Math 251 name Key

Exam III part 2

Spring 2013 Show All Work

1) Find the local maximum and minimum values and saddle points of the function

$f(x,y) = 2y^3 + 3x^2y - 9y^2 - 3x^2 + 2$

$f_x(x,y) = 6xy - 6x \longrightarrow f_x = 0 \rightarrow 6xy - 6x = 0 \rightarrow 6x(y-1) = 0$

$x = 0$ or $y = 1$

$f_y(x,y) = 6y^2 + 3x^2 - 18y \longrightarrow f_y = 0$

If $x = 0$

$6y^2 + 3x^2 - 18y = 0$

Becomes

$6y^2 - 18y = 0$

$6y(y-3) = 0$

$y = 0$ or $y = 3$

$(0,0)$ OR $(0,3)$

If $y = 1$

$6y^2 + 3x^2 - 18y = 0$

Becomes

$6 + 3x^2 - 18 = 0$

$3x^2 - 12 = 0$

$3x^2 = 12$

$x^2 = 4$

$x = \pm 2$

$(2,1)$, or $(-2,1)$

$D = f_{xx} f_{yy} - (f_{xy})^2$

$= (6y-6)(12y-18) - (6x)^2$

$D(0,0) = (-6)(-18) > 0$ $f_{xx} < 0$ c. down LOCAL MAX AT $(0,0,2)$

$D(0,3) = (12)(18) > 0$ $f_{xx} > 0$ c. up LOCAL MIN AT $(0,3,-25)$

$D(2,1) = 0 - 144 < 0$ SADDLE POINT $(2,1,-5)$

$D(-2,1) = 0 - 144 < 0$ SADDLE POINT $(-2,1,-5)$

Scratch

$f(0,3) = 54 - 81 + 2 = -25$

$f(2,1) = 2 + 12 - 9 - 12 + 2 = -5$

$f(-2,1) = 2 + 12 - 9 - 12 + 2 = -5$