Problem 1

Water is flowing in a trapezoidal channel at a rate of $Q = 20\ m^3/s$. The critical depth y for such a channel must satisfy the equation

$$0 = 1 - \frac{Q^2}{gA_c^3} B$$

where $g = 9.81\ m/s^2$, A_c = the cross-sectional area (m^2), and B = the width of the channel at the surface (m). For this case, the width and the cross-sectional area can be related to depth y by

$$B = 3 + y \qquad \text{and} \qquad A_c = 3y + \frac{y^2}{2}$$

Write a single program (**<u>source file name must be</u>** problem1. extension) to solve for the critical depth using
(a) bisection,
and (b) false position.

For (a) and (b) use initial guesses of xl = 0.5 and xu = 2.5, and iterate until the approximate error falls below ***user specified tolerance***.

At first, print the value of y and f(y) from 0.5 to 2.5, increasing by 0.1. Then, ***ask the user for upper bound and lower bound***. If the root finding is possible, <u>print the solution</u>, otherwise <u>print no root is possible</u>. You also need to print the following table in your console view.

iteration	Upper value	Lower value	X*m*	f(X*m*)	Relative approximate error

Lastly,
Draw <u>six</u> graphs from above solution.
In graph 1: the graph of x_m and relative approximation error (bisection).
In graph 2: the graph of no of iteration and relative approximation error (bisection).
In graph 3: the graph of x_r and relative approximation error (false position).
In graph 4: the graph of no of iteration and relative approximation error (false position).
In graph 5: Compare the relative approximate error with respect to number of iteration between the bisection method and false position method. For comparison, you need to draw the graph of number of iteration and relative approximation error.

In graph 6: Compare the relative approximate error with respect to *x* between the bisection method and false position method. For comparison, you need to draw the graph of *x* and relative approximation error.

Problem 2

Write a single program (**source file name must be** problem2. extension) to solve the following

(a) A devotee of Newton-Raphson used the method to solve the equation $x^{100} = 0$, using the initial estimate $x_0 = 0.1$. Calculate the next five Newton Method estimates.

(b) The devotee then tried to use the method to solve $3x^{1/3} = 0$, using $x_0 = 0.1$. Calculate the next ten estimates.

You also need to print the following table in your console view.

iteration	x_i	$f(x_i)$	$f'(x_i)$	Relative approximate error

Problem 3

Write a single program (**source file name must be** problem3. extension) to solve the following

(a) Consider following easily differentiable function,
$e^{0.5x} = 5 - 5x$
Use the secant method, when initial guesses of $x_{i-1} = 0$ and $x_i = 2$ with user specified tolerance.

(b) Locate the first positive root of
$f(x) = \sin x + \cos(1 + x^2) - 1$
where x is in radians. Use four iterations of the secant method with

initial guesses of (a) $x_{i-1} = 1.0$ and $x_i = 3.0$; (b) $x_{i-1} = 1.5$ and $x_i = 2.5$, and (c) $x_{i-1} = 1.5$ and $x_i = 2.25$ to locate the root.

You also need to print the following table in your console view.

iteration	Upper value	Lower value	Xm	$f(Xm)$	Relative approximate error

Submission:

Deadline: 9th September, 2018 11:59 PM

Bring the ***hard copy*** of the assignment with the following format (supplied before)

Sample:

01. Name of the assignment: (Example: Bisection Method/ Newton Raphson Method/ etc …)
02. Submitted by: (Your name, your roll)
03. Problem statement and Solution
    Example:

    Problem Statement-1,2,...n:

    which functions was given to evaluate, you only need to provide the functions and their parameters

    Solution-1,2,...n:
    Your solution (programs) for Problem statements-1,2,...n

04. Sample Input/Output

    Snapshot of your console view

05. Graphs

    Snapshot of your graphs along with the proper axis notations (if applicable)