Your Name:____________________ Signature:____________________

TA Name:____________________ Drill Time:____________________

Quiz 6 (Take Home)

Math 2574: Calculus III

Due: In Drill on Thursday, 3/17/20

Instructions: CLEARLY SHOW ALL YOUR WORK. Put a **box** around your final answer.

This quiz is due on **Tuesday, March 17,** at the beginning of your drill. Write your final solutions NEATLY on the sheets of paper below. FIRST, work out your solutions on scratch paper, and THEN write up your solutions *nicely* in the space provided. This quiz (like earlier ones) will be graded on a 0-1-2 scale. Remember, the *process and techniques* for finding the right answer are typically more important than the answer itself.

1. In this problem, you will find the absolute maximum and the absolute minimum of the function $f(x, y) = 6 - x^2 - 4y^2$ on R, where R is the closed rectangle in the xy-plane bounded by the lines $x = 1, x = -1, y = -1, y = 1$.

   (a) Compute ∇f, then find the critical points of the function f in the region R.

   (b) Divide the boundary of R into four line segments and find a formula for the restriction of f to each of these segments.

   (c) Find the maximum and minimum of f on each segment.

   (d) What are the maximum and minimum values of f on R and at which points do these values occur?

2. In this problem, you will find the point on the ellipsoid $x^2 + \frac{y^2}{4} + \frac{z^2}{25} = 1$ that is closest to the point $(2, 4, 10)$.

(a) Write a function $f \colon \mathbb{R}^3 \to \mathbb{R}$ that assigns to a point (x, y, z), the distance from (x, y, z) to $(2, 4, 10)$.

(b) Let $g(x, y, z) = x^2 + \frac{y^2}{4} + \frac{z^2}{25} - 1$. Next you will use the method of Lagrange multipliers to minimize f subject to the constraint that $g(x, y, z) = 0$. Find ∇f and ∇g.

(c) Use Lagrange multipliers to **set up a system of equations whose solution is** a point on the ellipsoid closest to $(2, 4, 10)$. **Do not solve the system of equations.**