

Hanna, John



I'm watching you

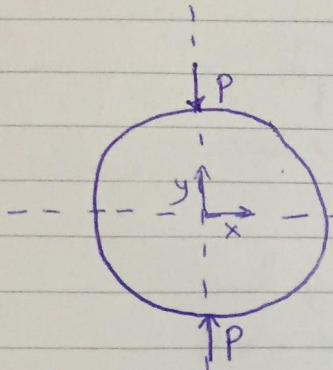
Assignment #2

2.1

1-2

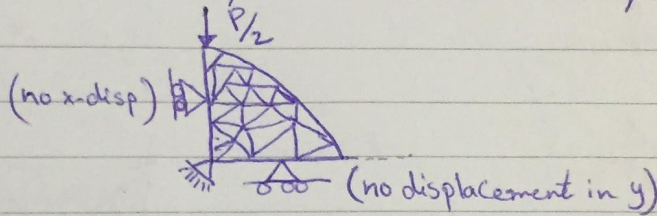
----- Symmetry line
----- anti-symmetry line

a)

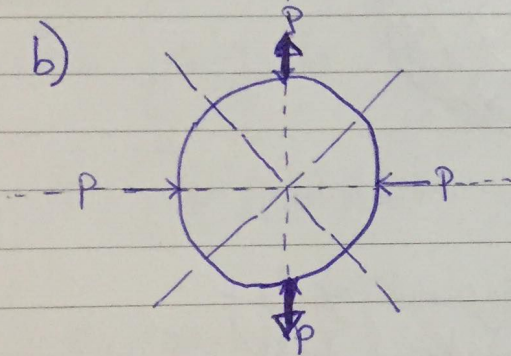


it has 2 symmetry lines

it's possible to cut it into quarter

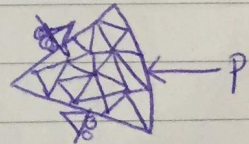
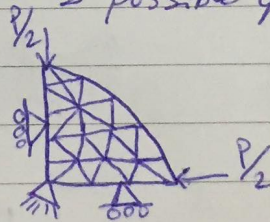


b)

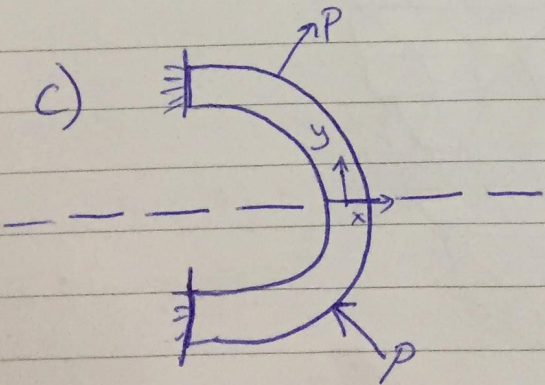


2 symmetry lines, 2 anti-symmetry lines

2 possible quarters can be obtained

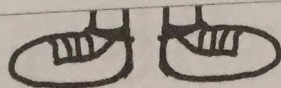
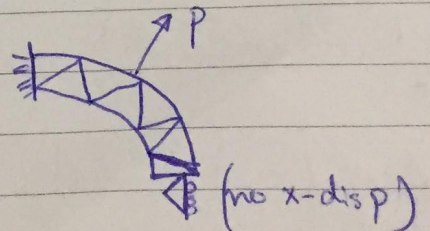


c)



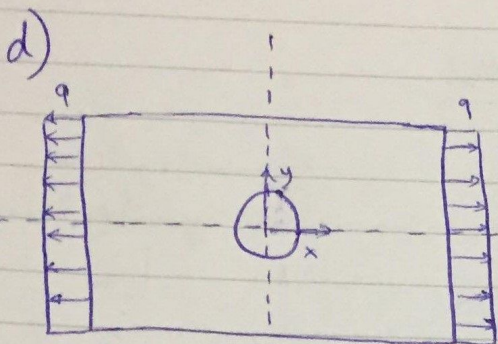
1 anti-symmetry line

1 possible half

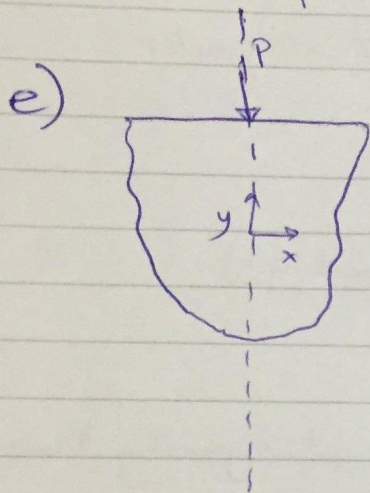
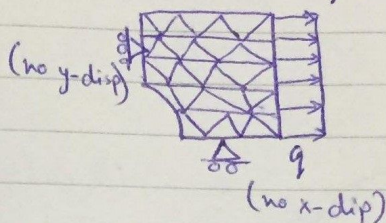




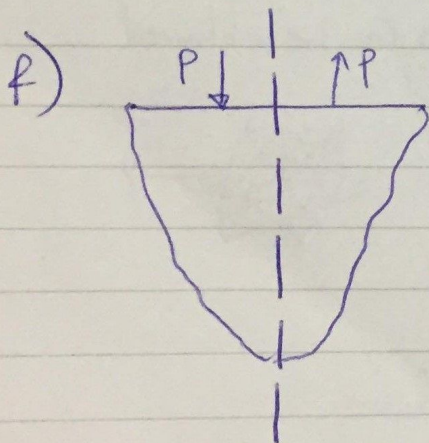
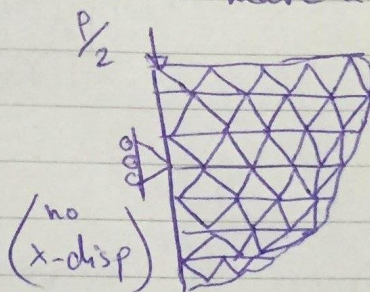
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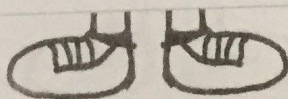
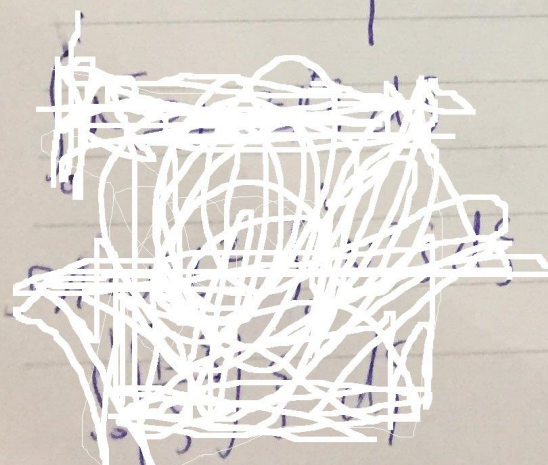
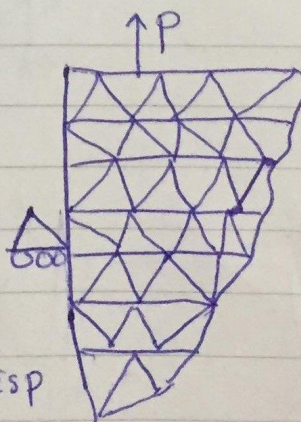
2 symmetry lines
Can make a quarter



1 symmetry line
Can make a half



1 anti-symmetry line
Can make a half





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2.2

* points N, D, I should have finer mesh because they have point loads and reaction which can cause stress singularities therefore, the mesh should be finer and it's good to distribute the load over several nodes for the solution to converge.

* points B, F, M, J These points are corners. Despite the fact that fillets exist in them, they still need good mesh refinement to capture the stress gradient and avoid singularities.

2.3

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

$$F_e = \int_0^L N^T q dx$$

$$dx = L d\xi$$

$$= \int_0^L N^T p w^2 A x dx = \int_0^1 p w^2 N^T (A_i (1-\xi) + A_j \xi) L \xi L d\xi$$

$$= p w^2 L^2 \int_0^1 \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} (A_i (1-\xi) + A_j \xi) \xi d\xi$$

$$= p w^2 L^2 \left[\begin{array}{l} (A_i \xi^2/2 - A_i \xi^3/3 + A_j \xi^3/3 - A_i \xi^3/3 + A_i \xi^4/4 - A_j \xi^4/4) \\ (A_i \xi^3/3 - A_i \xi^4/4 + A_j \xi^4/4) \end{array} \right]_0^1$$

$$F_e = p w^2 L^2 \begin{bmatrix} \frac{1}{12} A_i + \frac{1}{12} A_j \\ \frac{1}{12} A_i + \frac{1}{4} A_j \end{bmatrix}$$

When $A_i = A_j = A$

$$F_e = p w^2 L^2 A \begin{bmatrix} \frac{2}{12} \\ \frac{1}{3} \end{bmatrix} = p w^2 L^2 A \begin{bmatrix} \frac{1}{6} \\ \frac{1}{3} \end{bmatrix}$$

