MATH 234 QUIZ 6 27 OCT 2016, TA: JIUYA WANG

Name:

Notice:
1. Please box your final answer.
2. Please stop writing when time is up.

Problem 1 (10 points):
Given the following function:

$$f(x,y) = y^2 - 18x^2 + x^4$$

1. Compute critical point(s);
2. Determine for each critical point, what is the local behavior.

1. $f_x = -36x + 4x^3 = 0$ $\Rightarrow$ $y=0$ cp: $(0,0)$ $(3,0)$ $(-3,0)$
$f_y = 2y = 0$ $x = 0$ or ± 3

2. $f_{xx} = -36 + 12x^2$ $f_{xy} = 0$
$f_{yy} = 2$

at $(0,0)$ $Q(X,Y) = -36X^2 + 2Y^2$ indefinite.
saddle pt

at $(0,\pm 3)$
$Q(X,Y) = 72X^2 + 2Y^2$
positive definite.
local minimum.

Problem 2 (10 points):
Given the following functions:

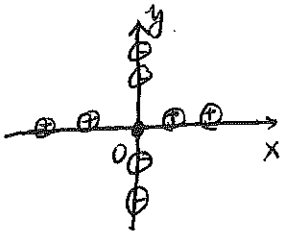
$$f(x,y) = x^2 - y^4 \; ; \; g(x,y) = x^2 + y^4$$

1. For f, compute critical points and find the associated quadratic form;
2. For g, compute critical points and find the associated quadratic form;
3. Is the second order derivative test conclusive or not? If not, what is the local behavior at these critical points?
Hint: you might want to draw zero set.

1. $f_x = 2x$ $f_y = -4y^3$
$=0$ $=0$
$\Rightarrow$ c.p $(0,0)$
$f_{xx} = 2$ $f_{yy} = -12y^2$ $f_{xy} = 0$
$Q(X,Y) = 2X^2$

2. $f_x = 2x$ $f_y = 4y^3$
$=0$ $=0$
$\Rightarrow$ c.p. $(0,0)$
$f_{xx} = 2$ $f_{yy} = 12y^2$
$f_{xy} = 0$
$Q(X,Y) = 2X^2$

3. No. For f:



saddle.

For g: $x^2 + y^4 > 0$ if (x,y) is not origin.
so local min.