Math B1131, Quiz #10, Fall 2012 Name KEY

Instructions: Show all work. Use exact values unless specifically told to round.

1. Find the critical points for the function $f(x,y) = x^3 + 6xy + 10y^2 + 4y + 4$, and characterize each point as either a maximum, minimum, saddle point, or cannot be determined.

$f_x = 3x^2 + 6y = 0$ $\quad x^2 = -2y \quad -\frac{1}{2}x^2 = y$

$f_y = 6x + 20y + 4 = 0$

$\frac{6x - 10x^2 + 4 = 0}{-2}$

$5x^2 - 3x - 2 = 0$

$(5x+2)(x-1) = 0$

$x = -\frac{2}{5} \quad x = 1$

$x = 1$

$-\frac{1}{2}(1)^2 = -\frac{1}{2} \qquad (1, -\frac{1}{2})$

$x = -\frac{2}{5}$

$-\frac{1}{2}\left(-\frac{2}{5}\right)^2 = -\frac{1}{2} \cdot \frac{4}{25} = \frac{-2}{25} \qquad \left(\frac{-2}{5}, \frac{-2}{25}\right)$

$f_{xx} = 6x$

$f_{yy} = 20$ $\qquad D(x,y) = f_{xx} \cdot f_{yy} - (f_{xy})^2$

$f_{xy} = 6$

$D(1, -\frac{1}{2}) = 6(20) - 6^2 > 0 \qquad f_{xx} > 0 \cup \quad$ MIN

$D(-\frac{2}{5}, -\frac{2}{25}) = \left(-\frac{12}{5}\right)(20) - 6^2 < 0 \qquad$ Saddle point