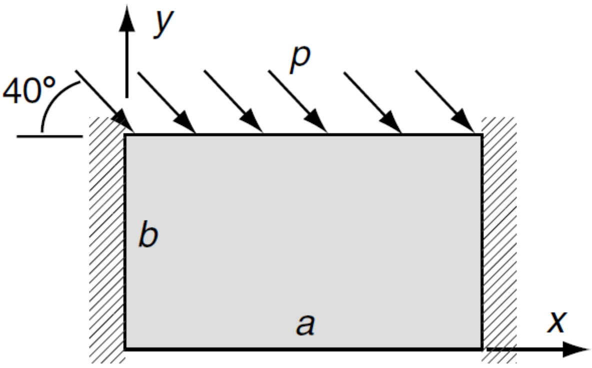
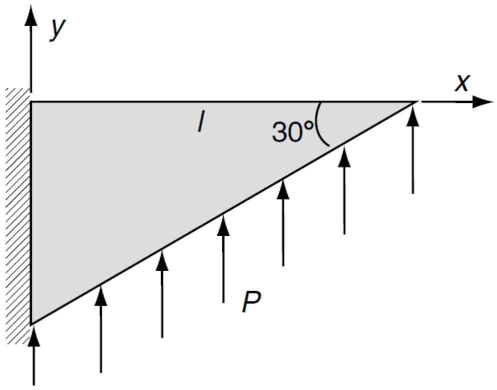
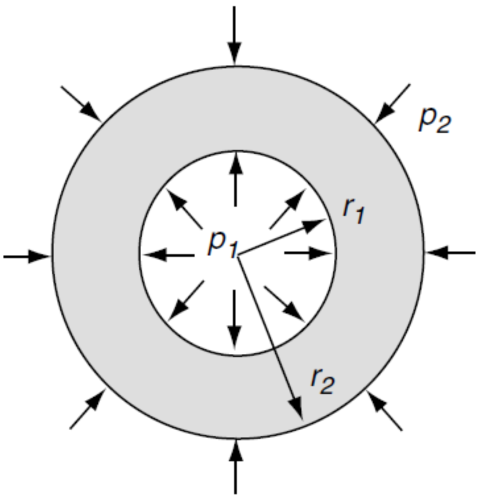
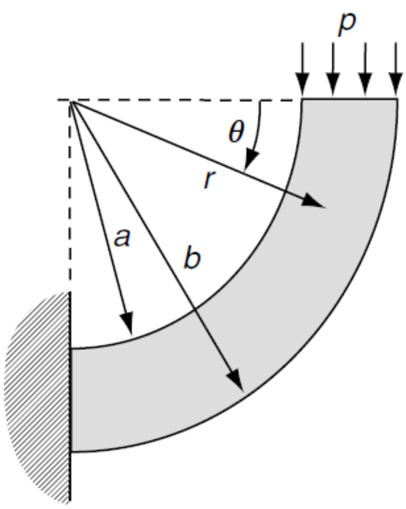
1. Express all boundary conditions for each of the problems illustrated in the following figure.









2. Go through the details and explicitly develop (a) the Beltrami-Michell compatibility equations and (b) the Navier equations.

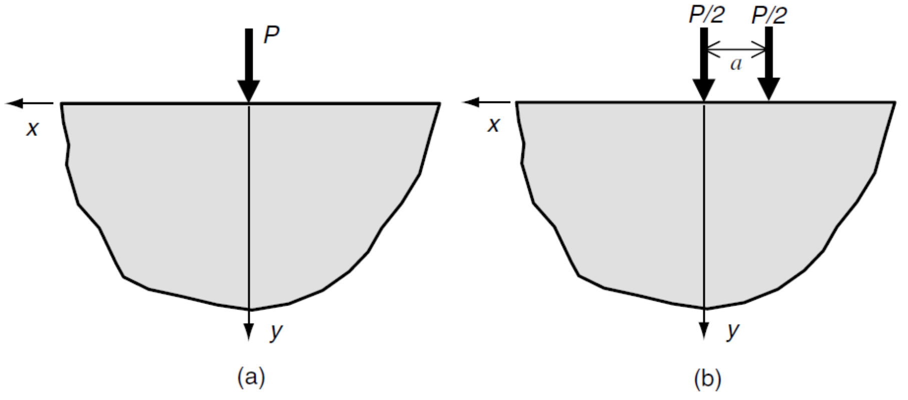
3. For an arbitrarily shaped elastic medium subjected to a uniform pressure p on all boundaries (including holes), show that the following stress state satisfies all field equations and the traction boundary conditions. Thus, this stress state is the correct solution of the present problem by the uniqueness principle.

$$\sigma_x = \sigma_y = \sigma_z = -p, \quad \tau_{xy} = \tau_{xz} = \tau_{yz} = 0.$$

4. Consider the problem of a concentrated force acting normal to the free surface of a semi-infinite solid as shown in case (a) of the following figure. The two-dimensional stress field for this problem is given by

$$\sigma_x = -\frac{2Px^2y}{\pi\left(x^2+y^2\right)^2}, \sigma_y = -\frac{2Py^3}{\pi\left(x^2+y^2\right)^2}, \tau_{xy} = -\frac{2Pxy^2}{\pi\left(x^2+y^2\right)^2}$$

Using this solution with the method of superposition, solve the problem with two concentrated forces as shown in case (b). Because problems (a) and (b) have the same resultant boundary loading, explicitly show that at distances far away from the loading points the stress fields for each case give approximately the same values (Saint-Venant Principle).



5. (Optional) Using MATLAB or a similar tool, explicitly plot and compare σ_y and τ_{xy} for each case in the previous problem on the surface $y = 10a$ and $y = 100a$.