

Calculus Lab, Week 3

Our goal this week is to answer some mathematical questions using Maple, then write up our solutions in LaTeX. For the lab, write a LaTeX report with three sections (one section for each question below).

Before next week's lab, upload the tex and PDF files to a new CLEO folder for the week. You do not have to turn in the Maple worksheet. There's a template LaTeX file you can use on the class website to get started.

1 Exercise: Riemann Sums

In this exercise, the goal is to get into the Maple help and figure out how to get the Riemann sum for a given function (and its plot). Your "answer" to this section should, in a narrative form:

- Discuss the relationship between the definite integral and the limit of the Riemann sum. Here's an example of some LaTeX- Change it to suit your answer:

`\lim_{n\rightarrow \infty} \sum_{i=1}^n f\left(\frac{\dots}{\dots}\right)...`

You might look in a Calculus textbook to find the notation used for the Riemann sum using right endpoints.

- Look up the help file for the Maple command: `RiemannSum`. Use the example to get a graph and estimate for the integral of the following function on the following interval:

$$f(x) = x + \sin(x) \quad -\pi \leq x \leq 2\pi$$

You should use 25 rectangles, right endpoints for the heights. Color in the rectangles using a nice pink color and set the transparency to 0.5 (you'll see this in the help file).

- In your solution, insert the figure obtained from Maple in getting the Riemann sum (you can keep the text that is output as well).

2 Exercise: Find the Pattern

In this exercise, we want to see if there is a pattern to the integral:

$$\int \frac{1}{(x+p)(x+q)} dx$$

where p, q are integers. Try a few first to see if you can find a pattern- For example,

$$\int \frac{1}{(x-3)(x+2)} dx \quad \int \frac{1}{(x+2)(x+6)} dx \quad \int \frac{1}{(x-3)^2} dx$$

You might want to look at two cases- One where $p \neq q$, and one where $p = q$. In your LaTeX file, give the problem statement and your solution write up.

3 Exercise: More on Plotting

In Maple, plot the function f given below, together with its derivative and antiderivative. Define your antiderivative as:

$$F(t) = \int_{-1}^t f(x) dx.$$

Plot $f(t) = e^{-t^2}$, with $f'(t)$ and $F(t)$ on the same axis, $-2 \leq x \leq 4$. Label the three functions using a legend. Label the x -axis as “Time”, and include the end result in a figure in your LaTeX document.