MATH 262-01 Notes

April 12, 2023

1 Midpoint Rule

We assume that $n = \mathbb{Z}^+$. Given an integral $\int_a^b f(x)\,dx$, we split the interval into n parts from $[a,b]$. We take the midpoint of these intervals. Our δx is defined as $\frac{b-a}{n}$. Thus, $M_n = \delta x[f(x_n) + f(x_{n+1}) + .. + f(x_{n-1})]$

2 Trapezoid Rule

We split again into n intervals from $[a,b]$. This time, we take every n interval between $[a,b]$ rather than the middle part. If we have a numberline from $1, 2, 3, 4, 5$, we take all those elements.
However, this time, we divide δx by 2 and multiply every nth element between n and $n-1$ by 2.

$$\tfrac{\delta x}{2} = f(a) + 2f(n) + 2f(n+1) + 2f(n+2) + f(b)$$

3 Simpsons Rule

Same rules apply, except this time we divide by 3 instead and rather alternate by multiplying 4 then 2 then 4 then 2 and so on.

$$\tfrac{\delta x}{3} = f(a) + 4f(n) + 2f(n+1) + 4f(n+2) + f(b)$$

4 Error for Midpoint, Trapezoid

When finding the error for both of these rules, our goal is to find a K in which $K = |f(x)''| \le K \forall a \le x \le b$. 1.)