Math 150 Name: ________________________

QUIZ ON CHAPTER 4

APPLICATIONS OF DERIVATIVES; MATH 150 – SPRING 2017 – 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) Let $f(x) = x\sqrt{6x+1}$. Show all work, as in class. (16 points total)

a) What is the domain of f ? Write your answer in interval form (the form using parentheses and/or brackets). (3 points)

b) Find and simplify $f'(x)$ as: $\dfrac{\text{a simplified polynomial in } x}{\sqrt{\text{a simplified polynomial in } x}}$.

Do not rationalize the denominator in your final answer. (9 points)

c) Find and box in all critical number(s) of f . If there are none, write "NONE." (4 points)

2) Find the absolute maximum point (x, y) and the absolute minimum point (x, y) on the graph of $y = x^4 - 7x^3$, where x is restricted to the interval $[4, 6]$, in the usual *xy*-plane. Indicate which point is the absolute maximum point and which is the absolute minimum point. You may round off coordinates to two decimal places. (9 points)

3) State the Mean Value Theorem (MVT) for Derivatives, 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)

4) Let $s(t)$ be the height in feet (at time *t* in seconds) of a particle that is moving along a vertical line. If $s'(4) = -5 \frac{\text{ft}}{\text{sec}}$, and $s''(4) = -15 \frac{\text{ft}}{\text{sec}^2}$, what is the particle doing "at" (really, on a neighborhood of) $t = 4$ seconds? Box in one: (2 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.

5) Sketch the graph of $y = f(x)$, where $f(x) = x^6 + 6x^5 - 3$, in the usual *xy*-plane.

YOU MAY USE THE BACK OF THIS SHEET. (29 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.

6) The following is true of the polynomial function f:
$f(1)=6,\ f'(1)=0,\ f''(1)=-8$. The point $(1,6)$ on the graph of $y=f(x)$ in the usual *xy*-plane must be …. (Box in one:) (2 points)

a local minimum point　　　　a local maximum point　　　　neither

7) Let $f(x)=\dfrac{3x+5}{4x-7}$. Consider the graph of $y=f(x)$ in the usual *xy*-plane. You do **not** have to show work. (4 points total)

a) Write the equation of the horizontal asymptote for the graph.

b) Write the equation of the vertical asymptote for the graph.

8) We want to approximate a root (or zero) of x^4+2x-5 using Newton's Method with $x_1=1.3$ as our "seed" (our first approximation). (10 points total)

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

9) We need to make a (right circular) cylindrical metal soup can with a closed top and bottom and with a volume of 175 cubic inches. (25 points)

• Find the base radius and the height of such a cylinder that requires the least amount of metal, and box in these answers.

• You must round off your answers to at least three significant digits.

• Write your answers with appropriate units.

• Show all work, and verify that you are, in fact, finding the appropriate cylinder requiring the **absolute** minimum amount of metal, as in class.

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

Hints: The surface area of a closed right circular cylinder is given by $2\pi r^2 + 2\pi rh$, where r is the base radius and h is the height. If you forgot the formula for the volume, you can buy it from me for 3 points. You can't get negative points for this problem.