Instructions 03/30

Objective

In this lecture we will explore the implementation of numerical integration schemes in MATLAB.

To do List

1. Watch the short videos on the introduction to numerical integration, the Midpoint and Trapezoidal methods.
2. Work the exercises below.

Exercise

1. Write a matlab function

   ```
   approx_int = mid_point_method(f,a,b,n)
   ```

   that takes as input an anonymous function f the start and end points of an interval $[a, b]$ and the number of intervals n and approximates

   $$\int f(x)\,dx$$

   using the midpoint method.
   Testing

   (a) Test your function using the integral $f(x) = e^{x^2}$ on the interval $[0, 1]$.

   (b) Use the MATLAB `integral` function to compute the exact integral. Recall that you can create an anonymous function as

   ```
   >>f=@(x)exp(x.^2);
   ```

   then you can compute the approximate integral using MATLAB's own built in function as

   ```
   >>true_int_val = integral(f,0,1);
   ```

   You will use this as the "true solution" because we cannot find the exact integral using analytic techniques.

   (c) Write a script that calls your `mid_point_method` function for $n = 10, 20, 30, \cdots, 1000$ and compute the approximate integral along with the error.

   (d) Your errors should decrease. Look for a pattern in the rate of decrease.