MATH-131 (Numerical Methods for Scientists and Engineers) — Worksheet 1

Semester: Spring 2019,   Instructor: Nicholas Knight

> ***Due Jan. 29 at 2359.*** *Remember to cite your sources, including your collaborators, and show your work. Please see the syllabus for details on the collaboration policy and for submission instructions.*

Deliverable: Submit a Live script titled `worksheet1.mlx` via CatCourses (under Assignments). Divide this file into sections, one for each of the following questions, plus an extra (final) section containing all the function definitions. Document each function definition to explain the input and output arguments.

1. Write a function `myalternatesum` that inputs an integer n and outputs $\sum_{i=1}^{n}(-1)^i i$. Use a for-loop to compute this sum. Evaluate this function for $n = 20$ and $n = 100$.

The following questions concern $f \colon x \mapsto \frac{1}{2}(x-1)^2$, which you should implement as an anonymous function.

2. Compare the results of evaluating $f(\sqrt{3})$ after typing `format long` and `format short`.

3. Evaluate $f(x)$ at both 10 and 100 equally spaced points from 0 to 1, inclusive. Plot both curves on the same axes, using different styles to distinguish them.

4. Compute the absolute error of approximating $f'(1.1)$ by the *forward difference* formula, $f'(x) \approx \dfrac{f(x+h) - f(x)}{h}$, comparing $h = 0.1$, $h = 0.01$, and $h = 0.001$.

5. On the same axes plot f, the tangent line to f at $x = 1.1$, and the approximation to this tangent line obtained from the forward difference formula. Use 100 equally spaced points from 0 to 1, inclusive, and different styles to distinguish the three curves.