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SHOW ALL WORK!

Problem 1 (25 pts)

Given the function $f(x) = e^{-x} \sin x$,

a) Find $f_2(x)$, the second order truncated Taylor Series Expansion of the function about the point x_0. Leave your answer in terms of x and x_0.

Note: Your final answer should not be

$$f_2(x) = f(x_0) + f'(x)(x - x_0) + \frac{f''(x_0)}{2}(x - x_0)^2$$

b) If $x_0 = \pi/2$, then the quadratic function $f_2(x)$ can be expressed as

$$f_2(x) = a_0 + a_1 x + a_2 x^2$$

where $a_0, a_1,$ and a_2 are constants. Find $a_0, a_1,$ and a_2 and leave your answers in terms of π.

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SHOW ALL WORK!

Problem 2 (25 pts)

Consider the function $f(x) = (x - 0.4)e^x - 2.5x + 1$. Fill in the tables below using the Bisection Method and the False Position method. Stop when the $|e_A|$ falls below 5%. Express all answers to four digits after the decimal point.

i	x_l	x_u	x_r	$f(x_l)$	$f(x_r)$	$\|e_A\|$, %
1	0.0000	1.5000				
2						
3						
4						
5						
6						
7						
8						

Bisection Method

i	x_l	x_u	x_r	$f(x_l)$	$f(x_u)$	$f(x_r)$	$\|e_A\|$, %
1	0.0000	0.7500					
2							
3							
4							
5							
6							
7							
8							

False Position Method

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Problem 3 (25 pts)

Solve the system of equations $A\underline{x} = \underline{b}$ by finding A^{-1} and then using $\underline{x} = A^{-1}\underline{b}$. Leave all answers in terms of fractions. Use the method of cofactors to find A^{-1}.

x			-	2z	=	0
2x	+	3y	+	4z	=	3
36x	-	60y	+	12z	=	1

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SHOW ALL WORK!

Problem 4 (25 pts)

a) Apply the Newton-Raphson method to find the root of the function

$$f(x) = x - \frac{16}{x^3}$$

starting with an initial guess of x_0=1. Compute the approximate and true relative errors, expressed as a percent, at the completion of the 3rd iteration. Express all answers to 4 places after the decimal point.