MATH 203 Calculus III

Homework 13

Basic Information

This assignment is due on Gradescope by **1:30 PM on Tuesday, March 25**.

Make sure you understand MHC honor code and have carefully read and understood the additional information on the class syllabus. I am happy to discuss any questions or concerns you have!

Since this is a 200-level mathematics course, quite a few homework questions will ask you to explain your reasoning or process for solving a problem. Whenever possible, write your explanations in complete sentences and write your answers as if you were explaining to a peer in the class.

The homework problems will be graded anonymously so please do not put your name or other identifying information on the pages.

Turn In Problems

- #1. Find the critical points of the function $f(x, y) = x^3 - 12xy + 8y^3$ and use the 2nd derivative test to determine whether the critical points are max, min, or saddle points.
- #2. Find three positive numbers whose sum is 90 and whose product is maximum. Make sure to confirm your answer with the 2nd derivative test!
- #3.[1]. In Calculus I, if a continuous function has only one critical number which corresponds to a relative max, then that local max must be an absolute max. However, for functions of two variables, this is not true.
  - (a) Show that the function $f(x, y) = 3xe^y - x^3 - e^{3y}$ has one critical point that is a maximum.
  - (b) Graph that function in Desmos and then explain how it is possible to only have one critical point which is not an absolute maximum nor an absolute minimum.

Additional Problems (to do on your own, not to turn in)

- 12.8: 13
- Blood types (A, B, AB, O) are determined by *alleles* A, B, and O, and each person has two alleles. The proportion of individuals in a population who carry two *different* alleles (eg. AB, AO, BO) is given by the Hardy-Weinberg Law: $p = 2pq + 2pr + 2rq$ where r, q, and p are the proportions of A, B, and O in the population. Use the fact that $p + q + r = 1$ to show that P is at most $2/3$.

[1] Problem 2, 3 and the word problem in the additional problems are from Stewart Calculus: Early Transcendentals 6th edition, page 931-932