1. **(25 Pts)** Consider the solution to $f(x) = 0.5$ where $f(x) = x^3$. Choosing initial guesses of $x_a = 0$ and $x_b = 1$,

   i Write down an expression to show how the error en in the bisection method decreases with subsequent iterations.

   ii Using the bisection method, determine the solution to four decimal places. Does the number of iterations this took agree with the predicted number?

i A function $f_{app}(x)$ is to be used as an approximation to a set of data (x_i, f_i) with $i = 0, 1, 2, \ldots, N$. Suppose further that the function $f_{app}(x)$ depends on two parameters a and b. Provide full details of how the parameters a and b can be determined by a Least Squares Method.

ii Using the result of the previous item, obtain the normal equations for the function $f_{app}(x) = a + b\sqrt{x}$. **Do not attempt to solve these equations.**

i Find the Fourier coefficients for $f(x) = x^2 - 1$ if it is periodic and one period extends from $x = -1$ to $x = 2$. Do not evaluate the integrals.

ii Write the Fourier series expansion for this function up to 3rd term.

i Fill the following table within the five digit accuracy

x_i	f_i
0.00000	0.00000
1.20000	

ii Approximate $\int_0^{1.2} f(x)dx$ using the *Trapezoidal Rule* and a step size of $h = 0.2$.

iii Approximate $\int_0^{1.2} f(x)dx$ using the *Trapezoidal Rule* and a step size of $h = 0.4$.

iv Analyze and compare your results. Estimate the *error* in your answers.