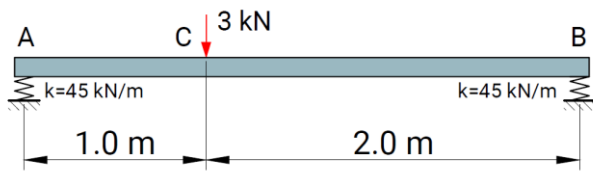# Problem 3

Figure

A
C | 3 kN
B
k=45 kN/m
k=45 kN/m
1.0 m
2.0 m

Description

A steel bar is supported at its ends, A and B, by two identical vertical springs. Each spring has a stiffness of k = 45 kN/m and is initially unstretched. A vertical load of 3 kN is applied at node C, located 1 m from end A and 2 m from end B. Neglect the weight of the bar and use the material properties of steel (E = 200 000 kN/m^2, I = 4.6875×10^{-6}m^4).

Determine:

- Vertical displacement of node C.

Model

Units:	m, kN
Element:	Beam element
Material:	Steel, E = 2.0×10^8 kN/m^2
Section property:	Beam: I = 4.6875×10^{-6}m^4
Constraints:	Ux restrained, Uy – spring with ky = 45 kN/m
Load Case:	Beam concentrated load –3 kN are applied at nodes C in the Y direction.

Results

-3.00 kN
max: -44.444
max: -38.459
22.222

Project Title:			Untitled Project	
Load Case/Combination:			LC0 - Default Case	
Units:			m	
Element	x/L	Ux	Uy	Ur
1	0	0	-0.04444	0.00563
1	1	0	-0.03846	0.006696
2	0	0	-0.03846	0.006696
2	1	0	-0.02222	0.00883

Comparison of Results

Node	Deformation, mm		
	Theoretical	RodX	Midas/Civil
Δy(C)	−38.5	−38.5	−38.5

Reference

1. Hibbeler R. C, Mechanics of Materials, 10th Edition in SI units, 2017, Pearson, example 12.16, p.648