

## Programming Assignment 06

### Group Assignment

Assigned: Wednesday 8 October

Due: By start of class, Monday 20 October

**Problem:** A common engineering activity is to perform functional analysis on an equation that is used for design purposes.

**Your task:** Design, code, and debug a MATLAB script that

- (1) Asks the user what kind of function (string, in-line, or m-file), function name, domain of interest, and annotation information (**function**);
- (2) Displays an annotated plot of the function in the desired domain (**function**);
- (3) Displays a menu asking what type of analysis with zeros, minima, maxima, area under the curve, display integral over function, display derivative over function;
- (4) Uses a switch-case structure with the menu response to
  - (a) Locate as many zeros as desired, report location of each zero found in command window, and compiles vector with zero locations (**function**)
  - (b) Locate as many minima as desired, report location and value of each minimum found in command window, and compiles two vectors with location and values (**function**)
  - (c) Locate as many maxima as desired, report location and value of each maximum found in command window, and compiles two vectors with location and values (**function**)
  - (d) Perform as many integrations as desired, report domain and value of each integration performed in command window, and compiles a matrix with three columns with the first two columns corresponding to the domain and the third column corresponding to the integral value for the domain. User is to be asked what type of integration (trapezoid or quadl) to use. If trapezoid, user is to be asked how many intervals to use. (**function**)
  - (e) Display the integral of the current function on top of the function display (**function**)
  - (f) Estimate the derivative at as many points as desired (**function**)
  - (g) Display the derivative of the current function on top of the function display (**function**)
- (5) After finding as many of desired option, returns to step 3.
- (6) After working with current function, asks whether analysis of another function is desired, and if so, returns to step 1.

*See section 4.15 of Introduction to Engineering notes.*

Use your script to find

- 1.) All zeros
- 2.) All minima
- 3.) All maxima
- 4.) The area under the curve in the subdomain  $[-\pi \pi]$  using the trapezoidal method with 3, 7, 10, and 15 subdivisions
- 5.) The area under the curve in the subdomain  $[-\pi 0]$  using quadl
- 6.) Estimate the derivative at  $x = -1, 0,$  and  $2$
- 7.) Create a display with the function, its integral, and its derivative, properly annotated.

for the function

$$y = 3x \cos(2x) e^{0.1x}$$

in the domain  $[-2\pi 2\pi]$

**Turn in:**

1. An outline of your program approach.
2. A printed copy of your script and any associated functions and a disc containing same.
3. Printed copy of the MATLAB graph (item 7)
4. A diary file showing execution of your script for items 1 through 6 with the requested values highlighted.

## Programming Assignment 06 - Evaluation Criteria

Name(s) \_\_\_\_\_

| Criteria                        | Points Available  | Points Awarded |
|---------------------------------|-------------------|----------------|
| <b>Script Requirements</b>      |                   |                |
| Fcn to get plot info            | 10                |                |
| Fcn to display plot             | 10                |                |
| Option menu/switch-case         | 10                |                |
| Separate fcn for option (7)     | 70                |                |
| While loop to cycle on option   | 10                |                |
| While loop to cycle on fcn      | 10                |                |
| <b>Output</b>                   |                   |                |
| Script ran w/ at least 1 option | 40                |                |
| Options a-c and f-g working     | 60                |                |
| Option d (integration) works    | 20                |                |
| Plot properly annotated         | 10                |                |
| Items 1-6 correct               | 60                |                |
| Points to lose total            |                   |                |
|                                 | <b>Total Pts:</b> | <b>/310</b>    |

| Points to Lose Criteria                       | Max Points        | Points Lost |
|---|-------------------|-------------|
| Header does not display                       | 10                |             |
| Header missing from any function              | 10                |             |
| Variable dictionary missing from any function | 10                |             |
| Names not meaningful                          | 10                |             |
| Poor whitespace/readability                   | 10                |             |
| Poor commenting                               | 10                |             |
| Poor user interface                           | 10                |             |
|   | <b>Total Pts:</b> |             |