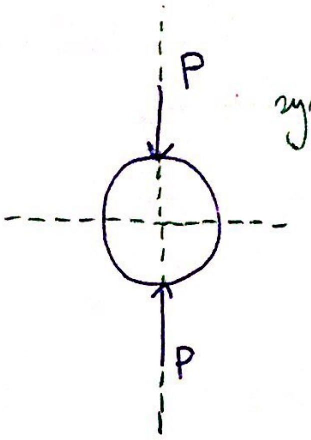
Oriol Falip

1]

a)



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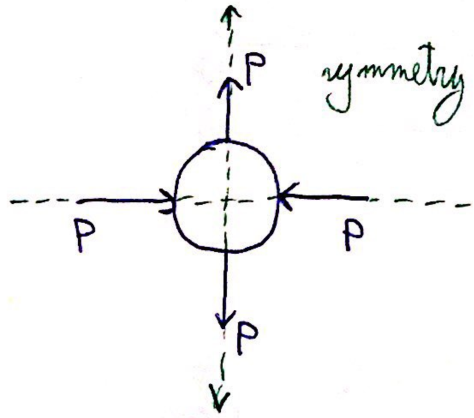
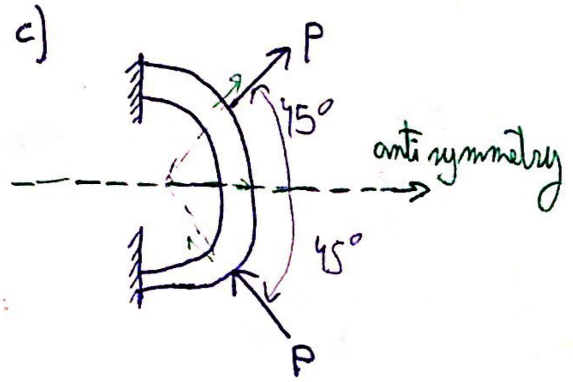
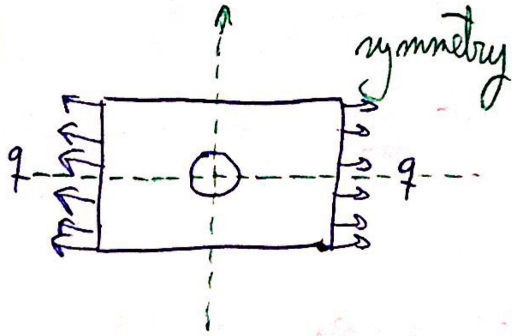


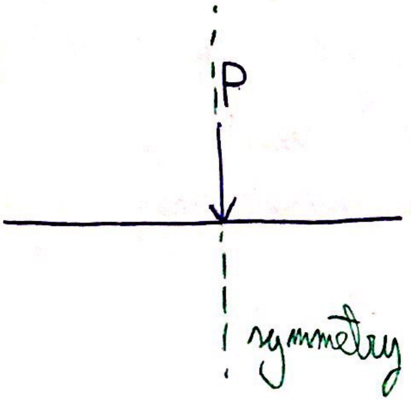
c)



d)



e)



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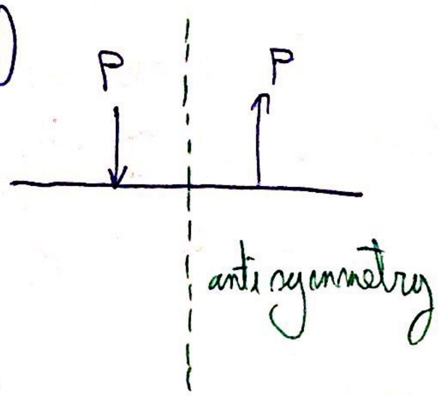
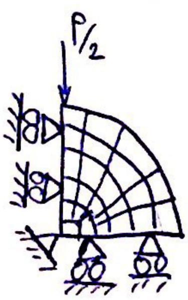


2) a)



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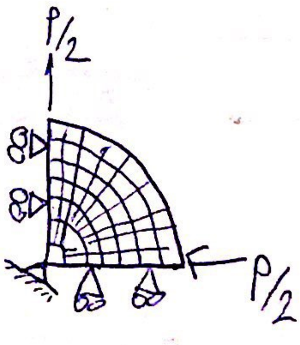

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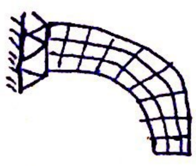

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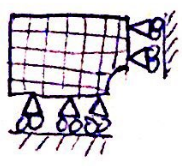

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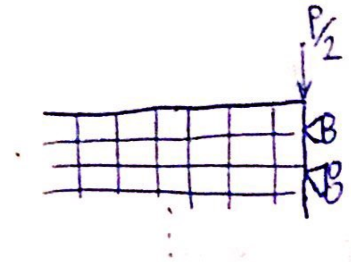

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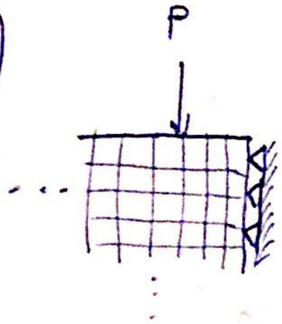
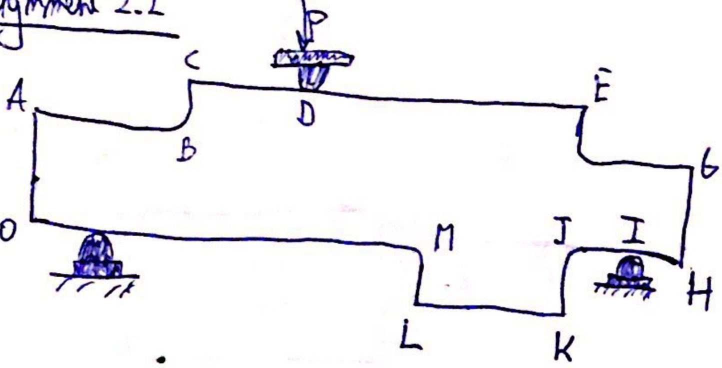


Assignment 2.2

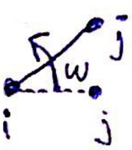


The ~~trouble~~ trouble spots are:

- Point P because we have a concentrated point load
- Points N and I because we have a sharp contact area
- Points B, F, J, M because of the entrant corners

Assignment 2.3

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



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

The consistent nodal forces are written as:

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

we have $q(x) = \rho A(\xi)\, \omega^2 x$

we need to express all terms in terms of ξ so we need to change the variable x:

given that $\xi = \dfrac{x - x_i}{x_j - x_i}$ if $x_i = 0$ and $x_j = l$

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

then $q(x) \rightarrow q(\xi) = \rho A(\xi)\, \omega^2 \xi l$

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

$$f_{ext} = \rho \omega^2 l^2 \int_0^1 \begin{pmatrix} A_i(\xi + \xi^3 - 2\xi^2) + A_j(\xi^2 - \xi^3) \\ A_i(\xi^2 - \xi^3) + A_j \xi^3 \end{pmatrix} d\xi$$

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

$$f_{ext} = \rho \omega^2 l^2 \begin{pmatrix} A_i \left(\frac{1}{2} + \frac{1}{4} - \frac{2}{3}\right) + A_j \left(\frac{1}{3} - \frac{1}{4}\right) \\ A_i \left(\frac{1}{3} - \frac{1}{4}\right) + A_j \frac{1}{4} \end{pmatrix}$$

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

if $A_i = A_j = A$

$$\boxed{f_{ext} = \rho \omega^2 l^2 \begin{pmatrix} \frac{A}{6} \\ \frac{A}{3} \end{pmatrix}}$$