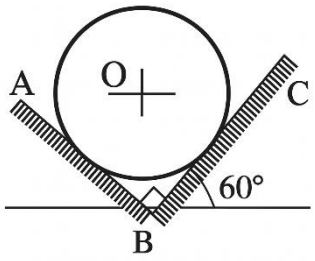
Solid Static

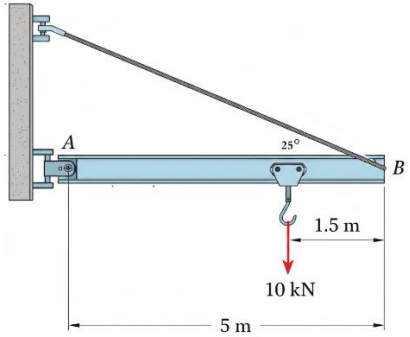
Exercise 01:

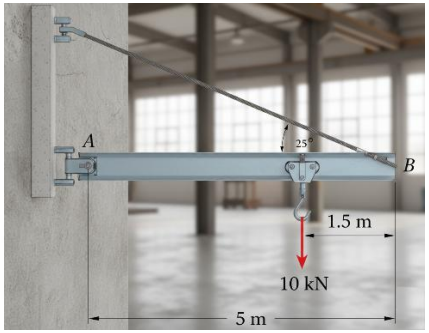
A homogeneous sphere with a weight of 12 kN rests on two smooth inclined planes AB and BC, which are perpendicular to each other (see figure). Knowing that plane BC makes an angle of 60° with the horizontal, determine the reactions exerted by the two inclined planes on the sphere.



Exercise 02:

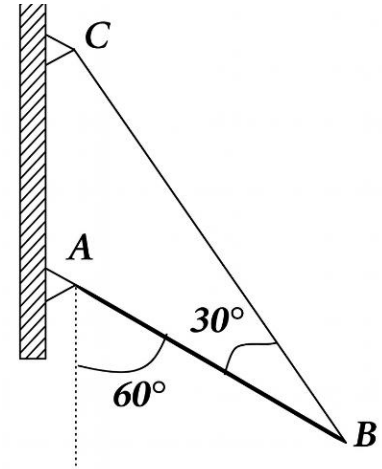
Determine the magnitude **T** of the tension in the supporting cable, and the reaction force (magnitude of the resultant force) at pin **A** for the jib crane shown. The beam **AB** is a standard 0.5-m I-beam with a mass of 95 kg per meter of length.

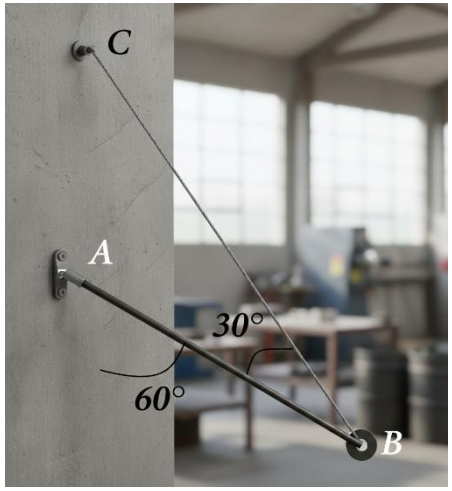




Exercise 03:

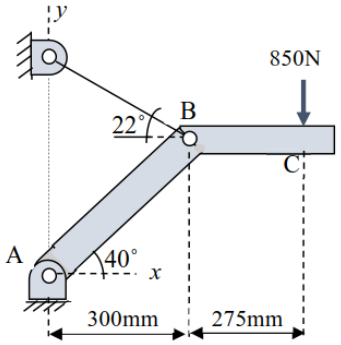
A homogeneous bar weighing 80 N is connected by a cylindrical hinge at its end **A** to a wall. It is held at an angle of 60° with the vertical by an inextensible, negligible-mass cable attached to the other end B. The cable makes an angle of 30° with the bar. Determine the tension in the cable and the reaction at point **A**.

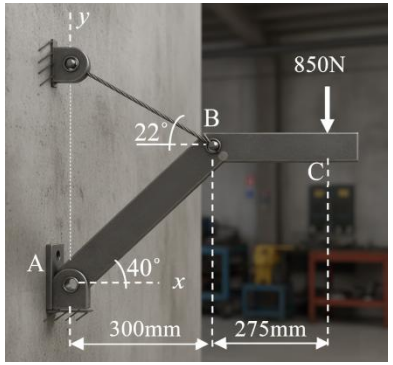




Exercise 04:

Determine the tension in the cable acting at point B, as well as the reactions at the double support A (magnitude and direction) required for the equilibrium of the body ABC (see adjacent figure).

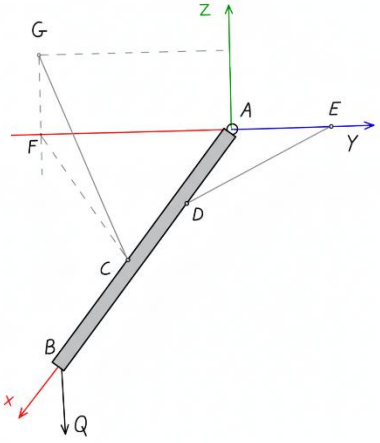




Exercise 05:

A homogeneous bar **AB**, of weight **P** and length **4a**, is fixed to a vertical wall by a **spherical hinge at A**.

The bar is kept **perpendicular to the wall** by cables **DE** and **CG**. Cable **DE** is horizontal, whereas cable **CG** is slightly inclined upward with respect to the horizontal.



At the free end **B** of the bar, a load of weight **Q** is attached.

Given: $AE = AD = DC = a, AF = 4a, FG = a$

1- Isolate the system and represent all external forces.

2- Write the equilibrium conditions of the system in vector form.

3- Determine the vector expression of each force in the $(\vec{\imath}, \vec{\jmath}, \vec{k})$ coordinate system. Deduce the three projected equilibrium equations.

4- Determine the moment vectors with respect to point A. Deduce the projected moment equilibrium equations.

5- If P=50N and Q=3kN, compute the tensions T_{DE} and T_{CG}. Deduce the reaction at point A

Exercise 06:

The ABC post, 6m long, is subjected to a force P, as shown in the adjacent figure. The post is held in a vertical position by a spherical hinge at A and by two cables BD and BE.

1- Isolate the ABC post and construct the Free Body Diagram (FBD).

2- In the coordinate system $(O; x; y; z)$, determine the components of: the tension T_1 in cable BE, the tension T_2 in cable BD, and the force P.

3- Write the **static equilibrium equations** of the ABC post.

4- From these equations, express **as functions of** P the components of the reaction at point A, as well as the tensions T_1 and T_2.