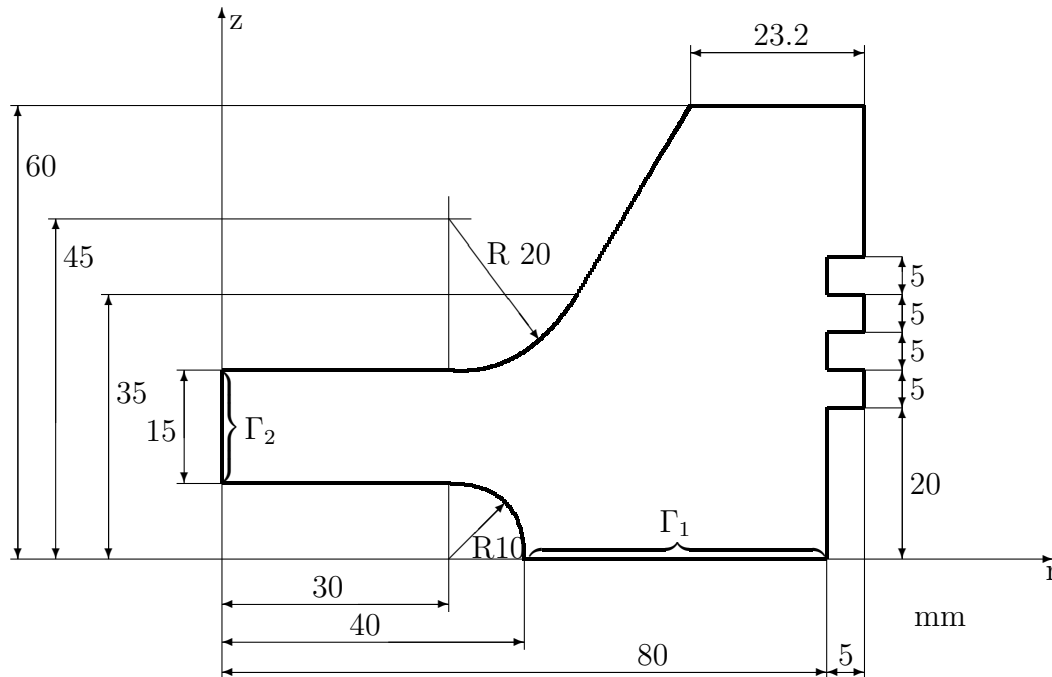


## PA03 “PISTON”: Head conduction

Compute the temperature field in the following body that is rotationally symmetric (the rotated area  $\Omega$  is sketched below). On part  $\Gamma_1$  of the boundary, the temperature is prescribed by  $280^\circ\text{C}$ . On  $\Gamma_2$  there holds  $\frac{\partial u}{\partial n} = 0$  due to the symmetry. On the rest,  $\Gamma_3$ , there occurs heat flux with the surrounding, the temperature outside is  $20^\circ\text{C}$ .



The material parameters are given by  $\lambda = 0.159 \frac{\text{W}}{\text{mm}\cdot\text{K}}$  and  $\alpha = 4.06 \cdot 10^{-5} \frac{\text{W}}{\text{mm}^2\cdot\text{K}}$ .

### Tasks:

- Derive the mathematical model. If possible use symmetries or reduction in the dimension
- Give the variational formulation
- Analysis: discuss existence and uniqueness of solutions
- Discretize the domain  $\Omega$
- Numerical analysis: provide an error estimate
- Choose a solver for the system of equations you obtain
- Implementation
- Visualize the results and (if possible) compare them to analytical solutions

- 1 Mathematical model
- 2 Variational formulation
- 3 Analysis
- 4 Discretization
- 5 Solver
- 6 Numerical analysis
- 7 Implementation
- 8 Numerical results