EXAM II
MA 125-CT, CALCULUS I
March 1, 2017

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

Show all your work, simplify 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 9 points each.

1. Find the derivative of the function $f(x) = \sin(x^3 + 2x)$.

2. Find the derivative of the function $f(x) = \left(x^4 - x\right)^4$

3. Find the absolute maximum and minimum of the function $f(x) = -4x^3 + 108x + 17$ on the interval $[0, 4]$.

4. Verify that the conditions of the Mean Value Theorem hold. Next find the number(s) c which satisfies the conclusion of the Mean Value Theorem for the function $f(x) = 3x^3 - 9x + 1$ on the interval $[-2, 2]$.

5. Find all critical points of the function $f(x) = 3x^4 - 20x^3 + 24x^2 + 1$.

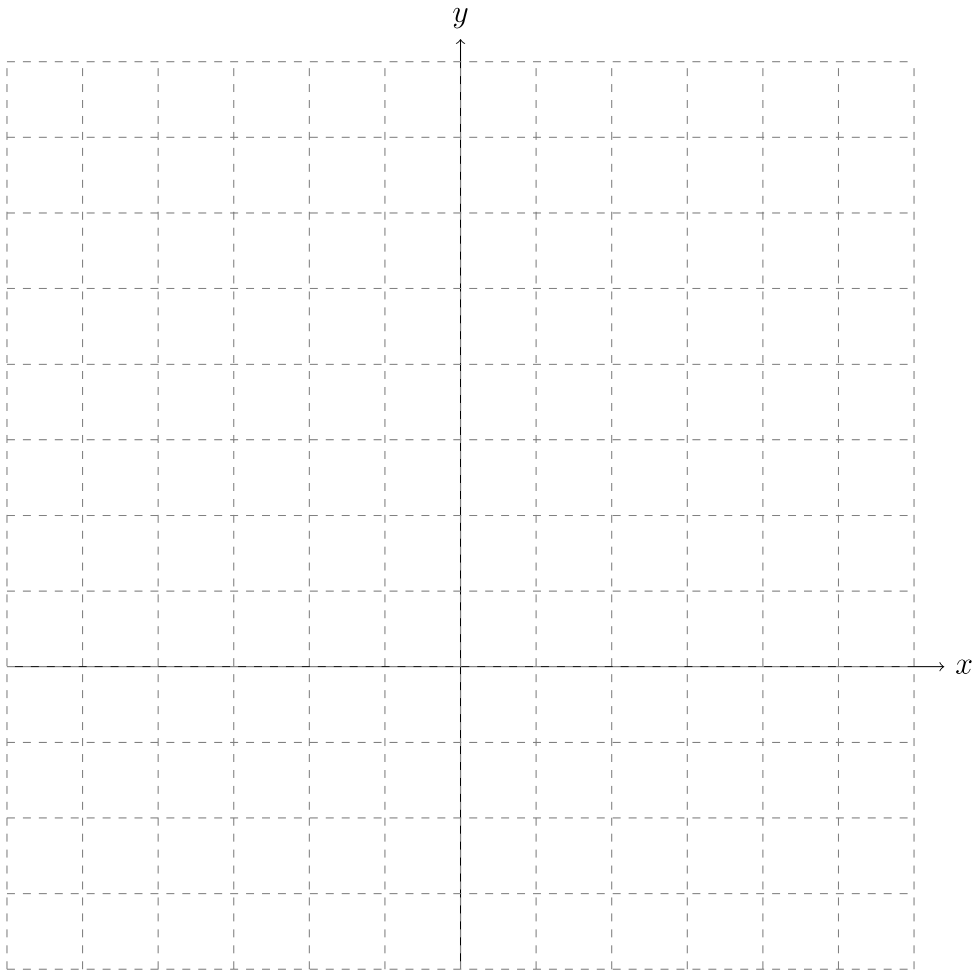
6. It is given that $f'(x) = x^2 + 3x - 4$. What are the local minima of the function f? What are the local minima of the function f?

$\boxed{\textbf{PART II}}$

7. [**16 points**] You have to design a rectangular box of volume 3 m^3 of minimal surface area if one side of the base is three times as long as the second side of the base. To this end, draw a box with dimensions of the base x and $3x$, and height y so that its volume $V = 3x^2y = 3\ m^3$. Then compute the area of all sides (including top and bottom); add these and minimize the resulting function. For what value of x the minimal surface area is achieved?

8. [**20 points**] **Use calculus** to graph the function $f(x) = \dfrac{x^3}{3} + \dfrac{x^2}{2} - 2x$.

Draw the graph below but do your work on the next page



In problem 8, indicate

- only 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.

9. [**10 points**]

- (6pts) Give the formula for linearization of the function $\sqrt[4]{x}$.
- (4pts) Use this formula to approximate $\sqrt[4]{82}$. Hint: as the base point a choose a number close to 82 for which the fourth root can be easily computed out.