MA 113 CALCULUS I, SPRING 2014
WRITTEN ASSIGNMENT #5
Due **Wednesday, 26 March**, at the beginning of lecture.

Instructions: The purpose of this assignment is to develop your ability to formulate and communicate mathematical arguments. Your complete assignment should have your name and section number on each page, be stapled, and be neat and legible. *Unreadable work will receive no credit.*

You should provide well-written, complete answers to each of the questions. We will look for correct mathematical arguments, careful explanations, and correct use of English. Your solution should be formulated in complete sentences. As appropriate, you may want to include diagrams or equations written out on a separate line. Your textbook provides examples of how we communicate mathematics.

Students are encouraged to use word-processing software to produce high quality solutions. However, you may find that it is simpler to add graphs and equations using pen or pencil.

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1. Suppose that $y(x)$ satisfies the equation $x^2y^2 + xy = 6$. The point $(x, y) = (1, 2)$ lies on this curve.

   (a) (2 points) Find the linearization of $y(x)$ at $x = 1$.

   (b) (2 points) Estimate $y(3/2) - y(1)$ using the derivative $y'(1)$.

2. Consider the function $f_\lambda(x) = 3x^4 + 4(1 - \lambda)x^3 - 6\lambda x^2$ on the real line with real parameter λ satisfying $0 \le \lambda \le 1$.

   (a) (2 points) Find the critical points of $f_\lambda(x)$ for the range $0 < \lambda \le 1$.

   (b) (2 points) Sketch the graph of $f_\lambda(x)$ for $\lambda = 1$ and $\lambda = 1/2$, and classify the local extrema. Are there any values of λ in the interval $(0, 1]$ for which the function $f_\lambda(x)$ is an even function? Explain your response.

   (c) (2 points) Find the critical points and classify the local extrema of $f_0(x)$. Sketch the graph of the function $f_0(x)$. How does $f_0(x)$ behave for x near zero? Is the number of critical points of $f_\lambda(x)$ the same for all values of $\lambda \in [0, 1]$?