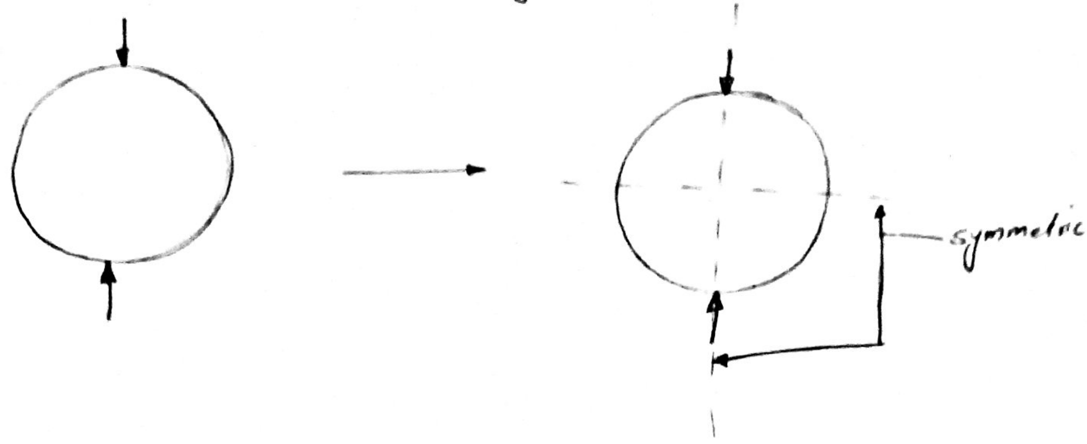
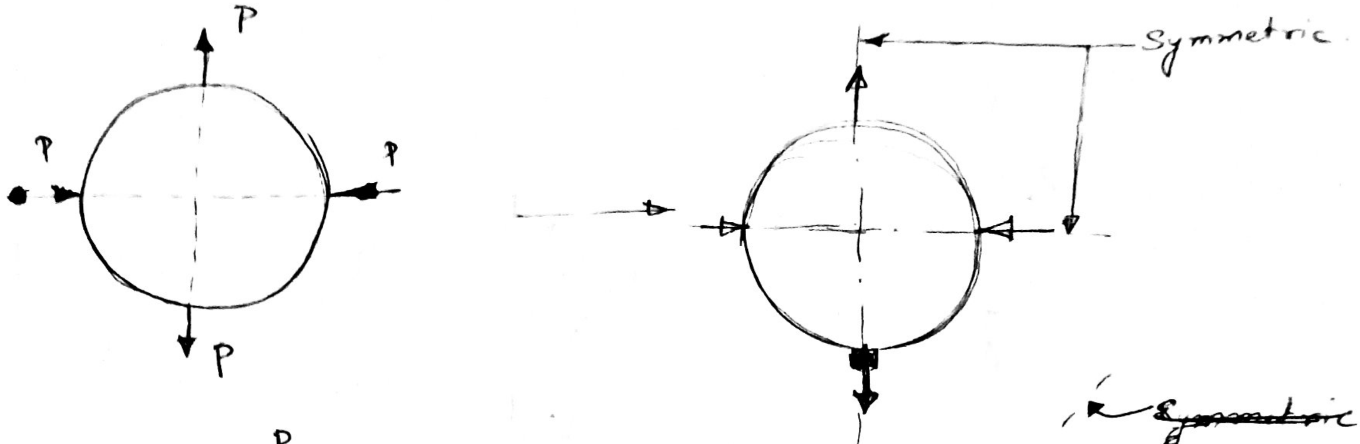
Assigment 2.1

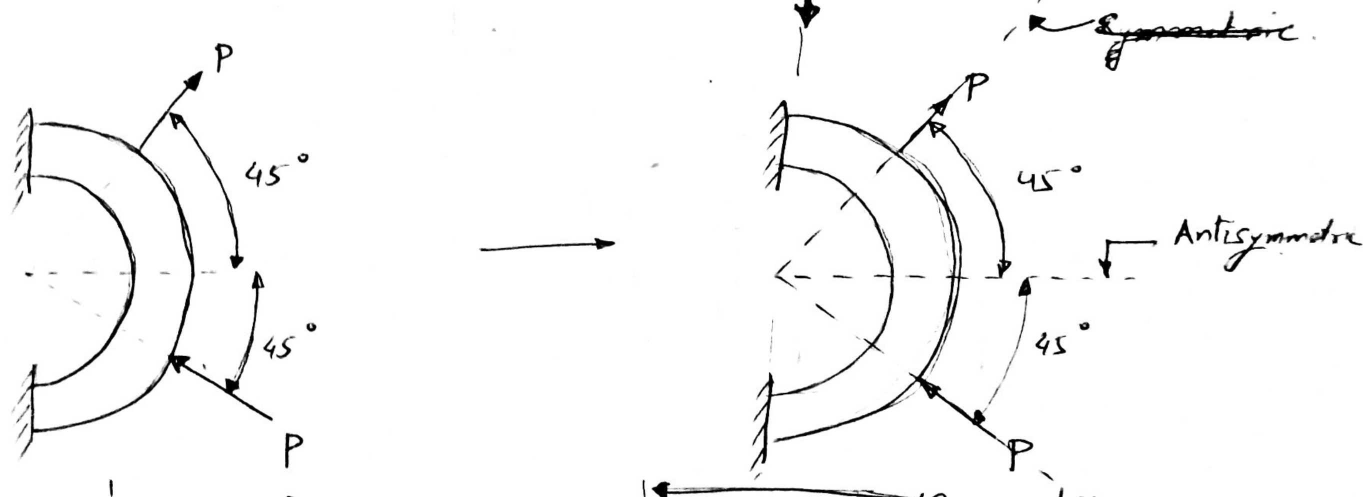
1 a)



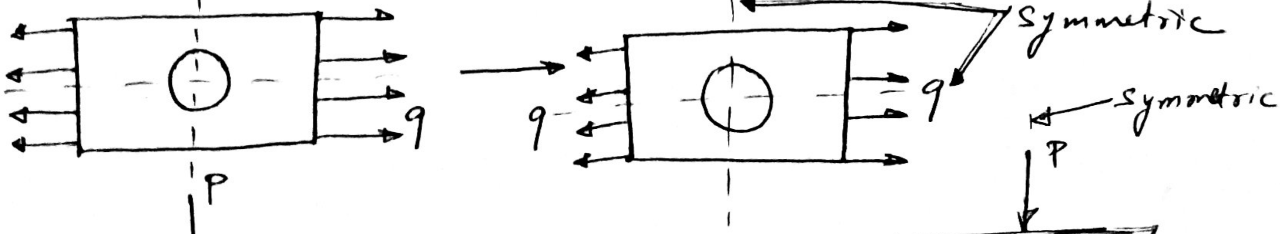
(b)



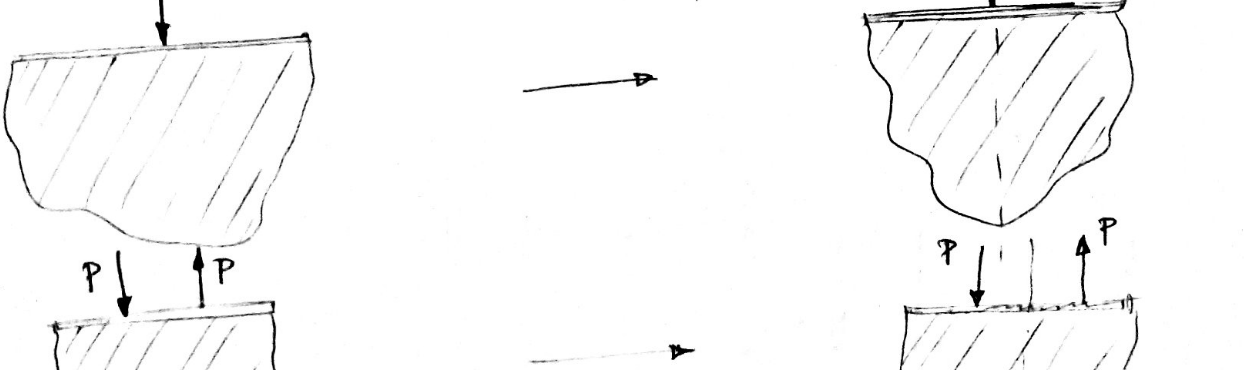
(c)



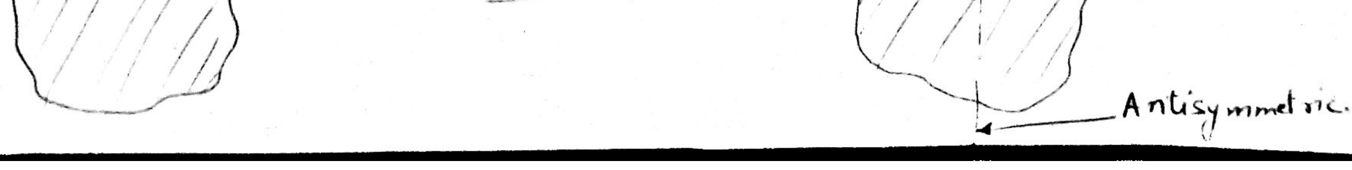
d)



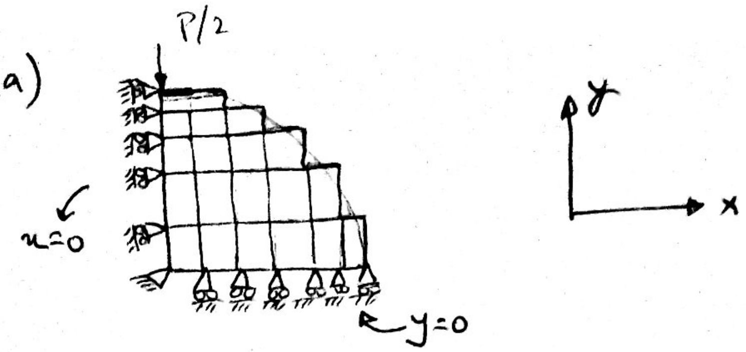
(e)



(f)

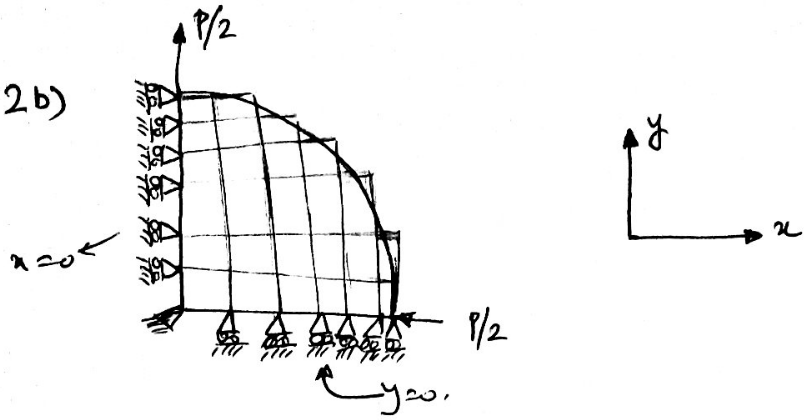


2a)



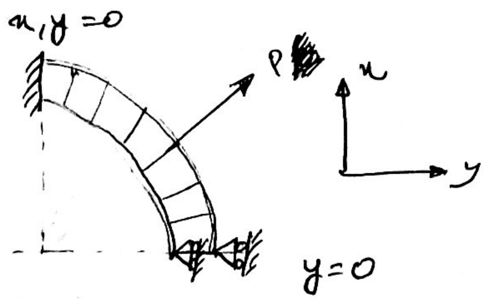
Possible to cut to 1/4.

2b)



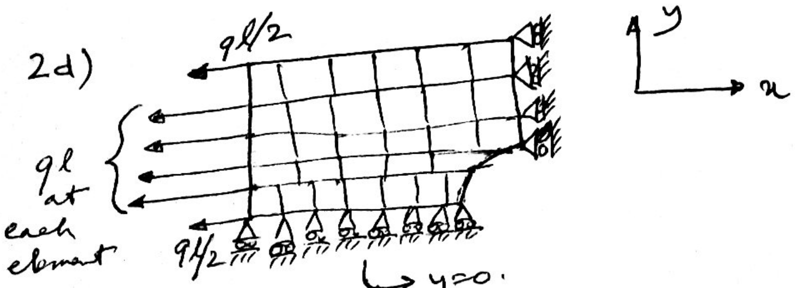
Possible to cut to 1/4.

2c)



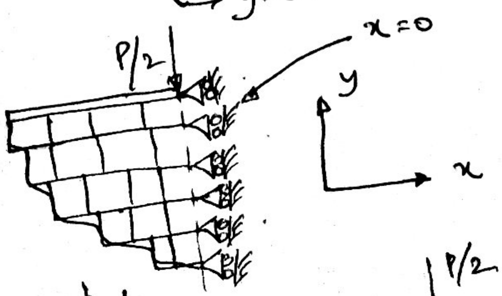
Possible to cut to 1/2

2d)



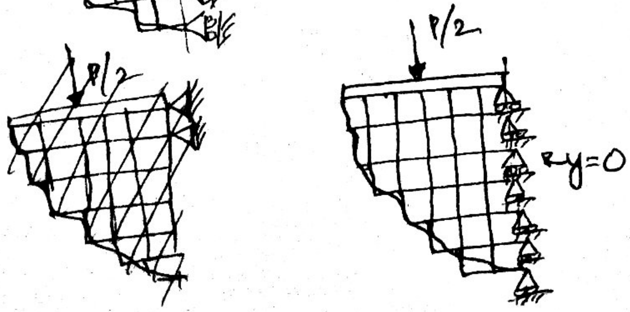
Possible to cut to 1/4

2e)

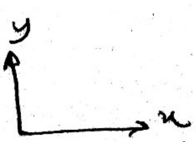


Possible to cut to 1/2

2f).

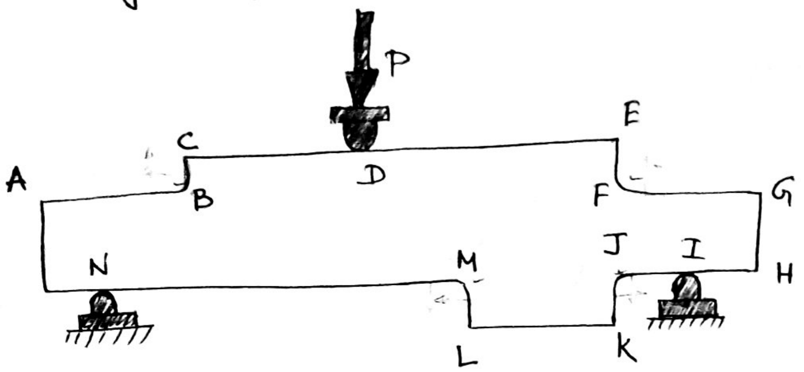


Possible to cut to 1/2



Assigment 2.2.

1) List of likely "Trouble Spots"



B, F, J M → Because they are ~~re~~ entrant corners.

D, ~~N, I~~ because of point loads.

E, K, L, C because of sudden change in crossection

N, I because of concentrated reaction.

Assignment 2.3

1. The consistent nodal forces are given by

$$[F] = \int_0^l q(x) \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} dx$$

$$= \int_0^l \rho A\omega^2 x \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} dx \qquad \text{where } q(x) = \rho A\omega^2 x$$

$\because x$ is longitudinal coordinate, $x = x^e$

we can take that as ξ in natural co-ordinates

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

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

$$= \int_0^l \rho\,\omega^2 \begin{bmatrix} A_i(\xi+\xi^3-2\xi^2) + A_j(\xi^2-\xi^3) \\ A_i(\xi^2-\xi^3) + A_j\,\xi^3 \end{bmatrix} l\,d\xi$$

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

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

$$= \rho \omega^2 l \begin{bmatrix} \frac{1}{12} (A_i + A_j) \\ \frac{A_i}{12} + \frac{A_j}{4} \end{bmatrix} = \frac{\rho \omega^2 l}{12} \begin{bmatrix} A_i + A_j \\ A_i + 3A_j \end{bmatrix}$$

For a ~~pa~~ prisimatic ~~bar~~ bar, $A = A_i = A_j$

$$\begin{bmatrix} F \\ F \end{bmatrix} = \frac{\rho \omega^2 l}{\cancel{12}\ 6} \begin{bmatrix} \cancel{2}A \\ 2\cancel{4}A \end{bmatrix}$$

$$\begin{bmatrix} F \end{bmatrix} = \frac{\rho \omega^2 l}{6} \begin{bmatrix} A \\ 2A \end{bmatrix}$$