AMS326 (Numerical Analysis) Spring 2025

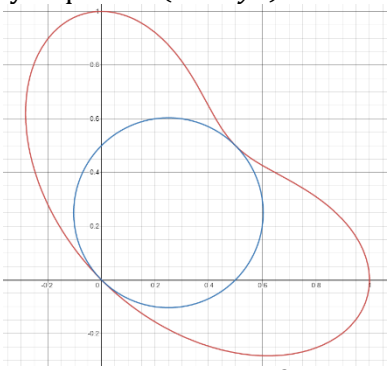
Yuefan Deng | yuefan.deng@stonybrook.edu

Homework 2

Notes:

1. Do all assigned problems.
2. The set is worth 100 points evenly distributed among problems for the entire set.
3. No late HW is accepted.

Problem 2.1 (20 Points) The "kidney" equation $(x^2 + y^2)^2 = x^3 + y^3$ (red curve) can be graphed as



Dig a disc from the kidney. The disc equation is $(x - 0.25)^2 + (y - 0.25)^2 = 0.125$ (blue).

(1) Write a program to use the rectangle method to compute the area of the remaining kidney (4 significant digits).

(2) Write a computer program to use the trapezoidal method to compute the area of the remaining kidney (4 significant digits).

Problem 2.2 (50 Points) Generate an $N \times N$ matrix A with uniformly distributed floating-point random numbers as its elements,

$$a_{ij} \sim U(-1, 1)$$

You are given a N-dimensional vector with "1" as its all elements:

$$b = \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix}$$

Please write a program to solve the linear system of equations $AX = b$, i.e., find the unknown vector X that satisfies the given linear system of equations for $N = 66$.