Name:_____

Math 206: Fall 2013
Exam 2: November 1   calculator allowed

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

1. (3 points each) Determine whether each of the following statements is *true* or *false*. No justification necessary, no partial credit available.

   (a) If $f_x(0,0)$ and $f_y(0,0)$ exist, then f must be differentiable at $(0,0)$.
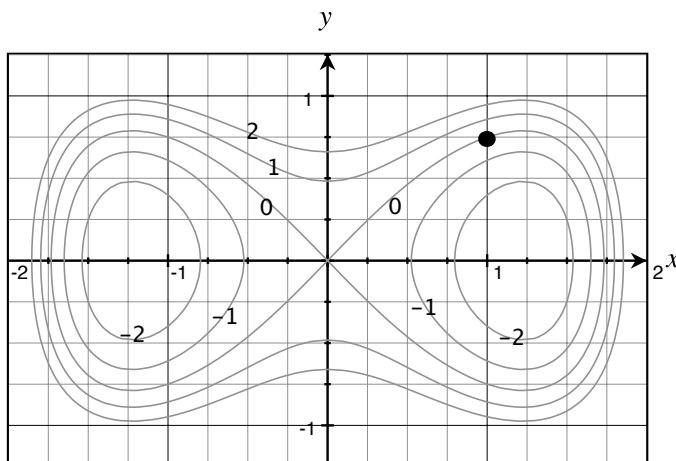
   (b) A partial derivative is a specific example of a directional derivative.

   (c) $\nabla f(a,b)$ is perpendicular to the graph of $z = f(x,y)$ at the point (a,b).

   (d) Vectors $\vec{a}$ and $\vec{b}$ are as pictured in the diagram, both are in the xy-plane.
   True/False: $\vec{a} \times \vec{b} = t\hat{k}$, where t is a positive number.
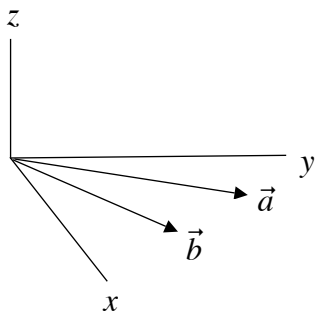
2. (5 points) Consider the function $g(x,y)$ with contour diagram below. Sketch a vector that points in the direction of $\nabla g(1, 0.75)$.

3. (8 points) The consumption of beef by one household, C (in pounds per week) is given by the function $C = f(I, p)$, where I is the annual household income in thousands of dollars, and p is the price of beef in dollars per pound. Explain the meaning of the statement: $f_I(80, 3) = 0.022$, include units in your answer.

4. (12 points) The table of some values of $C = f(I, p)$ is given below. Find a linearization of f at $(40, 3)$.

Price of beef, p ($/lb)

		3	3.5	4	4.5
Household	20	2.65	2.59	2.51	2.43
income	40	4.14	4.05	3.94	3.88
per year,	60	5.11	5.00	4.97	4.84
I ($1000)	80	5.35	5.29	5.19	5.07

5. (15 points) Find the equation of the plane tangent to $z^2 + 2zy + 4y = x^2 + 3$ at the point $(3, 1, -4)$.

6. (15 points) Let $w = 3x \cos y$. If $x = u^2 + v^2$ and $y = \dfrac{v}{u}$, find $\dfrac{\partial w}{\partial u}$ at the point $(u, v) = (2, 3)$. Give your answer to 2 decimal places. (Set your calculator to radians.)

7. (12 points) Suppose that $f_x(x, y) = \frac{1}{2}(x + 2y)^{-1/2}$ and $f_y(x, y) = (x + 2y)^{-1/2}$. Also suppose that $f(1, 0) = 1$. Find the quadratic Taylor polynomial (i.e., the quadratic approximation) of $f(x, y)$ at $(1, 0)$.

8. (10 points) Using the contour diagram for $f(x,y)$, find the sign of $f_{yy}(P)$ given that $f_{xx}(P) < 0$. Justify your answer.
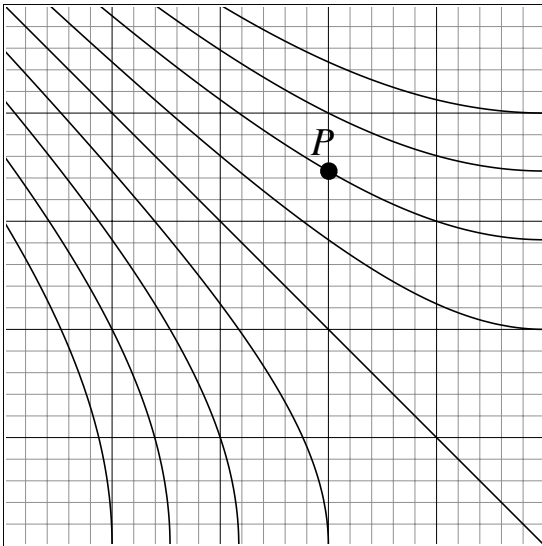
9. (8 points) Select ALL the planes that could NOT be tangent planes to the graph of a function $f(x,y) = z$ that is differentiable everywhere. (Briefly justify your choices.)

   (a) $3x - 5y - z = 2$

   (b) $5x + 3y = 2$

   (c) $3x + 5y = 2$

   (d) $3x + 5y + z = 2$

   (e) $5y = 2$

10. (3 points) What is your favorite food?