MA 125 8C, CALCULUS I

October 16, 2014

Name (Print last name first): ....

Show all your work and justify your answer!

No partial credit will be given for the answer only!

PART I

You must simplify your answer when possible.
All problems in Part I are 10 points each.

1. Find the absolute maximum and minimum of the function $y = f(x) = (x-1)^2(2x-3)$ on the interval $[0, 2]$.

2. Find the number c which satisfies the conclusion of the Mean Value Theorem for the function $y = f(x) = 2x^2 - x + 1$ on the interval $[0, 1]$.

3. Find all critical numbers of the function $y = f(x) = \sqrt[3]{x^3 - 3x}$ and identify all local/absolute max/min if any.

4. Suppose that the **derivative** of a function $y = f(x)$ is:
$f'(x) = x^2 - 2x - 3$.

   (a) Find the x-coordinates of all local max/min of the function $y = f(x)$.

   (b) At which x is the function $y = f(x)$ most rapidly decreasing?

   (c) What can you say about a formula for $f(x)$?

PART II

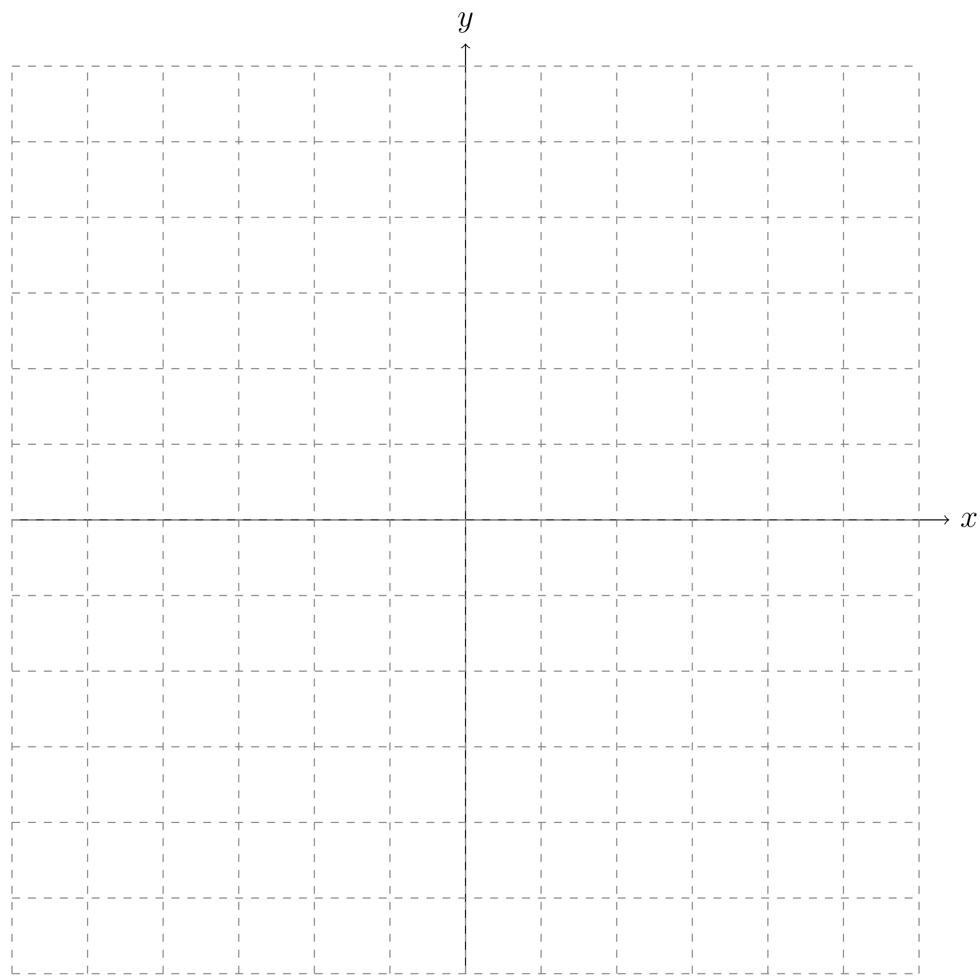
5. [**15 points**] The concentration of an average student during a 4 hour test at time t is given by $C(t) = -t^3 + 3t^2 + 9t + 10$. When, during the test, is the student's concentration maximal?

6. [**15 points**] A store has been selling 30 cups a day at 15 dollars each. A market survey indicates that for each 1 dollars rebate offered to buyers, the number of units sold will increase by 10 a day. Find the demand function and the revenue function. How large a rebate should the store offer to maximize its revenue?

7. [**20 points**] **Use calculus** to graph the function $y = f(x) = \dfrac{x^2 - 4}{x^2 - 1}$. Indicate

- x and y intercepts,
- vertical and horizontal asymptotes (if any),
- in/de-creasing; local/absolute max/min (if any).

You must show work to justify your graph and conclusions. You can use decimal numbers to plot points (but mark them with exact values).



8. This question has two parts.

   (a) [**5 points**] Show that the equation $y = f(x) = 4x^3 + 5x - 3 = 0$ has **exactly** one solution.

   (b) [**5 points**] Use linearization to find an approximate value of $\sqrt[3]{1.01}$ and compare the value when using the calculator. [Hint use the linearization of $f(x) = \sqrt[3]{x}$ at $x = 1$.].