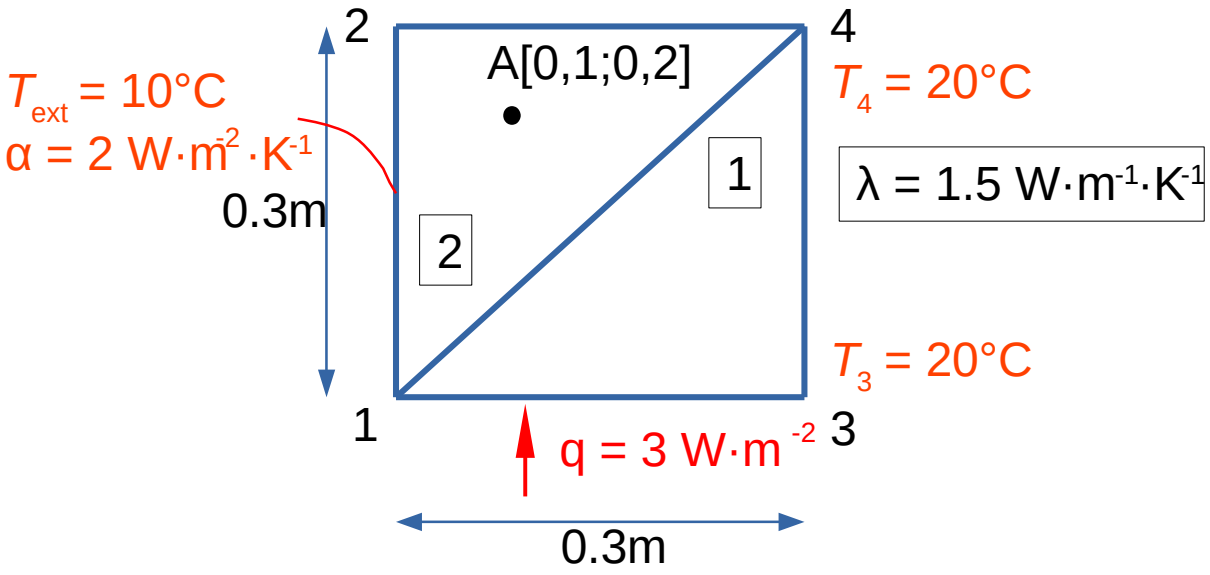
Final exam – Numerical analysis of structures

1) a) Determine temperatures at all nodes for 2D heat transfer problem - steady state.

b) Determine temperature at point A for given temperatures T_1 = 10˚C and T_2 = 15˚C, T_4 = 10C.



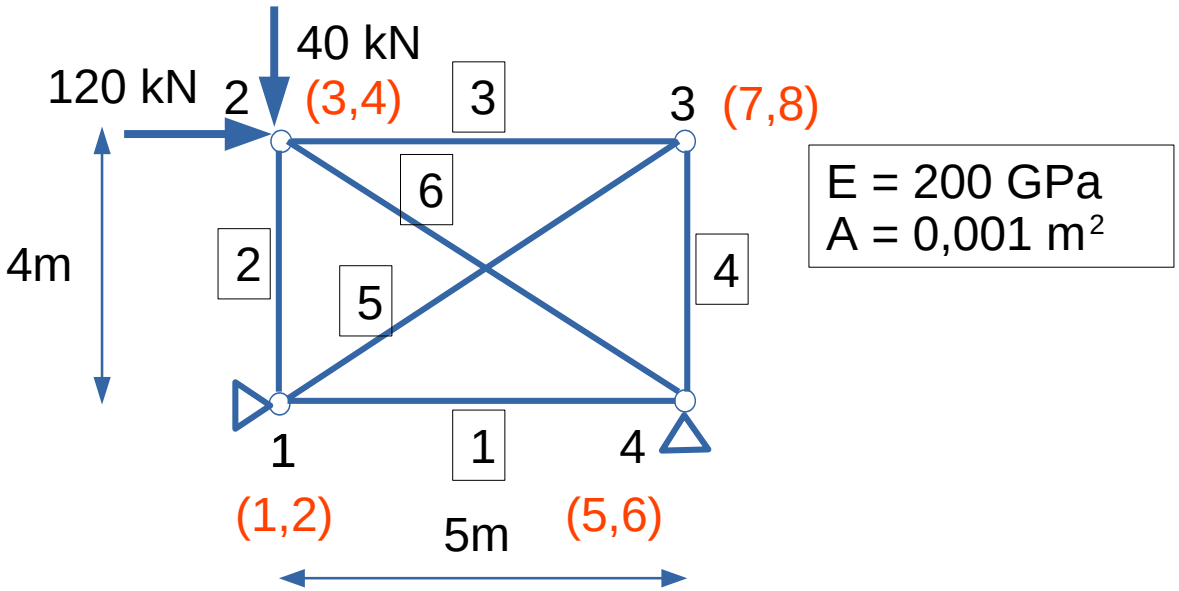
2) a) Determine the 5th row of the stiffness matrix for the truss structure.

b) Determine the right-hand side vector for:

- force loading
- prescribed displacement u_3 = 1mm
- temperature loading (uniform temperature change) of bar No. 5

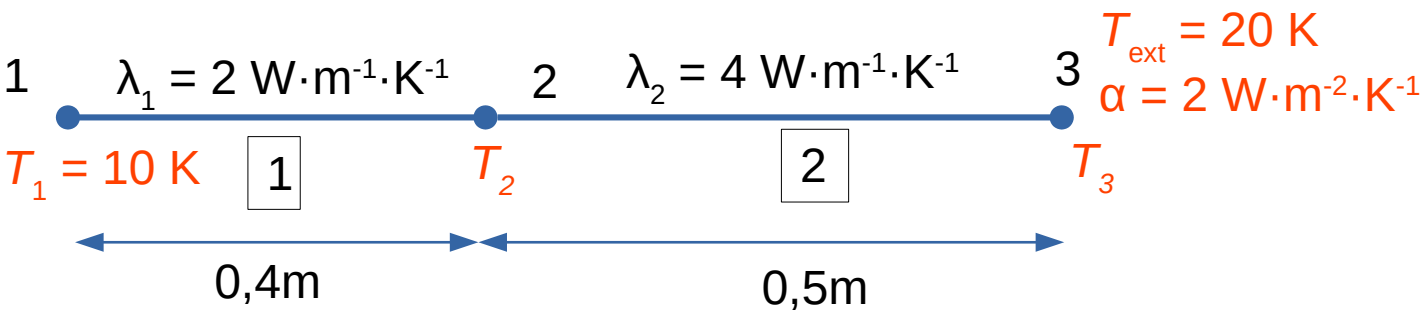
ΔT = 10 °C, α = 12·10^{-6}K^{-1}

c) Determine the axial force of bar No. 6 for given displacements u_2 = -0.002m and v_2 = 0.0005m.



Final exam – Numerical analysis of structures

3) 1D heat transfer problem – non-stationary problem:
a) Determine the temperature profile in steady state.
b) Calculate nodal temperatures for the first two time steps t_1 a t_2 in the time-dependent problem (non-stationary). For time discretization, use the finite difference method with Δt = 1s, ρ = 10, c = 1, τ = ½. The initial temperature is t_0 = 10 K.



4) The wall is discretized by two triangle elements (thickness h=0,4 m). Determine:
a) both displacements at node No. 4 (horizontal u_{4x} and vertical u_{4y})
b) strain vector at point A for given displacements:
$u_{1x} = u_{1y} = u_{3y} = 0$; u_{3x} = 1mm, u_{4x} = 2mm, u_{4y} = -0,5mm