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Exercise 09
Integration

With integration, we can create a function that determine the integral with determined boundaries by using the more direct definition. Once completed and running my function to compare my function to the analytical value, the numpy trapz function, and scipy's simps and romberg functions. Please see results below.

Total area calculated by my function: 331.83549899999997
Total integral calculated by the Numpy's Trapz funct: 332.33449950000005
The integral calculated by the Scipy trapz funct: 332.33449950000005
The integral calculated by the Scipy simps funct: 332.3343331666667
The integral calculated by the Scipy romberg function: 333.3333333333333

When comparing my function to any of the others, there is a higher error with my value. The best function that provides the manually calculated value is the Romberg function. This I believe is due to the Romberg function being more closely related to following the rules of integration for a value squared. The integral of x**2 is ⅓*x**3 | [x_final - x_initial]. The other functions are more closely related to the definition where you sum the area of many equal width rectangles to calculate the total area under the curve. The scipy simps is based off of Simpson Rule and the trapz for both numpy and scipy use the Trapezoidal Rule. The simps function can provide a faster more precise result since it approximates the delta-areas with parabolas whereas the traps function approximates the delta-area with trapezoid shape. Either way, those methods allow us to approximate the area under a curve with greater precision since rectangles do not fit well under curves. So comparing my function to any of the other functions, the scipy functions will definitely approximate the value better.