Math 150 Name: ________________________

QUIZ ON CHAPTER 4

APPLICATIONS OF DERIVATIVES; MATH 150 – FALL 2016 – KUNIYUKI
105 POINTS TOTAL, BUT 100 POINTS = 100%
Show all work, simplify as appropriate, and use "good form and procedure" (as in class).
Box in your final answers!
No notes or books allowed. A scientific calculator is allowed.

1) Consider $f(x)=\dfrac{x+5}{16-x^2}$ and the graph of $y=f(x)$ in the usual *xy*-plane in parts a) through f). If the answer to a part is none, write "NONE." (25 points)

a) Find and box in all critical numbers of f. Show all work, as in class.

b) Find the *x*-intercept(s) on the graph of $y=f(x)$. **Answer only is fine.**

c) Find the *y*-intercept on the graph of $y=f(x)$. **Answer only is fine.**

Reminder: $f(x) = \dfrac{x+5}{16-x^2}$

d) Find the equation(s) of any horizontal asymptote(s) for the graph of $y = f(x)$. **Answer only is fine.**

e) Find the equation(s) of any vertical asymptote(s) for the graph of $y = f(x)$. **Answer only is fine.**

f) Find the absolute maximum point (x, y) and the absolute minimum point (x, y) on the graph of $y = f(x)$, if x is restricted to the interval $[-3, 0]$. Indicate which point is the absolute maximum point and which is the absolute minimum point.

2) State Rolle's Theorem, including the hypotheses and the conclusion. Write the conclusion using the algebraic notation we used in class; don't just refer to tangent lines or secant lines. (8 points)

3) Sketch the graph of $y = f(x)$, where $f(x) = x^3 - 3x^2 - 24x + 13$, in the usual xy-plane. **YOU MAY USE THE BACK OF THIS SHEET.** (27 points)

- Find all critical numbers of f and label them CNs.
- Find all points at critical numbers.
  Indicate these points on your graph.
- Find all inflection points (if any) and label them IPs.
  Indicate these points on your graph.
- Classify all points at critical numbers as local maximum points,
  local minimum points, or neither.
- Find the y-intercept. You do not have to find x-intercepts.
- Have your graph show where f is increasing / decreasing and where the
  graph is concave up / concave down. Justify with work, as in class.
- You may round off any non-integers to five significant digits.
- Show all steps, as we have done in class.

4) You do <u>not</u> have to show work for these problems. (9 points total)

a) The following is true of the polynomial function f:
$f(3)=4,\ f'(3)=0,\ f''(3)=5$. True or False: The point $(3,4)$ must be a local maximum point for the graph of $y=f(x)$. Box in one:

True False

b) The following is true of the polynomial function g:
$g(6)=-2,\ g'(6)=3,\ g''(6)=-2$. True or False: The point $(6,-2)$ must be a local maximum point for the graph of $y=g(x)$. Box in one:

True False

c) The function h has the interval $[6,\ 10]$ as its domain, and h is continuous on that interval. True or False: On the interval $[6,\ 10]$, there is an absolute minimum point for the graph of $y=h(x)$ in the usual *xy*-plane. Box in one:

True False

5) Let $s(t)$ be the height in feet (at time t in seconds) of a particle that is moving along a vertical line. If $s'(4)=3\,\frac{\text{ft}}{\text{sec}}$, and $s''(4)=-5\,\frac{\text{ft}}{\text{sec}^2}$, what is the particle doing "at" (really, on a neighborhood of) $t=4$ seconds? Box in one: (3 points)

a) The particle is rising and is speeding up.
b) The particle is rising and is slowing down.
c) The particle is falling and is speeding up.
d) The particle is falling and is slowing down.

6) We want to approximate a root (or zero) of $2x^4+x-1$ using Newton's Method with $x_1=-2$ as our "seed" (our first approximation). (12 points total)

a) Find x_2, which is our second approximation using Newton's Method. When rounding, use five significant digits; round off your answer to four decimal places.

b) Find x_3, which is our third approximation using Newton's Method. When rounding, use five significant digits; round off your answer to four decimal places.

7) Prove that, among all rectangles with fixed perimeter p, where $p > 0$, the largest in area is a square. (Keep p in your work; don't just pick a numerical value for p.)

• Show all work, and verify that a square is, in fact, the rectangle with the **absolute** maximum area, as in class.

• Do not use any shortcut precalculus formulas or methods when methods from calculus can be used instead.

(21 points)