Math 206: Winter 2014
Quiz 4: February 27
NO calculator

Correct answers accompanied by incorrect or incomplete work will not receive full credit.
Good Luck!

1. Let \( f(x, y) = (xy + y^3)^{100} \).
   (a) Find \( \frac{\partial f}{\partial x} \).
   
   (b) Find \( f_{xx} \).
   
   (c) Find \( \frac{\partial^2 f}{\partial y \partial x} \).

2. Let \( f(x, y) \) be such that
   \[
   f_x(x, y) = 2x + 2y^2 \quad f_y(x, y) = 4xy - 3y^2
   
   f_{xx}(x, y) = 2 \quad f_{yy}(x, y) = 4x - 6y \quad f_{xy}(x, y) = 4y
   \]
   Find the quadratic approximation of \( f(x, y) \) at \((2, 1)\).
3. Use the contour diagram below to answer the following questions.

(a) Give a numerical estimate of $f_x(1, 2)$. (Show your calculation!)

(b) Determine the sign of $f_{xx}(1, 2)$. Explain your answer BRIEFLY.