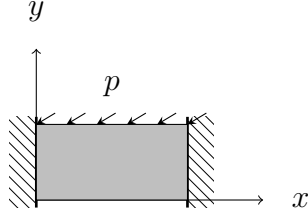Name:

Homework 5
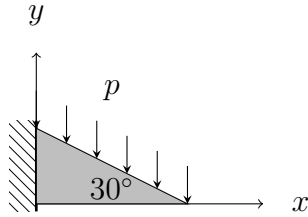### Due 23 Oct 2019

1. For the following figures, express the boundary conditions on each face.
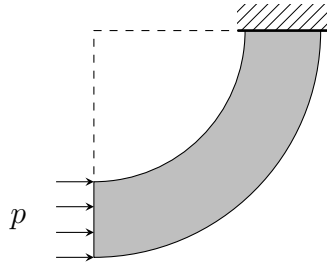
   (a) **Note:** Consider for any arbitrary loading angle, θ.

   (b) **Note:** In this case the load coincides with the vertical axis

   (c) **Note:** In this case the load coincides with the horizontal axis

2. Determine if the following strain field is compatible

$$\epsilon_{11} = 2x^2 + 3y^2 + z + 1$$
$$\epsilon_{22} = x^2 + 2y^2 + 3z + 2$$
$$\epsilon_{33} = 3x + 2y + z^2 + 1$$
$$\epsilon_{12} = 4xy$$
$$\epsilon_{13} = \epsilon_{23} = 0$$

3. The stresses in a 3-D body are

$$\sigma_{11} = -A(L - x)y$$
$$\sigma_{12} = \frac{1}{8}A(h^2 - 4y^2) = \sigma_{21}$$

With all other $\sigma_{ij} = 0$. Is this body in equilibrium? Are the strains compatible? What are the displacements?

Find and plot the vertical deflection along the line $y = 0$

Note: This problem is plane stress ($\sigma_{i3} = 0$), which is by nature, approximate. For plane stress problems, the relevant compatibility equations reduce to

$$\nabla^2(\sigma_{11} + \sigma_{22}) = -(1 + \nu) \left(\frac{\partial F_x}{\partial x} + \frac{\partial F_y}{\partial y} \right)$$

4. Check equilibrium and compatibility conditions for the following stress field

$$\sigma_{11} = Py \left(1 - \frac{y^2}{3b^2} \right)$$

With all other $\sigma_{ij} = 0$