CS4041 - Computer Modeling and Simulation

Assignment 4

Due Date: 28th April, 2024

For each of the given questions from 1 to 3, do parts a-d.

a. In the case of 2D problems, plot the function f, using some plotting library.
b. Using the Monte Carlo technique, define a function in any programming language with a parameter for the number of darts that returns an estimate of the indicated value.
c. Define a function that calls the function from Part b 1000 times and returns the mean and standard deviation of the results.
d. Using any computational tool or programming language, calculate the answer with integration.
e. Find the percentage error between the analytical solution and the solution by Monte Carlo's method (the mean value from part c) for each of the questions.

1. The area between the curve for $f(x) = \sqrt{(\sin^2(x) + 1)}$ and the x-axis from $x = 0$ to $x = 2$

2. The area between the curve for $f(x) = x^3$ and the x-axis from $x = 2$ to $x = 3$

3. An estimate of $\int_2^3 \cos(x^2)dx$. Note that the function is not entirely above or entirely below the x-axis, so we must adjust the algorithm studied in the class to estimate the integral. Recall that where a function is negative (below the x-axis), its integral is the negative of the area between the curve and the x-axis.