MA121 PRACTICE EXAM #3 Name:________________________

A decent try at all of the problems can earn you 5 points on Exam #3. (Less-than-decent tries earn less than 5 points – my call.) These are due Wednesday, November 7 at the exam.

1. Find the absolute and local maximum and minimum values of the following functions.
   (a) $f(x) = 4x - 1, \quad x \leq 8.$
   (b) $f(x) = 2x^3 + 3x^2 + 4, \quad -2 \leq x \leq 1.$
   (c) $f(x) = x^2 + 2/x, \quad \frac{1}{2} \leq x \leq 2.$
   (d) $f(x) = x^{4/5}, \quad -32 \leq x \leq 1.$
   (e) $f(x) = \sin x + \cos x, \quad 0 \leq x \leq \pi/3.$
   (f) $f(x) = (\ln x)/x^2, \quad 1 \leq x \leq 3.$
2. Find the critical numbers of
   (a) $f(x) = 4x^3 - 9x^2 - 12x + 3$
   (b) $f(x) = \sqrt[3]{x^2 - x}$
   (c) $f(\theta) = \sin^2(2\theta)$
3. Verify that the function $f(x) = \sqrt{x}$ on the interval $[1, 4]$ satisfies the hypotheses of the Mean Value Theorem. Then find all numbers c that satisfy the conclusion of the Mean Value Theorem.
4. Find the interval(s) on which $y = \dfrac{x}{(1+x)^2}$ is concave upward.
5. For the following functions, find (a) the intervals of increase or decrease, (b) the local maximum and minimum values, (c) the intervals of concavity, and (d) the x-coordinates of the points of inflection. Then use this information to sketch the graph.
   (a) $f(x) = 1 - 4x + 5x^2 - x^3$
   (b) $g(x) = x + 3x^{2/3}$
6. Sketch the graph of a function that satisfies the following conditions:
   $f(0) = 0$, $f'(-2) = f'(1) = f'(9) = 0$,
   $\lim_{x\to\infty} f(x) = 0$, $\lim_{x\to 6} f(x) = -\infty$,
   $f'(x) < 0$ on $(-\infty, -2)$, $(1, 6)$, and $(9, \infty)$,
   $f'(x) > 0$ on $(-2, 1)$ and $(6, 9)$,
   $f''(x) > 0$ on $(-\infty, 0)$ and $(12, \infty)$,
   $f''(x) < 0$ on $(0, 6)$ and $(6, 12)$.
7. If 1200 cm^2 of material is available to make a box with a square base and an open top, find the largest possible volume of the box.
8. Find the point on the parabola $x + y^2 = 0$ that is closest to the point $(0, -3)$.
9. A poster is to have an area of 180 in^2 with 1-inch margins at the bottom and sides and a 2-inch margin at the top. What dimensions will give the largest printed area?
10. Find the linearization of $f(x) = \sqrt[3]{1+3x}$ at $a = 0$. State the corresponding linear approximation and use it to give an approximate value for $\sqrt[3]{1.03}$.
11. Evaluate dy if $y = x^3 - 2x^2 + 1$, $x = 2$, and $dx = 0.2$.
12. Use differentials to approximate $8 + \sqrt{143.6}$.