MATH 1241 – CALCULUS I **Fall 2019**

COMMON FINAL EXAMINATION

UNC CHARLOTTE
Department of Mathematics and Statistics

Last Name: ______________________ First Name: ______________________
(Please PRINT) (Please PRINT)

Student ID #: ______________ Instructor: ______________ Section: ________

PART II

- Part II consists of 12 multiple choice problems. After you have handed in part I and your exam proctor announces that calculator may be used, you may use your calculator on this part of the exam. (Texas Instruments 83 or 84 or equivalent models of other brands are allowed. TI Inspire, TI 89 or equivalent calculators are NOT allowed on this exam.) **Use of cell phones/smart phones is prohibited at all times.**
- You must use a pencil with soft black lead (#2 or HB) to indicate your answers on the Opscan sheet.
- For each question, choose the response which best fits the question.
- If you wish to change an answer, make sure that you completely erase your old answer and any extraneous marks.
- There is no penalty for guessing.
- If you mark more than one answer to a question, that question will be marked as incorrect.
- You may perform your calculations on the test itself or on scratch paper, but do not make any stray marks on the Opscan sheet.
- Make sure that your name appears on the Opscan sheet and that you fill in the circles corresponding to your name in the format Last, First.
- At the end of the exam you must hand in all test material including the test booklets, Opscan sheet and scratch paper.

1. Suppose that f is a continuous function defined on tthe interval $[0, 3]$ and that $f(0) = -1$, $f(1) = -2$, $f(2) = 2$, and $f(3) = 1$. Then, according to the intermediate value theorem, which of the following **must** be true?
(a) $f(x) = 0$ may not have any solutions
(b) $f(x) = 0$ has exactly one solution.
(c) $f(x) = 0$ has at least one solution, but may not have two solutions
(d) $f(x) = 0$ has at least two solutions.
(e) None of the above.

2. Find the linear approximation for the function $f(x) = 1 + 2x + ln(x + 1)$ at $a = 0$.
(a) $L(x) = x + 1$
(b) $L(x) = 2x + 1$
(c) $L(x) = 3x + 1$
(d) $L(x) = x + 2$
(e) $L(x) = 2x + 2$

3. Let $f(x) = e^{2x}$. Evaluate $\lim_{h \to 0} \frac{f(2+h) - f(2)}{h}$.
(a) The limit does not exist.
(b) $2e^4$
(c) $4e^2$
(d) e^4
(e) $2e^2$

4. Which of the following functions is (are) one to one?
I. $h(x) = sin(x)$, the domain is $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$
II. $g(x) = e^x$, the domain is $-\infty < x < \infty$
III. $f(x) = x^2$, the domain is $0 < x < \infty$
(a) I and II and III
(b) II only
(c) III only
(d) I and II only
(e) II and III only

5. The **second derivative** of a function f is given by
$f''(x) = 3(x-1)^3(x-2)(x-3)^2$. Which of the following statements is correct?
(a) f has a relative max at $x = 1$.
(b) f has an inflection point at $x = 2$
(c) f is concave down on the interval $(2, 3)$
(d) f has an inflection point at $x = 3$
(e) None of the above.

6. Let $f(x) = e^{2x} + 1$. Then $f^{-1}(x)$, the inverse of $f(x)$, is equal to
(a) f is not invertible.
(b) $\frac{1}{e^{2x}+1}$
(c) $\frac{x-1}{2e}$
(d) $\frac{1}{2}ln(x-1)$
(e) $\frac{1}{2}ln(x) - 1$

7. Suppose that $f(x) = \begin{cases} -1, & x < 0 \\ x-1, & 0 \le x \le 1 \\ 2x-1, & 1 < x < 2 \\ x^2-1, & x \ge 2 \end{cases}$. Where is f discontinuous?

(a) $x = 0$ only
(b) $x = 1$ only
(c) $x = 0$ and $x = 2$ only
(d) $x = 0$, $x = 1$, and $x = 2$
(e) None of the above.

8. A particle moves vertically. Its height above the ground at time t is given by $h(t) = 10t - 3t^2 + t^3$ for $t \ge 0$, where t is measured in seconds and h is measured in feet. What is its acceleration when $t = 3$?
(a) 9 ft/sec^2
(b) 12 ft/sec^2
(c) 15 ft/sec^2
(d) 24 ft/sec^2
(e) 30 ft/sec^2

9. Suppose that $3x^2y^2 + 2x - 4y = 1$. Find the derivative $\frac{dy}{dx}$ at the point $(1, 1)$.
(a) -1
(b) -2
(c) -3
(d) -4
(e) -5

10. Let $f(x) = (x-2)e^{kx}$, for some positive constant k. This function has a critical number at $x = 3$. Find the value of k, and determine if $x = 3$ gives a relative max, min, or neither.
(a) $k = 1$, relative minimum.
(b) $k = 1$, relative maximum.
(c) $k = -1$, relative minimum.
(d) k = -1, relative maximum.
(e) The function does not have a relative max or min at $x = 3$

11. We wish to solve $x^3 + 5x = 4$ using Newton's method. Use $x_1 = 1$ as your initial approximation, and find x_2, the next approximation. (You are not being asked for the exact solution.) Round your answer to two decimal places.
(a) 0.65
(b) 0.70
(c) 0.75
(d) 0.80
(e) 0.85

12. Suppose that $f'(x) = 2 + 3\sqrt{x}$ and that $f(1) = 3$. Find a formula for $f(x)$, and then evaluate $f(4)$.
(a) $f(4) = 20$
(b) $f(4) = 21$
(c) $f(4) = 22$
(d) $f(4) = 23$
(e) $f(4) = 24$