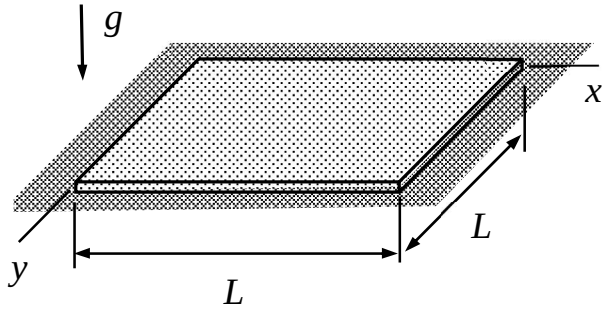
# LECTURE ASSIGNMENT 1

A rectangular membrane of side length $L$, density $\rho$, thickness $t$, and tightening $S'$ (force per unit length) is loaded by its own weight as shown. If the edges are fixed, find the transverse displacements at the grid points $(i, j) \in \{0,1,2,3\} \times \{0,1,2,3\}$ of a regular grid using the Finite Element Method. Use symmetry to reduce the number of non-zero independent displacements to one.



Name_____ Student number_____

In a stationary problem, the discrete equations given by the Finite Element Method on regular grid of spacing $h$ and piecewise linear approximation on triangle elements

$$S'[w_{(i-1,j)} + w_{(i,j-1)} - 4w_{(i,j)} + w_{(i+1,j)} + w_{(i,j+1)}] + h^2 f_i' = 0 \quad (i,j) \in I ,$$

$$w_{(i,j)} = 0 \quad (i,j) \in \partial I .$$

Displacement vanishes at the boundary points and, due to the symmetry, displacements at the interior points should be equal. Denoting the common value by

$$w_{(\_,\_)} = w_{(\_,\_)} = w_{(\_,\_)} = w_{(\_,\_)} = w_1$$

all equations for the interior points boil down to

_____ $= 0$

giving as the displacement at the interior points

$w_1 =$ _____ .