Homwork set 2

1- Investigate what problem is solved by the Airy stress function
$\emptyset = Fxy^2(3-2y)$
Applied to the region bounded by $y=0$, $y=1$ and $x \longrightarrow \infty$

2- Show that
$$\emptyset = \frac{q}{8}\left[x^2(y^3-3y+2)-\frac{1}{5}y^3(y^2-2)\right]$$
Is a stress function, and find what problem is solves when applied to the region bounded by $y = \pm 1$, x=0 and $x \longrightarrow \infty$.

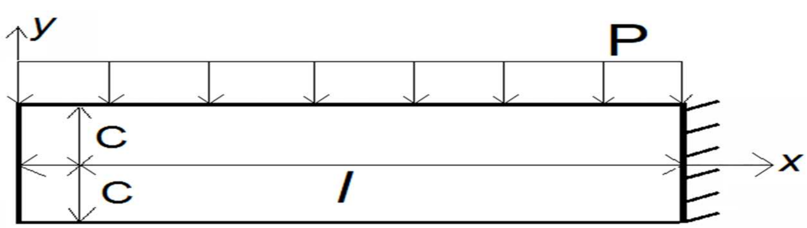
3- The stress function:
$$\emptyset = \frac{s}{4}\left[xy - \frac{xy^2}{C} - \frac{xy^3}{C^2} + \frac{ly^2}{C} + \frac{ly^3}{C^2}\right]$$
Is proposed as giving the solution for a cantilever ($y = \pm 1, 0 < x < l$) loaded by uniform shear along the lower edge, the upper and the end $x=l$ being free from load. In what respect is this solution imperfect? Compare the expressions for the stresses with those obtainable from elementary tension and bending formulas.

4- In the cantilever problem shown in figure below, the support conditions at $x=l$ are given as:

At $x = l,\ y = 0;$ $\qquad u_x = u_y = 0,$

At $x = l,\ y = \pm c;$ $\qquad u_x = 0$

Find the deflection at $x = y = 0$.



5- Show that:

$$(Ae^{ay} + Be^{-ay} + Cye^{ay} + Dye^{-ay})\cos ax$$

Is a stress function. Drive series expressions for the stresses in semi-infinite plate, $y > 0$, with normal pressure on the straight edge $(y = 0)$having the distribution

$$\sum_{m=1}^{\beta} b_m cos\frac{m\pi x}{l}$$

Show that stress σ_x at a point on the edge is a compression equal to the applied pressure at that point. Assume that the stress tends to disappear as *y* becomes large.

6- Could the following stress fields be possible stress fields in an elastic solid, and, if so, under what conditions?

(a) $\sigma_{11} = ax_1 + bx_2, \quad \sigma_{22} = cx_1 + dx_2, \quad \sigma_{12} = fx_1 + gx_2,$
$\sigma_{13} = \sigma_{23} = \sigma_{33} = 0$

(b) $\sigma_{11} = ax_1^2x_2^2 + bx_1, \quad \sigma_{22} = cx_2^2, \quad \sigma_{12} = dx_1x_2,$
$\sigma_{13} = \sigma_{23} = \sigma_{33} = 0$

Where *a, b, c, d, f and g* are constants.

7- Identify the state of strain which correspond to the given displacement fields. Also, find the rotation components.

(a) $u_x = Ax, \qquad u_y = Ay, \qquad u_z = Az$

(b) $u_x = Ax, \qquad u_y = 0, \qquad u_z = 0$

(c) $u_x = 2Ay, \qquad u_y = 0, \qquad u_z = 0$

(d) $u_x = u_x(x, y), \qquad u_y = u_y(x, y), \qquad u_z = 0$