

Instructions: \implies

If you do not read the instructions, then how will you know what to do? Read them now.

Be sure to write your name in the space above.

- You may use one note-sheet prepared in advance. You must put your name on your note-sheet, but do not turn in your note-sheet. Your note-sheet must be letter size, 8.5×11 inches, or A4 paper, 21×29.7 cm, or smaller. You may write on both sides of your note-sheet.
- Note-sheets may not be shared. If you do not bring a note-sheet you will have to do without any help notes.
- You may not use any books, notebooks nor additional note-sheets.
- You may use a calculator. Calculators and other equipment may not be shared.
- For work-out problems sketch your work neatly. Highlight your answer by drawing a frame around it. Scratch out irrelevant or incorrect work so it will be clear what you are submitting as a solution. Give exact answers when possible. Simplify your answer when reasonable to do so. Partial credit will be assigned only for relevant, clear, correct, legible work. If you do not show some relevant work or explain your solution, your grade may be 0.
- For multiple-choice problems indicate your choice in the answer box provided. You need not show any work nor offer any explanations for your answer. If you need to do some work, you may do it in the space provided, if any, or on the back of the examination sheets, but your work will not be graded. **You will be graded only on the letter you select and put in the provided answer box.** Note this test does not use a scantron.
- Use the backs of the examination sheets for scratch work.

Please note $\log(x)$ means the natural logarithm of x on this test.

Problem 1. (25 points if correct, 0 points if wrong). For a certain function f we have the Taylor polynomial of degree 5 is given by

$$p_5(x) = 1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{25}{24}x^4 + \frac{121}{120}x^5$$

Moreover it is known that $|f^{(6)}(x)| \leq 9000$ for $0 \leq x \leq 1$. Estimate the absolute error $|f(0.4) - p_5(0.4)|$ when $p_5(0.4)$ is used to estimate $f(0.4)$. (Select the best estimate.).

- A.) 12.5000 B.) 0.0512
 C.) 0.004131 D.) 0.004096 E.) None of the above.

\leftarrow Letter corresponding to your answer to problem 1.

Problem 2. (25 points if correct, 0 points if wrong). Given $f(2.01) = 3.54$, $f(2.03) = 3.57$, $f(2.05) = 3.71$ and $f(2.07) = 3.75$ use a central (symmetric) second order numeric differentiation approximation to estimate the first derivative $f'(2.03)$.

- A.) 7.00 B.) 4.50
 C.) 4.25 D.) 1.50 E.) None of the above.

\leftarrow Letter corresponding to your answer to problem 2.

Problem 3. (25 points if correct, 0 points if wrong). Consider a (lousy) computer with a floating point representation with a mantissa of only 10 bits, and suppose it employs chopping rather than rounding, and that no packing is used. Assume the mantissa m is normalized so $1 \leq m < 2$. Find the exact value of the floating point number that would be stored to represent $\frac{2}{17}$? (For convenience the number is expressed in decimal in the selections.)

- A.) $\frac{15}{128}$ B.) $\frac{963}{8192}$
 C.) $\frac{1927}{16384}$ D.) $\frac{3855}{32768}$ E.) None of the above.

←Letter corresponding to your answer to problem 3.

Problem 4. (25 points if correct, 0 points if wrong). (**Calculator required.**) The function g defined by $g(x) = x - \frac{3}{4}\cos(x)$ has at most one root because it is increasing. In addition it is easily seen to have a root in the interval $[0, \pi/2]$. Let $x_0 = 0$ be an initial guess for the root and let x_1, x_2, x_3 , etc., be successive Newton iterates. Compute x_3 . (Select the closest answer.)

- A.) .6133130147 B.) .6133103527
 C.) .6168412670 D.) .7500000000 E.) -5.649301316

←Letter corresponding to your answer to problem 4.

Problem 5. (25 points if correct, 0 points if wrong). Let $h(x) = \frac{1}{4}x^4 - \frac{9}{4}x^2 + 3$. Then 1 and 3 are fixed points of h . Find an additional fixed point of h .

- A.) -2 B.) -1
 C.) 0 D.) There are no more fp. E.) None of the above.

←Letter corresponding to your answer to problem 5.

Problem 6. (25 points). Write a *brief technical* essay describing what topic in Mth 351 that you have enjoyed the most so far. Do not write more than one or two paragraphs. You may wax poetic if you wish, but be sure you include one or two equations, symbolic statements or technical remarks.
