

MAE384, Spring 2018 Homework #4

Hard copy of report is due 12:15 PM on the due date. Computer codes used to complete the tasks should be included in the report.

Note: Uses of Matlab built-in functions for numerical integration, such as **trapz** and **quad**, are NOT allowed for this homework.

Task 0 (no point, but mandatory to complete for the report to be accepted)

Provide a statement to address whether collaboration occurred in completing this assignment. **This statement must be placed in the beginning of the first page of report.** If no collaboration occurred, simply state "No collaboration". This implies that the person submitting the report has not helped anyone or received help from anyone on this assignment. If collaboration occurred, provide the name of collaborator (only one allowed), a list of the task(s) on which collaboration occurred, and descriptions of the extent of collaboration. Please see related clarifications in Homework #1.

Task 1 (4 points)

Evaluate the following integral,

$$I = \int_0^{1.8} x \sin(x^6) dx ,$$

using (a) the composite Trapezoidal method, (b) the composite Simpson's 1/3 method, and (c) the composite Simpson's 3/8 method. For each method, perform the calculations with three different choices of grid spacing: $h = 0.1$, 0.01 , and 0.001 . Fill Table 1 with the outcome of your calculations. The filled Table 1 and printout of computer codes are the key deliverables of this task.

Table 1: Fill the blanks with the values of the integral, I , as the key deliverables of Task 1.

	Trapezoidal method	Simpson's 1/3 method	Simpson's 3/8 method
$h = 0.1$			
$h = 0.01$			
$h = 0.001$			

Task 2 (1 point; this task can be done entirely by hand)

An integral is given as

$$I = \int_0^4 (5x^4 + 6x^3 - 7x + 3) dx .$$

First, evaluate it analytically. Then, evaluate it using Gauss quadrature by the following procedure:

(i) Transform the original integral to the standard form,

$$I = \int_{-1}^1 f(X) dX ,$$

where $X = (x/2) - 1$.

(ii) Use the 3-point Gauss quadrature in Table 9-1 to perform the numerical integration. Compare the result of numerical integration with the analytic solution.