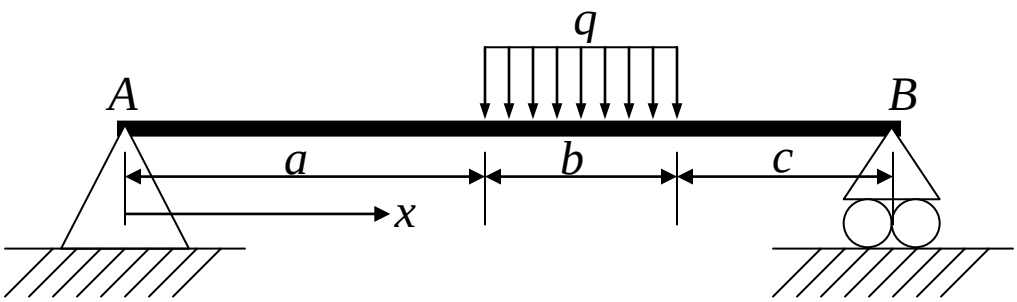
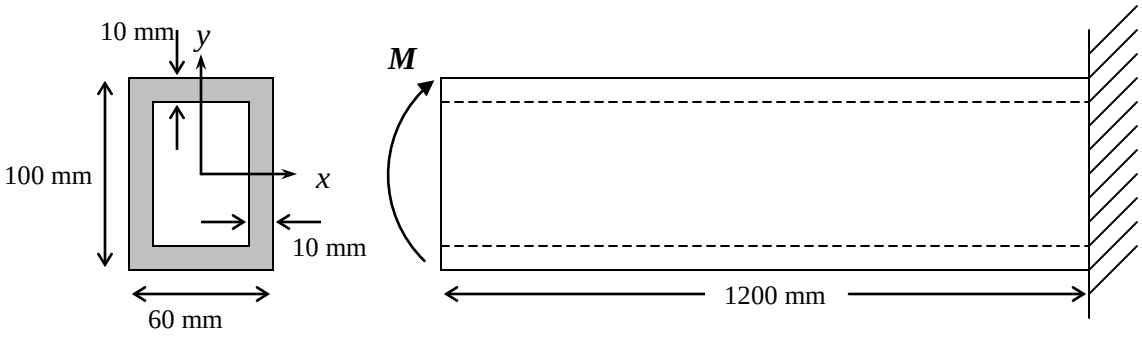
Problem1

Construct the shear-force and bending-moment diagrams for a simple beam with a uniform load of constant intensity q acting over part of the span. Clearly show all solution details. Note: L = beam length = $a+b+c$



Problem 2

The rectangular hollow tube shown is made of an elastic material (Young's modulus 70 GPa and Poisson's ratio 0.3), and is undergoing pure bending.



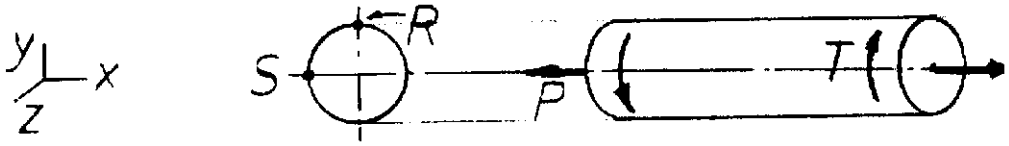
(a) Determine the moment of inertia I_x, by using $I_x = \int_A y^2 dA$ (not by memorizing formula).

(b) If the maximum allowable stress is 50 MPa, what will be the maximum bending moment allowed?

(c) What will be the radius of curvature of this tube under such bending? (Derive the formula first if you wish.)

Problem3

A straight, round rod is subjected to the loads shown (*P* and T). These loads generate the following stresses: *P/A* = 4 kpsi and *Tc/J* = 3 kpsi.



(a) Is there any torsional shear stress at the center of the rod (due to the loads shown)? Briefly explain.

(b) Consider a stress element at point *S* (see side view) on the surface of the rod and show stresses that are present on this element.

(c) Would the stress element corresponding to point *R* at top of the rod look any different than the element for point *S*? Why?

(d) Draw the Mohr's Circle for your stress element (point *S*).

(e) Find the principal normal stresses.

(f) Find the maximum principal shear stress.

(g) Is there any transverse shear stress present in this rod due to the loads shown? What kind of load would generate this stress?