Review Exercises Math 200
Third Test
UBC

October 24, 2018

1. The plane $x + y + 2z = 2$ intersects the paraboloid $z = x^2 + y^2$ in an ellipse. Find the points on this ellipse that are nearest to and farthest from the origin.

2. Use Lagrange multipliers to find the maximum and minimum values of
   
   (a) $f(x, y, z) = xyz$, subject to the constrain $x^2 + y^2 + z^2 = 3$
   
   (b) $f(x, y, z) = x^2 + 2y^2 + 3z^2$, subject to the constrains $x + y + z = 1$, $x - y + 2z = 2$

3. Find the directional derivative of $f(x, y, z) = x^2y + x\sqrt{1+z}$ at $(1, 2, 3)$ in the direction of $\vec{v} = 2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$

4. Find the local maximum and minimum values and saddle point(s) of the function $f(x, y) = (x^2 + y^2)e^{y^2-x^2}$

5. Find the absolute maximum and minimum of $f(x, y) = e^{-x^2-y^2}(x^2 + 2y^2)$ on the disk $x^2 + y^2 \leq 4$