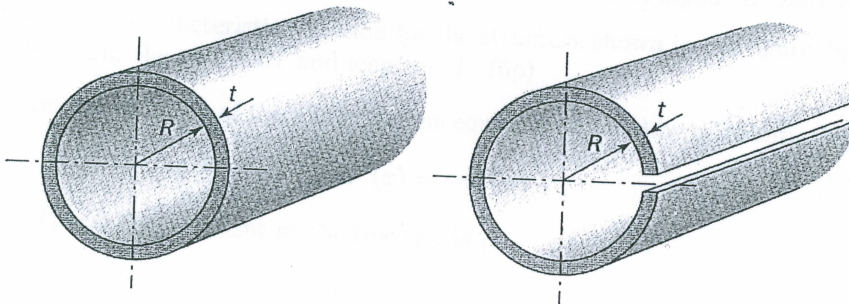


Answer to each five (5) problems. Write your name and student number to every sheet. Return every sheet, including this exam sheet and empty sheets.

**Problem 1.** Give a short answer to the following questions: / Define shortly the following terms:

- When is buckling elastic and when plastic? (1p)
- The critical force for a simply supported beam  $P_{cr} = n^2 \pi^2 EI / L^2$ . What is the meaning of  $n$  in the equation? (1p)
- Why cannot the Coulomb torsion be used for a rod with an arbitrary cross-section? (One reason is sufficient) (1p)
- What is/are the boundary terms for de Saint Venant's torsion? (1p)
- Curving of the cross-section in torsion. (1p)
- Sketch the shear stress field for the profiles in the figure, when torque  $T$  is applied to the beams. (1p)



Kuva 1: Figure of problem 1 f