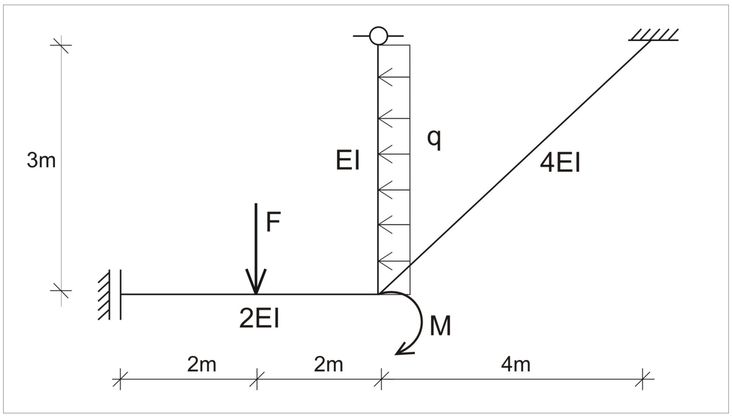
Task 2.

Create the primary structure of the Displacement Method, implement it into Robot and then read the value of coefficient: k_{10}.



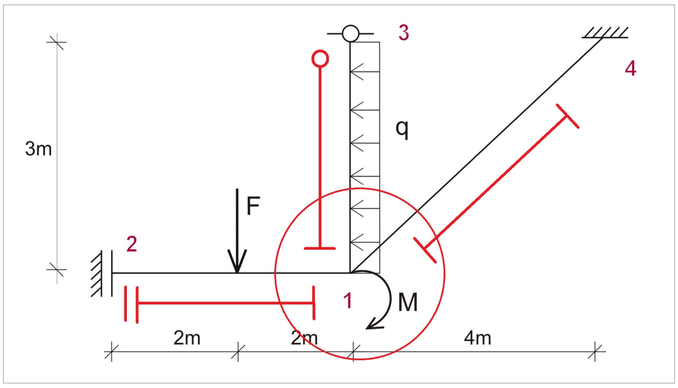
F = 10 kN
q = 20 kN/m
M = 30 kN m

1. At first we need to designate the degree of kinematical indeterminacy.

$n_g = n\Delta + n\varphi$

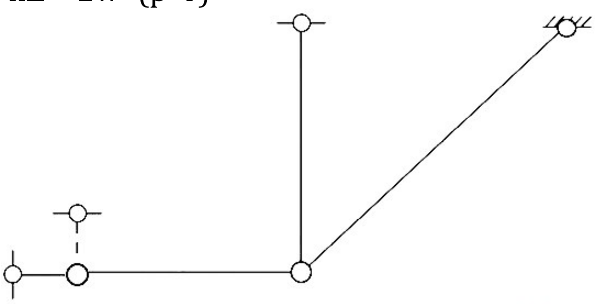
We will start from designating $n\varphi$.
$n\varphi$ - is the number of unknown rotations, which is equal to the number of fixed nodes (without support nodes)

In this case there is one fixed node and therefore $n\varphi$ is equal to 1.



Now we need to calculate $n\Delta$. We will use formula $n\Delta = 2w - (p+r)$. We can do it in the pin-jointed model. In this model every support is a pin support. In every node we need to implement a hinge. In the case of cantilever or a glade support we need to add an extra constraints, as is the case in this example (marked with the dashed line):

$n\Delta = 2w - (p+r)$

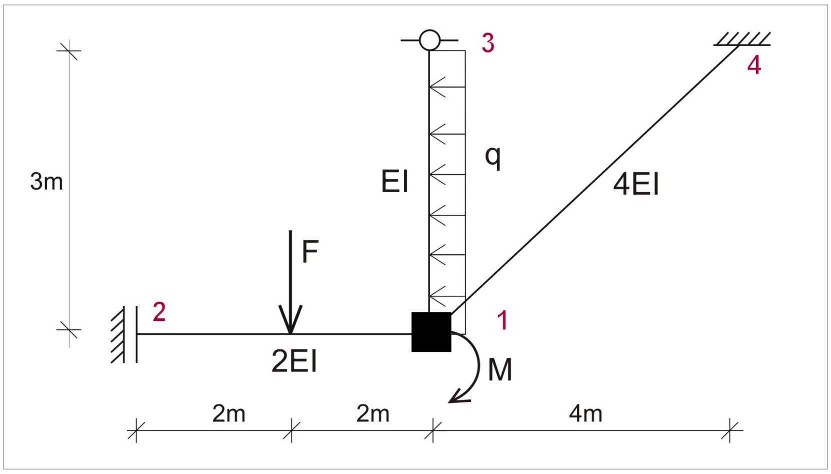


w = 6 (number of nodes = number of circles)
p = 5 (number of bars = number of lines)
r = 8 (number of support reactions - 5 x 2 reactions)

$n\Delta = 2 \times 6 - (5+8) = -1$

This means that there is no displacements.

The primary structure will have the following form:



Please note that it is very important to number all the nodes starting from those where the new constraints are located (black squeres).

Now implement this primary structure into Robot.
Create two load cases:
1. SW
2. ML

Now solve the structure and read the values of coefficients k_{10}, and k_{20}.

The values of these coefficients are as follows:
k_{10} = 7,5 kNm