MT308 Exercise Questions for weeks 1 to 4 **Spring 2026**

Notes: **Use rounded numbers with <u>at least 3 significant figures</u>.**

1. a) Develop a fixed-point iteration to find the root of the following expression:
$$f(x) = e^{-(x-1)/4} - \frac{x}{3}$$
b) Compute the root up to the fourth iteration.
c) What is the absolute error at the fourth iteration?

2. Write a code to solve Question 1.
3. (a) Please use the Newton-Raphson method to find the root of $f(x)=2x^2+6x-54$ with an initial point $x_0=2$ and continue 5 iterations.
(b) Calculate the relative error of this calculation at the fifth iteration.

4. (a) Please use the Regula-Falsi method to find the root of f(x)=2 ln(2x-3)-x with the initial interval <x<. Continue five iterations.
(b) Calculate the relative error of this calculation at the fifth iteration.

5. Write a code to solve Question 3 by using the bisection method so that the absolute error is less than 1E-5.
6. Given that $f(x) = x^3 + x - 20$(a) Develop an iteration formula and show that this iteration is convergent. (b) Calculate the first three iterations with any appropriate guess. (c) What is the absolute error at (b)?
7. (a) Use the bisection method to find a root of $f(x) = \ln(2x) + x^3$ within the interval 0.2<x<0.6. Continue for 4 iterations. (b) Calculate the absolute error at the 4th iteration.
8. Please determine the minimum and the maximum decimal numbers can be represented in a digital system (calculator) that uses 4 bits for mantissa and 3 bits for exponent. what is the relative error of this system in calculation of a=0.6+1/6.
9. Use the false position method to find the root of $f(x) = \tan(0.15x - 0.4)$ by using the initial interval [2, 3]. Calculate the first 3 iterations and find the error at the end of third iteration.
10. Please use the bisection method to calculate the root of f(x)=ln(x-2) with a maximum error of 0.1 where $1 \leq x \leq 6$.
11. Please use the Newton Raphson methot to calculate a root of,
$f(x) = \sin(x) - \frac{x}{2\pi} + 1$ with an initial poin of $x_0=\pi$. Please calculate the relative error at 4th iteration.
12. Please solve problem 3 by the secant method with two initial gusses of x -1=$2\pi/3$ and x0=π. Please calculate the relative error at 4th iteration.
13. Please use the Newton-Raphson Method to calculate the root of, g(x)=2x3+3x2-2 x-3=0 with an initial guess of x0= - 1.7.

14. Please calculate the root of f(x)=tan(x)-x=0 in the range of $4.3 \leq x \leq 4.6$ (use the bisection method).
15. Use the fixed-point iteration to find the root of $f(x) = e^x - 100 - 12x$. Define the iteration formula and carry out the calculations up to the 4th iteration.
16. Use any appropriate iterative method to calculate $\sqrt{57}$ where the absolute error is less than 0.05.
17. Use any appropriate iterative method to calculate $\sqrt[3]{32}$ where the absolute error is less than 0.05
18. Please write a MATLAB expression that creates a row matrix of x=[100, 90, 80, ⋯, 0] and plots f(x)=x/150.
19. Please write a Matlab for loop that adds dt=0.001 to a variable t, 20 times
20. Please write a Matlab while loop that stops when the variable $k \leq 100$ as k incremented by 2.5 in each iteration.
21. Write a Matlab function that accepts two arguments, and returns to the following expression: $f(x, N) = \frac{\pi}{2} + \sum_{n=1}^{N} \left(\frac{1}{n^2}\cos(n\pi x)\right)$
22. Write a Matlab function that accepts an argument, c, and returns the value of polynomial.
    P(x)=$P(x) = 4x^4 + x^3 - 3x^2 + 6x - 2$

    At the point x=c, by using Horner's method.

23. Write a MATLAB script to sketch $f_1(x) = 4e^{-2x}$ and $f_1(x) = 2.5\ln(x + 0.25)$ for 0.2<x<4 on the same figure.