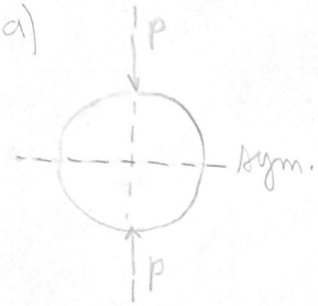
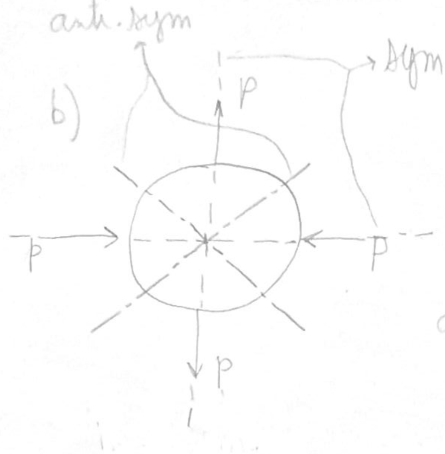
Assignment 2.1

1)

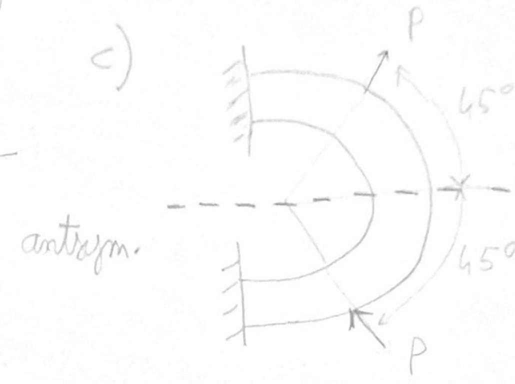
a)



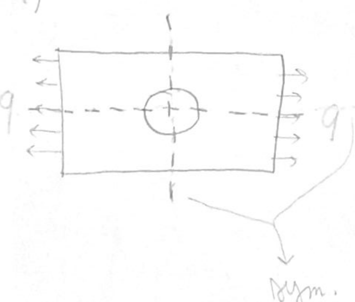
b)



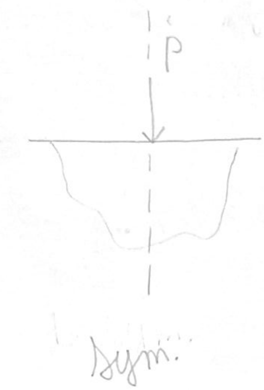
c)



d)



e)



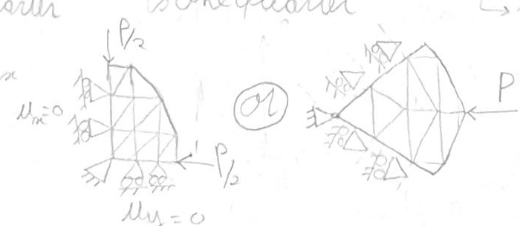
f)

Falmont's problem

2)

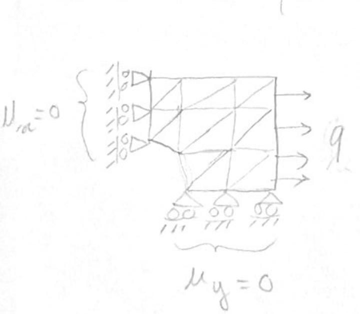
a) The structure could be cut to one quarter

b) The structure could be cut to one quarter

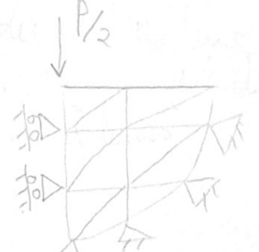


c) The structure could be cut to one half

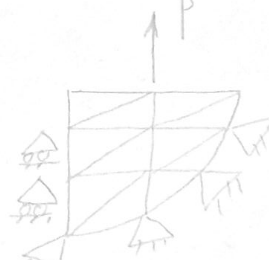
d) The structure could be cut to one quarter



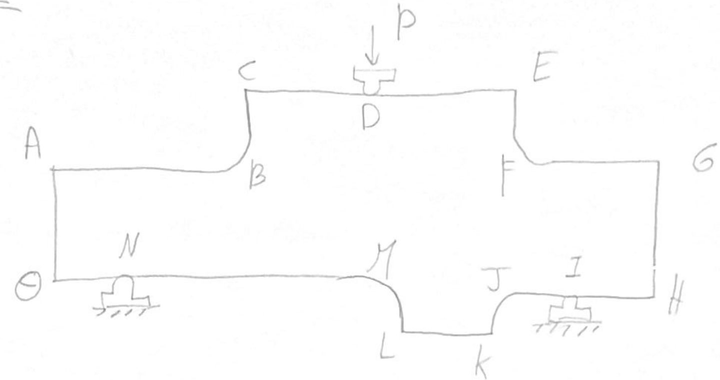
e) This could be cut in half



f) This could be cut in half



Assignment 2.2

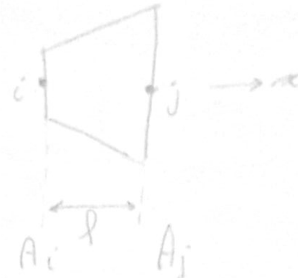


The first "trouble spots" would be the sharp corners as they create stress concentrations. They also cause problems in the numerical solution. This is the case of points A, C, E, G, H, K, L and O. The second type of location that require mesh refinement are the fillets or corners present at points B, F, J and M. The last location of concern are the points of application of the loads and the supports. Because they are applied over a fairly narrow area, a refinement of the mesh is necessary. This is the case of points D, I and N

Assignment 2.3

1)

$$A = A_i(1-\xi) + A_j\xi$$



$$q(x) = \rho A \omega^2 x$$

$$\xi = \frac{x}{l}$$

*

$$f = \int_0^1 q \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} l\, d\xi$$

$$= \int_0^1 \rho\left[A_i(1-\xi) + A_j\xi\right]\omega^2(\xi l)\begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} l\, d\xi$$

$$= \rho l^2 \omega^2 \int_0^1 \left[A_i(\xi-\xi^2) + A_j\xi^2\right]\begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} d\xi$$

$$= \rho l^2 \omega^2 \left.\begin{bmatrix} A_i\left(\frac{\xi^2}{2} - \frac{2}{3}\xi^3 + \frac{\xi^4}{4}\right) + A_j\left(\frac{\xi^3}{3} - \frac{\xi^4}{4}\right) \\ A_i\left(\frac{\xi^3}{3} - \frac{\xi^4}{4}\right) + A_j\left(\frac{\xi^4}{4}\right) \end{bmatrix}\right|_0^1$$

$$= \rho l^2 \omega^2 \begin{bmatrix} \frac{A_i}{12} + \frac{A_j}{12} \\ \frac{A_i}{12} + \frac{A_j}{4} \end{bmatrix}$$

* Let $A = A_i = A_j$

$$f = \rho l^2 \omega^2 A \begin{bmatrix} 1/6 \\ 1/3 \end{bmatrix}$$