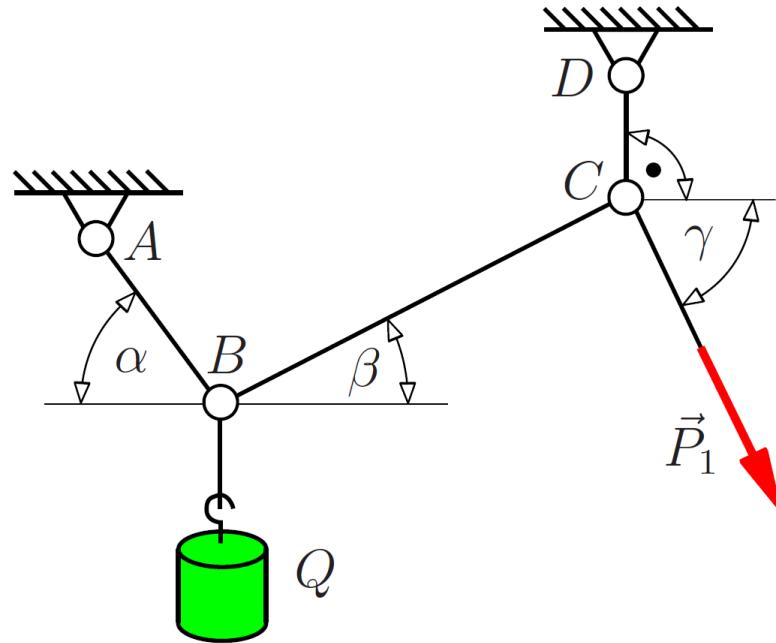Convergent system of forces – problems

1. The AB, BC and CD rods are connected to each other with joints and to the ground at points A and D. The mass Q was attached to the system at point B. Calculate forces in each of rods and value of force $P_1$ if the whole system is in balance as it is shown in the drawing. Data: Q = 100 [kg], $\alpha = 60°$, $\beta = 30°$, $\gamma = 45°$ Unknowns: $F_{AB}$, $F_{BC}$, $F_{CD}$, $P_1$.



2. The rectangular plate is attached to the ground at point A by the rope and to the weight at point B. Find what weight Q has been attached to the end of the rope passed through the roll at point C and the reaction at point A to balance the force P1 acting in the center of the plate. Data: $P_1$ = 300 [N], $\alpha$=45° Unknowns: Q, $R_A$.
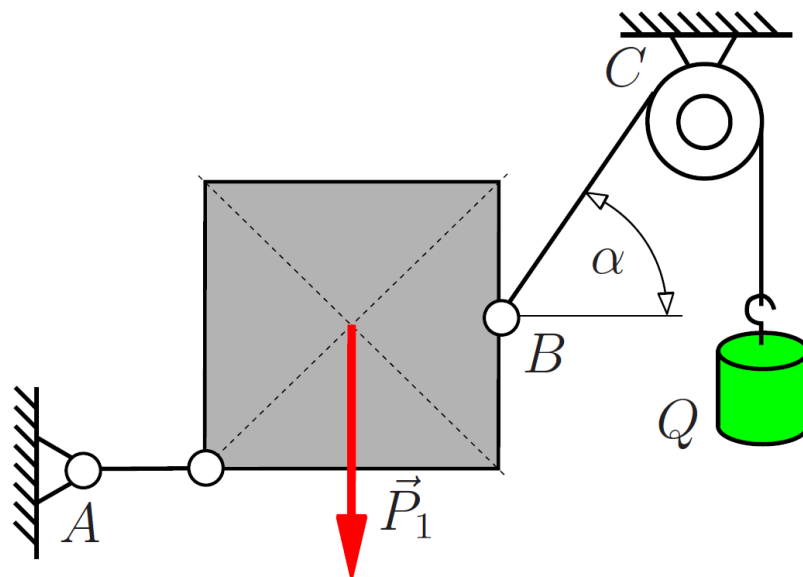
3. The stiff rod was connected to the ground at point A by the joint and to the rope at point B. Additionally at point B mass Q was attached. Calculate the value of the force P1 and the forces in the other rods and ropes SAB, SBC, SCD if the system is in equilibrium as in the drawing. Data: Q = 300 [kg], $\alpha$ = 30°, $\beta$ = 45° Unknown: $P_1$.
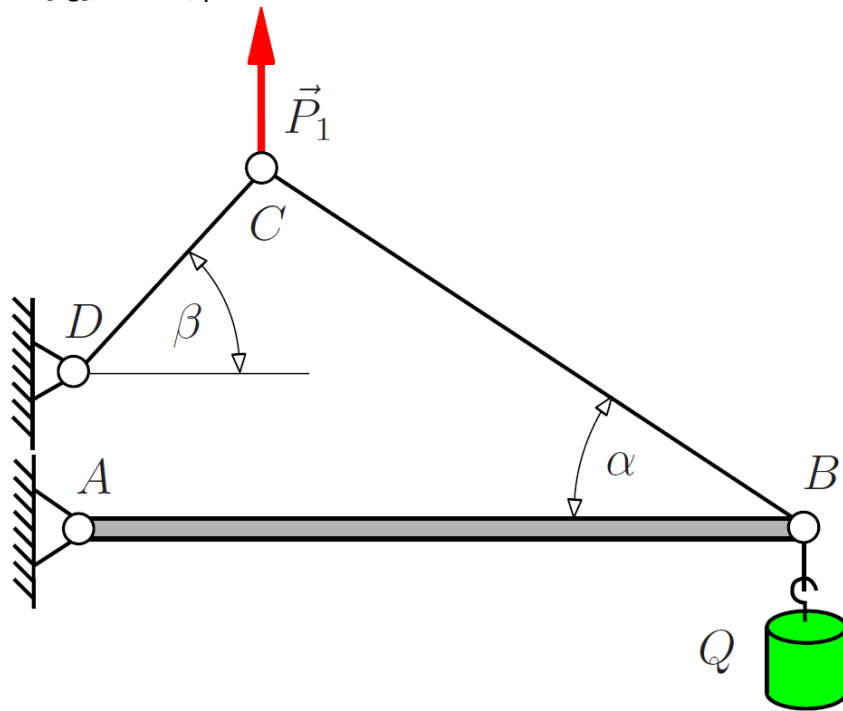


4. The wheel under load $P_2$ keeps on an inclined plane at an angle $\beta$ thanks to a set of rods. AB and BC rods are connected to the ground and the wheel by the joints and mutually at point B. Calculate the value of force $P_1$, which keeps the whole system in position as shown in the figure. Data: $P_2$ = 120 [N], $\alpha$ = 30°, $\beta$ = 15°, $\gamma$ = $\alpha$ Unknown: $P_1$.