

Sp 95
EGN 3420

Exam 1A

Name _____

SHOW ALL WORK!

Problem 1 (25 pts)

Consider the function $f(x) = x^{10} - 1$.

- A) Find an expression for the 2nd order truncated Taylor Series Expansion $f_2(x)$ evaluated at $x=1.01x_0$, where x_0 is the point at which the series is expanded about. Leave your simplified answer in terms of x_0 . Numeric constants should be rounded to 5 places after the decimal point.
- B) If $x_0=1$, find the true relative error, as a per cent, in $f_2(1.01x_0)$.
- C) If $x_0=1$, find $f_3(1.01x_0)$.

In Parts B) and C) express your answer rounded to 5 places after the decimal point.

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Problem 2 (25 pts)

Use the simple one point iteration method to find the root of

$$f(x) = x - \ln(x^2 + 2) = 0$$

Start with $x_0 = 0$ and fill in the table below. Round all entries in the table to 4 places after the decimal point. Do not round the results of intermediate calculations.

i	x_i	$f(x_i)$
0	0	
1		
2		
5		
10		

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Problem 3 (25 pts)

Complete the first four iterations of the Bisection Method to find the positive root of $f(x) = x^4 - 16$. Complete the table below. Round all answers to 4 places after the decimal point.

x_L	x_U	x_R	$ e_T , \%$
0	5		

SHOW ALL WORK!

Problem 4 (25 pts)

- A) Complete the table below to find the coefficients of the Newton Divided Difference 3rd order interpolating polynomial, i.e.

$$f_3(x) = b_0 + b_1(x-x_0) + b_2(x-x_0)(x-x_1) + b_3(x-x_0)(x-x_1)(x-x_2)$$

i	x_i	$f(x_i)$	Δ	Δ^2	Δ^3
0	0	-1			
1	2	1			
2	3	3.5			
3	4	7			

- B) Use $f_3(x)$ to estimate $f(1)$.