

Su 97
EGN 3420

Exam 1

Name _____

SHOW ALL WORK!

Problem 1 (25 pts)

Consider the function $f(x) = xe^x$. At $x=1$, the difference between the 2nd order Taylor Series expansion of $f(x)$ about some pt x_0 and the 1st order Taylor Series expansion of $f(x)$ about the same pt x_0 is equal to $1/4$.

1. Find an equation that can be used to solve for x_0 .
2. Perform 2 iterations of the simple one point iteration method to determine x_0 .

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Problem 2 (25 pts) Display all answers to 3 places after the decimal point!

- a) Apply the Bisection method to find the root of the function $f(x) = x - \frac{16}{x^3}$ located between $x_1=1$ and $x_2=4$. Compute the approximate and true relative errors expressed as a percent at the completion of the 3rd iteration.
- b) Repeat Part a) using the Newton-Raphson method starting with an initial guess of $x_0=1$.

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Problem 3 (25 pts) Display all answers to 3 places after the decimal point!

- a. Find the equation of the Lagrange polynomial that passes thru the data points $(0,-2)$, $(1,0)$, $(2,2)$ and $(4,6)$ taken from an unknown function $f(x)$.
- b. Use the polynomial for interpolation at $x=3$.
- c. Compute the true error under the assumption that the true function $f(x)$ is linear.

SHOW ALL WORK!

Problem 4 (25 pts) Display all answers to 3 places after the decimal point!

1. Fit a second order Newton's interpolating polynomial $f_2(x)$ thru the data points $(-1, e^{-1})$, $(0,1)$ and $(1,e)$ from an unknown function $f(x)$.
2. Evaluate the resulting polynomial at $x=0.5$
3. Estimate the error in $f_2(0.5)$ by using an additional point at $(2,e^2)$.
4. Can we determine the true error at $x=0.5$? Explain.