ME 2450 Assignment 06b

Name: ____________________

Due: April 12, 2019 by midnight

Collaborators: ____________________

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I declare that the assignment here submitted is original except for source material explicitly acknowledged.

I also acknowledge that I am aware of University policy and regulations on honesty in academic work, and of the disciplinary guidelines and procedures applicable to breaches of such policy and regulations, as contained in the University website.

Name	Date
Signature	Student ID

Score

Exercise Graded: ______

Presentation: /2

Technical Content: /8

Total: /10

Exercise 1

The velocity, v, of a falling object is modeled as a function of time, t, by the following mathematical model:

$$v(t) = \sqrt{\frac{gm}{c_d}} tanh\left(\sqrt{\frac{gc_d}{m}} t\right) \tag{1}$$

where c_d is a drag coefficent, g is gravitational acceleration, and m is the object mass.

Assume for this exercise that:

- $g = 9.81$ [m/s^2]
- $m = 68.1$ [kg]
- $c_d = 0.25$ [kg/m]

Part 1

Determine the distance that the object falls after 10 seconds by integrating Eqn. 1 using:

a) analytical integration to determine the true solution.

b) multiple-segment trapezoidal rule using 10 segments.

c) multiple-segment Simpson's 1/3 rule using 10 segments.

Submit your code and the result for each of these 3 parts.

Part 2

Plot the true error as a function of the number of segments used in the numerical approximation for both methods (trapezoidal and Simpson's 1/3). Increase the number of segments until round-off error begins to dominate the solution. Your submitted plot should illustrate the decrease in truncation error and the increase in round-off error upon increased discretization. Submit your plot and identify the optimal number of segments (minimizing true error) for both methods (trapezoidal and Simpson's). See Fig. 22.2 in the textbook as an example of this type of plot.