Name: **Lab# 03** **Your ID #:**

Root-Finding Methods

Please answer the below questions:

Q1 (2.5*pts*): Implement the bisection method in a Python programming language to find the roots of a simple polynomial function (e.g. f(x) = x^3 - x^2 + 2). Plot the function and the root found using the bisection method.

Q2 (2.5*pts*):

The function defined by $f(x) = \sin \pi x$ has zeros at every integer. Show that when $-1 < a < 0$ and $2 < b < 3$, the Bisection method converges to

a. 0, if $a + b < 2$ **b.** 2, if $a + b > 2$ **c.** 1, if $a + b = 2$

Q3 (2.5*pts*):

Use the Bisection method to find solutions accurate to within 10^{-2} for $x^4 - 2x^3 - 4x^2 + 4x + 4 = 0$ on each interval.

a. $[-2, -1]$ **b.** $[0, 2]$ **c.** $[2, 3]$ **d.** $[-1, 0]$

Q4 (2.5*pts*): Using Newton Method to find a root of**:**

$$f(x) = e^{-x} - x, \qquad f'(x) = -e^{-x} - 1$$

Try to produce the result in the following format:

x_k	$f(x_k)$	$f'(x_k)$	$\frac{f(x_k)}{f'(x_k)}$
1.0000	-0.6321	-1.3679	0.4621
0.5379	0.0461	-1.5840	-0.0291
0.5670	0.0002	-1.5672	-0.0002
0.5671	0.0000	-1.5671	-0.0000

Q5 (2.5*pts*): Use Newton's method to find solutions accurate to within 10^{-5} for the following problems

a. $e^x + 2^{-x} + 2\cos x - 6 = 0$ for $1 \le x \le 2$

b. $\ln(x - 1) + \cos(x - 1) = 0$ for $1.3 \le x \le 2$

Q6 (2.5*pts*): Repeat Exercise 6 using the Secant method.