Taker Name: Key GTID: 903 Section:

Grader #1: GTID: 903

§14.7: Optimization and critical points

Find all the critical points of the function.

$$f(x,y) = x^4 + y^4 + 4xy$$

Find $\nabla f = \begin{bmatrix} f_x \\ f_y \end{bmatrix}$ and set $\nabla f = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$.

① $f_x = 4x^3 + 4y = 0 \Rightarrow -x^3 = y$ ①

② $f_y = 4y^3 + 4x = 0 \Rightarrow -y^3 = x$ ②

Sub ② into ① to get

$$y = -(-y^3)^3 = +y^9$$

So $-y^9 + y = 0 \Rightarrow y(-y^8 + 1) = 0$

So $y = 0$ or $y^8 = 1 \Rightarrow y = 1$ or $y = -1$.

Sub back into ②

If $y = 0$ then $x = 0$, get $(0,0)$

If $y = 1$ then $x = -1$ get $(-1,1)$

If $y = -1$ then $x = 1$ get $(1,-1)$.

So three crit points $\boxed{(0,0), (-1,1), (1,-1)}$

A		
J		
N		
A		
J		
N		
A		
J		
N		