MATH 2153 - Calculus III – Recitation 7

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1. Suppose $f(2,1,1) = 4$, $f_x(2,1,1) = -3$, $f_y(2,1,1) = 2$ and $f_z(2,1,1) = 6$. Estimate $f(2.1, 0.9, 1.2)$.

2. Find an equation for the tangent plane to the graph of the function $f(x,y) = y^x$ at the point $(1,2,2)$.

3. Find the local extremal values, saddle points and absolute extremal values of the function $f(x,y) = \dfrac{2y^2 - x^2}{2 + 2x^2y^2}$

   (a) on the region R bounded by the lines $y = x$, $y = 2x$ and $y = 2$. (*Hint:* Draw the region R first.)

   (b) on $\mathbb{R}^2$.

4. Find the local extremal values and saddle points values of the function $f(x,y) = x^2y - 3$. Decide if f has extremal values on $\mathbb{R}^2$ and on $R = \{(x,y) : y \geq 0\}$.

5. Find the extremal values of the function $f(x,y,z) = x^2 + y^2 + z^2$, subject to the constraint $xyz = 4$.

6. Find the local extremal values, saddle points and absolute extremal values of the function $f(x,y) = x^4 + 4x^2y - 8x^2 + 8y^2 - 16y + 1$ on the region $\{(x,y) : x^2 + y^2 \leq 4\}$.

7. Draw the gradient vectors at all the marked points of the following contour map of a differentiable function $f(x,y)$. Decide from the picture if f has any saddle points, or local extremal values.