# MATH 203 Calculus III
Homework 12

## Basic Information
This assignment is due on Gradescope by **3 PM on Tuesday, October 29**.

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
- 9.4: 6, 10, 48
- #4. Sketch the region in the $xy$ plane consisting of points whose polar coordinates satisfy the following conditions.
  (a) $r > 1$
  (b) (b) $1 \leq r < 3$ and $-\pi/4 \leq \theta \leq \pi/4$
  (c) (c) $-1 \leq r \leq 1$ and $\pi/4 \leq \theta \leq 3\pi/4$
- #5. Use Lagrange multipliers to find the shortest distance from $(2, -2,3)$ to the plane $2x + 3y - z = 1$. (Yes, this is the same problem as in HW 11 but you are to use Lagrange multipliers this time.).
- #6. Use Lagrange multipliers to find the maximum and minimum values of the function $f(x, y) = x^2 - y^2$ subject to the constraint $x^2 + y^2 = 1$.
- #7 Use Lagrange multipliers to find the maximum and minimum values of the function $f(x, y, z) = 2x + 6y + 10z$ subject to the constraint $x^2 + y^2 + z^2 = 35$.

## Additional Problems (to do on your own, not to turn in)
- 9.4: 5, 9, 47
- Use Lagrange multipliers to find the maximum and minimum values of:

(a) the function $f(x, y) = x^2 + y^2$ subject to the given constraint $x^4 + y^4 = 1$
(b) The function $f(x, y, z) = 8x - 4z$ subject to the constraint $x^2 + 10y^2 + z^2 = 5$.
- Use Lagrange multipliers to find the volume of the largest rectangular box in the first octant with three faces in the coordinate planes and one vertex in the plane $x + 2y + 3z = 6$
- Do the previous problem using techniques from 12.8 instead.