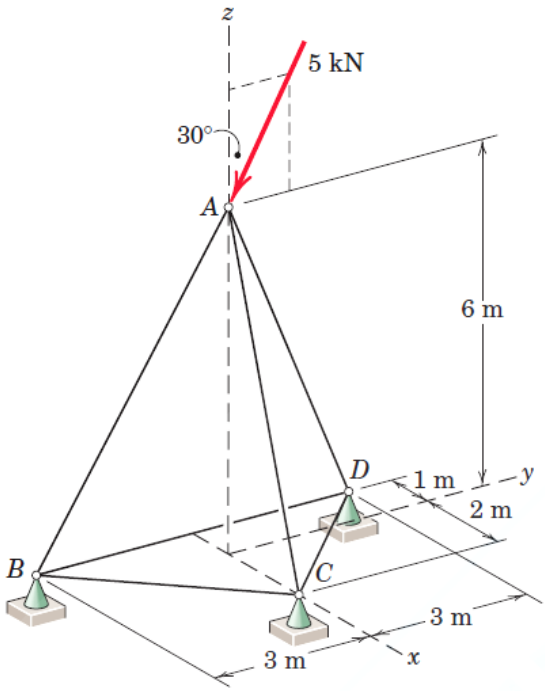


Q38

Determine the force in member *BE* of the loaded truss.

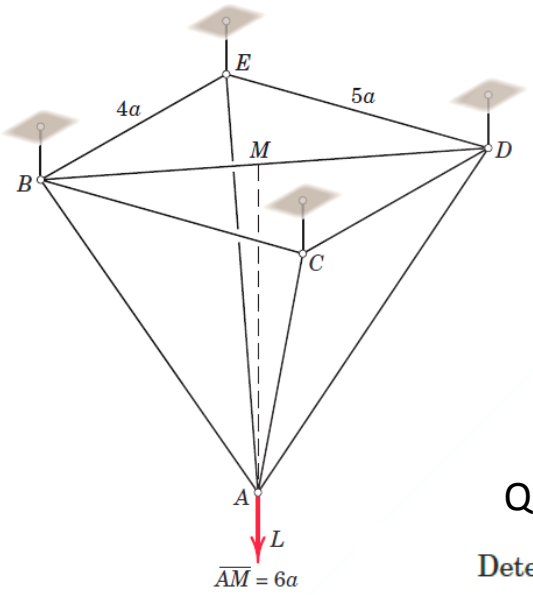


Q39 Determine the forces in members AB, AC, and AD.



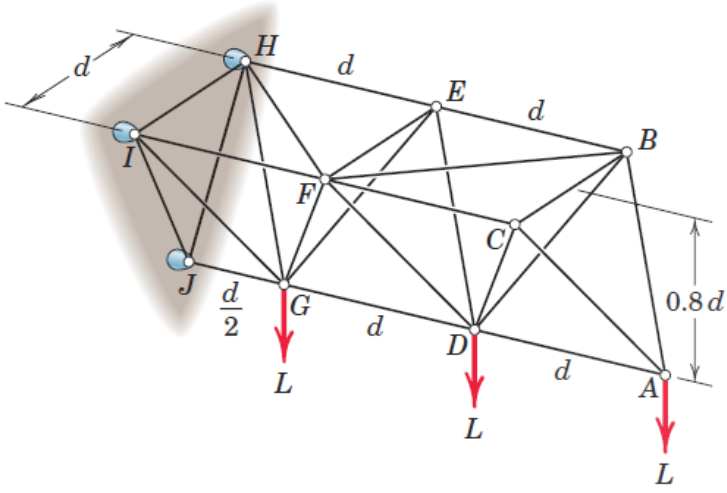
Q40

Determine the forces in members AC and BD of the inverted pyramidal truss with rectangular base. Point M is the midpoint of BD.

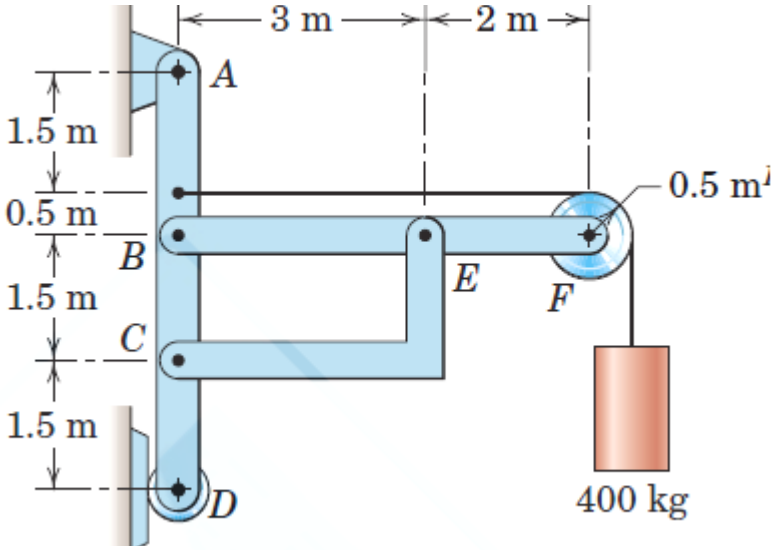


Q41

Determine the forces in members AD and DG.

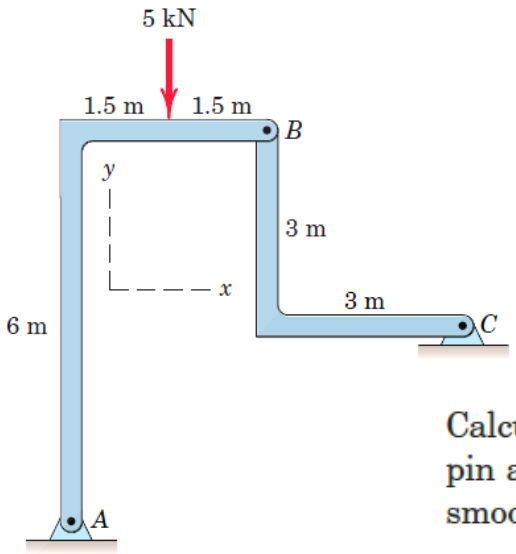


Q42 The frame supports the 400-kg load in the manner shown. Neglect the weights of the members compared with the forces induced by the load and compute the horizontal and vertical components of all forces acting on each of the members.



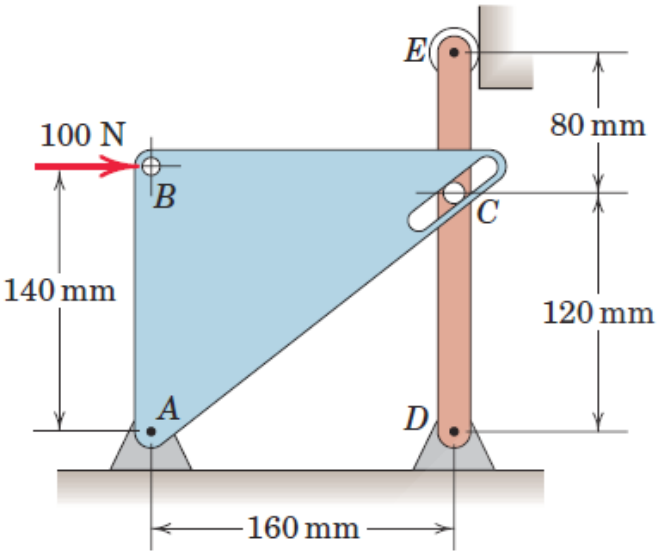
Q43

Determine the components of all forces acting on each member of the loaded frame.

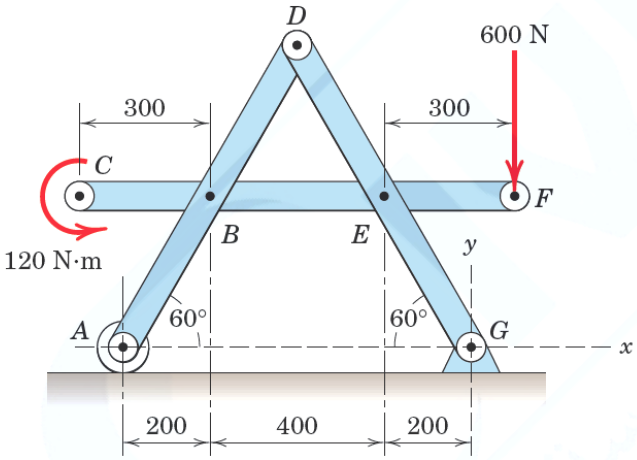


Q44

Calculate the magnitude of the force acting on the pin at D. Pin C is fixed in DE and bears against the smooth slot in the triangular plate.



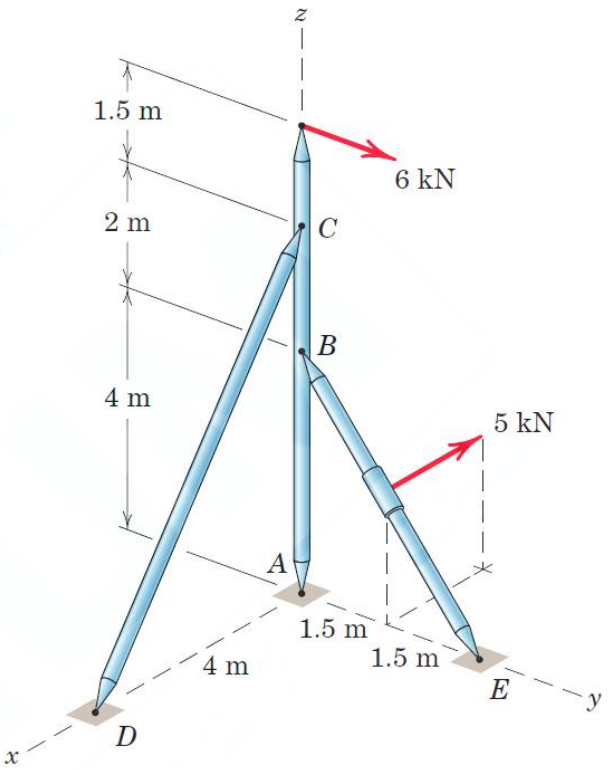
Q45 Calculate the x- and y-components of all forces acting on each member of the loaded frame.



Dimensions in millimeters

Q46

Determine the components of the reaction at A for the loaded space frame shown. Each connection may be treated as a ball-and-socket joint.



Q47

The compound beam is fixed supported at A and supported by rockers at B and C. If there are hinges (pins) at D and E, determine the reactions at the supports A, B, and C.

$a = 2$ m $\quad M = 48$ kN·m

$b = 4$ m $\quad w_1 = 8 \dfrac{\text{kN}}{\text{m}}$

$c = 2$ m

$d = 6$ m $\quad w_2 = 6 \dfrac{\text{kN}}{\text{m}}$

$e = 3$ m