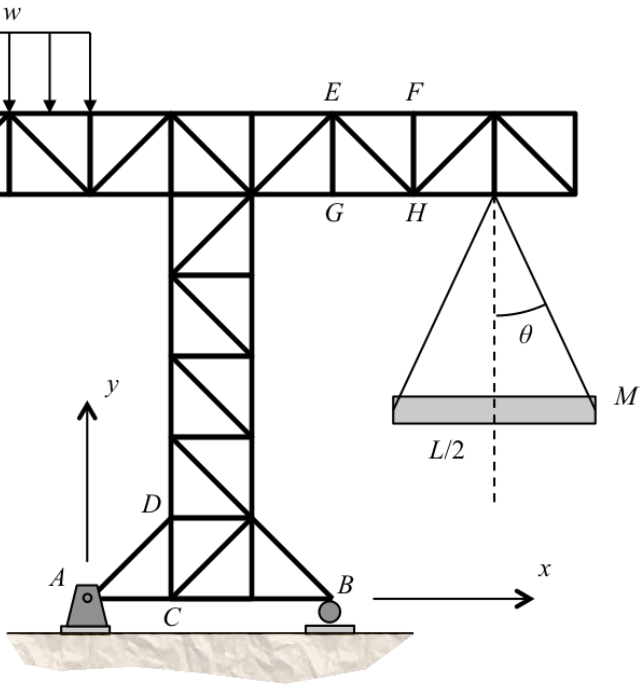
Problem 1

Consider the following crane, where

- all links are connected by pins except where the crane connects to the ground at points A (pin) and B (roller);
- all vertical and horizontal links have a length of 2 m;
- a beam of length $L = 5$ m and mass $M = 300$ kg is hoisted by two cables close to one end; the cables form an angle $\theta = 30°$ with the y-axis (note: take gravity as 10 m/s^2);
- a counterweight exerts a constant distributed load $w = 1.125$ kN/m at the other end.

1) Find the forces in members AC, EF, EH, and GH and state if these members are in tension or compression.
2) Extra credit: Assuming that you can represent the constant distributed load with a concentrated resultant force, how many zero-force members are there (state the number and show them on the diagram by drawing a circle in their middle)?



Problem 2

Consider the beam shown below: it is supported by a pin at B and a roller at C; a constant distributed load w is acting on the beam from points A to B and a second linear distributed load is ranging from 0 at point C to $2w$ at point D. The beam will fail if the maximum bending moment reaches M_{max} = 18 kN m or the maximum shear reaches V_{max} = 6 kN.

1) Express the internal shear force, normal force, and bending moment as functions of x for sections AB and BC.
2) Draw the internal shear force and bending moment diagrams for the entire length of the beam.
3) Extra credit: Determine the largest load distribution w that the beam can support.