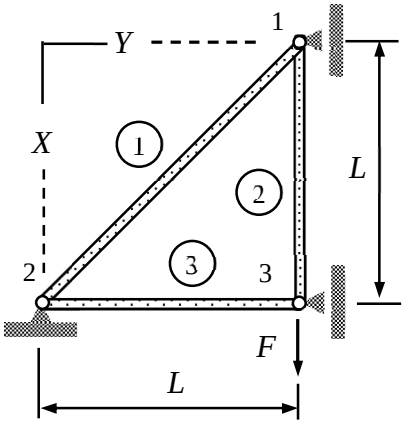
Name_____ Student number_____

Problem 1

The structure shown consists of three elastic bars connected by joints and a point force acting on node 3. Young's modulus of the material is E. The cross-sectional area of bars 2 and 3 is A and that for bar 1 $\sqrt{2}A$. Determine the displacement components u_{X1} and u_{X3}.



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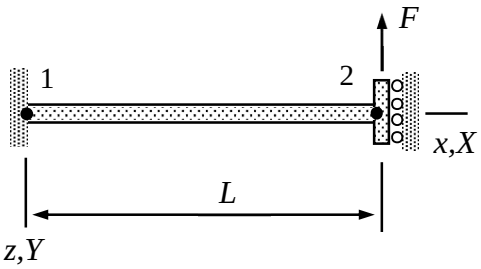
Problem 2

Determine the displacement u_{Y2} of the beam shown at the support of the right end, which allows transverse displacement but not rotation. Young's modulus E of the material and the second moment of cross-section $I_{yy} = I$ are constants. Use the virtual work density expression and a cubic approximation to the transverse displacement.



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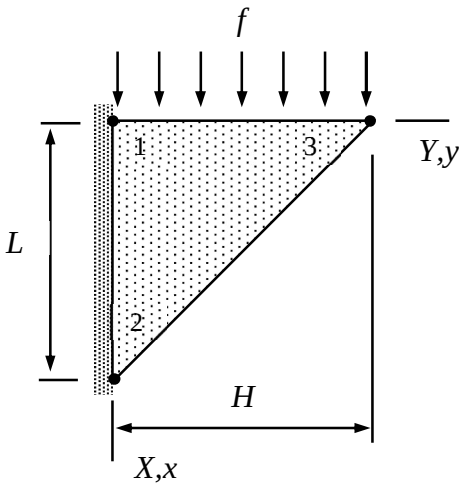
Problem 3

Triangular shelf supports, placed at the ends of the shelf, are loaded by the weight of the shelf of mass m. The supports are rigidly attached to a wall, and the distributed force f due to the weight of the shelf is constant. Derive the virtual work expression δW for a shelf support, and solve for the nodal displacements. Use the thin slab model under the plane stress assumption and a linear approximation on a triangle element. The material parameters E, ν and thickness t are constants. Omit the self-weight of the shelf support.



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Problem 4

A circular plate of radius R, which is simply supported on the outer edge, is loaded by force F at the centerpoint. Use the plate bending mode virtual work density of the Kirchhoff plate model to find the transverse displacement at the centerpoint. Use the approximation $w = a_0(x^2 + y^2 - R^2)$ to the transverse displacement. Material properties E, ν and thickness t are constants.