

Assignment #3

Eric Rouse; Individual Programming 53

Understanding the Problem

Write a program that calculates the integral of $f(x) = 2x^2$ numerically using two different methods, area by rectangles and area by trapezoids. Make sure to use full error checking and handling on all the places that a user inputs data. Let the user re-enter data as needed.

Devising a Plan/Design

Here is the pseudocode that I came up with.

- 1) Prompt the user for the starting and ending points of the integration area.
{reprompt if not an integer or InputMismatchDetected}
- 2) Prompt the user to choose a method of numeric integration, either
 - [1] Rectangular, or
 - [2] Trapezoidal, or
 - [3] Both{reprompt if one of these is not selected or InputMismatchDetected}
- 3) Let user choose the amount of rectangles and trapezoids used. These are independently determined in the case that both are chosen.
{reprompt if not an integer or InputMismatchDetected}
- 4) Print function being evaluated: $f(x)=2x^2$
- 5) Print starting and ending points
- 6) Print number of rects/traps used
- 7) Print the calculated areas by the selected methods.
 - a. Area by rectangles:
 - i. Base = (end point – start point)/# rects
 - ii. Height = f(sum of previous bases)
 - iii. Total Area = $\sum_{i=0}^{\# \text{rectangles}} \text{base}_i * \text{height}_i$
 - b. Area by trapezoids
 - i. Base = (end point – start point)/# traps
 - ii. Height1 = f(sum of previous bases)
 - iii. Height2 = f(sum of previous bases + current base)

$$\text{Total Area} = \sum_{i=0}^{\# \text{trapezoids}} 1/2(\text{base1}_i + \text{base2}_i) * \text{height}_i$$

Looking Back/Self-Reflection

Wow. Error checking is a real pain. At least 80% of my program has to do with making sure the data that I let the user input is correct and won't cause a crash. I mean, really, the actual integral calculation is two lines of code. The rectangular method for instance:

```
for (float i = a; i <= b; i+=rsd){  
    rectarea += rsd*2.0*Math.pow(i, 2.0);  
}
```

Everything else is about get in data, making sure it is good and prompting the user along!

To check the output I worked through every possible path in the code and entered faulty data where I could. To check the integration I ran several different possibilities and verified them by hand using the relation:

$$\int 2 * x^2 = \frac{2 * x^3}{3}$$

evaluated over the interval.

I learned how to apply error checking to what seems like trivial inputs and how hard that can be.