
MATH 122 - Numerical Integration - Full Example

You Try

Our goal is to approximate the following integral to within an error tolerance of $|E| < .001$

$$\int_0^2 \cos^2(x^2) dx$$

Follow along with the Colab Notebook. You do not have to change very many things in the code, but you should make sure that you understand what is happening behind the scenes. Please answer the following questions:

1. What do you notice about your function during step 1 (Exploration)? Is your function increasing, decreasing, concave up, down, etc.? What do you expect in terms of over or under estimates?
2. Do the values you got for N in step 2 (Understanding Error) make sense? How did the code find K1, K2, and K3? Why did you need to calculate so many derivatives by hand? What are the error formulas? Please write down the formulas using the output of the code. In other words, I should see

$$|E| < \text{your equation}$$

for each method.

3. What is the output for each cell in step 3 (Find Approximate Values) telling you? Why do some methods also print out other results?
4. When we compared LEFT(8), RIGHT(8), MID(8), TRAP(8) and SIMP(8) on previous worksheets we got better and better answers, here, why do all of the approximate values look so similar In step 4 (Compare)?