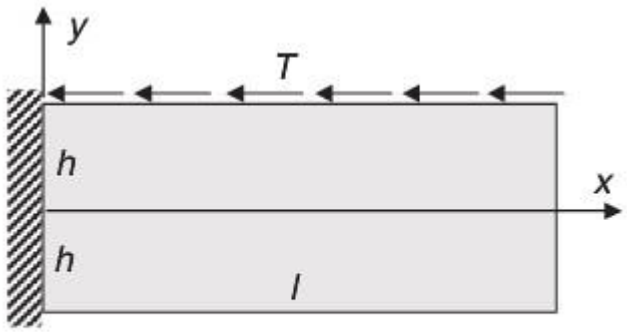
MCE 571 – Homework # 6

Textbook problems 5-1d, 7d, 12 (not collected)

5.1 Using Cartesian coordinates, express all boundary conditions for each of the illustrated problems.



(d)

5.7 As mentioned in Section 5.6, Saint-Venant's principle will allow particular boundary conditions to be replaced by their statically equivalent resultant. For problems (b), (c), (d), and (f) in Exercise 5.1, the support boundaries that had fixed displacement conditions can be modified to specify the statically equivalent reaction force and moment loadings. For each case, determine these reaction loadings and then relate them to particular integrals of the tractions over the appropriate boundary.

5.12 Using the inverse method, investigate which problem can be solved by the two-dimensional stress distribution $\sigma_x = Axy$, $\tau_{xy} = B + Cy^2$, $\sigma_y = 0$, where A, B, and C are constants. First show that the proposed stress field (with zero body force) satisfies the stress formulation field equations under the condition that $C = -A/2$. Note that for this two-dimensional plane stress case, the Beltrami–Michell compatibility equations reduce to the form given by (7.2.7). Next choose a rectangular domain $0 \leq x \leq l$ and $-h \leq y \leq h$, with $l \gg h$, and investigate the interior and boundary stresses. Finally use strength of materials theory to show that these stresses could represent the solution to a cantilever beam under end loading. Explicitly determine the required constants A, B, and C to solve the beam problem.