MA 587: Homework 2

You may work in groups of two. For output include graphs.

1. Consider the simple 2D problem and fem2d.m with flag = 0.
   (a). Let the right side be equal to \( f = 10 \), and used \( K = 1.0 \) and \( C = 0.0 \).
   Find the exact solution.
   (b). Modify fem2d.m and ffem2d.m to approximate the solution in part (a).
   Experiment with different numbers of nodes and compare the exact and approximate solutions.

2. Consider the membrane problem and fem2d_membrane.
   (a). Modify gennodcircle.m from a circular domain to an elliptical domain
given by \( x^2 + \frac{y^2}{4} = 1 \).
   (b). Experiment with different pressures in ffem2d.m

3. Consider heat problem the pipe in fem2d.m using flag = 1.
   (a). Modify the domain from a rectangular to circular insulated pipe.
   (b). Modify the domain from a rectangular to circular cooling fin.

4. Consider cooling fin problem with derivative (Robin) boundary conditions.
   (a). Modify the codes associated with fem2d_fin.m to a fin shaped
   in semi-circular given by \( (x - 0.05)^2 + (y - 0.1)^2 = (0.1)^2 \) and \( y \leq 0.1 \).
   (b). Experiment with different values of \( H \).