Name: _____

VIP ID: _____

- Write your name and your VIP ID in the space provided above.

- The test has five (5) pages, including this one.

- Enter your answer in the box(es) provided.

- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.

- Credit for each problem is given in parentheses at the right of the problem number.

Page	Max. points	Your points
2	50	
3	50	
Total	100	

Problem 1 (20 pts—10 points each). Find equations of the tangent plane to the graph of the following functions at the indicated points.

(a) $f(x, y) = \sqrt{x^2 + y}$ at $P = (0, 1, 1)$.

Plane:

(b) $f(x, y) = x \cos(xy)$ at $P = (1, \pi, 1)$

Plane:

Problem 2 (10 pts). Find the direction in which the function $f(x, y) = \frac{1}{2}x^2 + \frac{1}{2}y^2$ increases more rapidly at the point $(1, 1)$. What is that value?
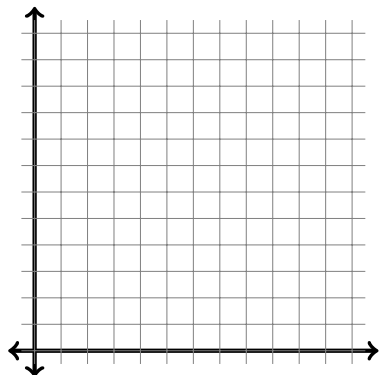
Direction:

Value:

Problem 3 (20 pts). Find and classify all the critical points of the function

$$f(x, y) = 3y^2 - 2y^3 - 3x^2 + 6xy.$$

Problem 4 (50 pts—10 pts each part). Find the absolute maximum and minimum values of the function $f(x,y) = 8x + 12y - x^2 - y^2 + 73$ on the set $D = \{(x,y) : 0 \le x \le 10, 0 \le y \le 7\}$.

I will walk you through the different steps:

(a) Sketch the domain D.

(b) Let's gather some candidates. The first kind of candidates are the critical points of f. Find them. For those on the domain D, place them in the diagram above, and indicate the value of the function in those locations.

(c) The rest of candidates are going to be located on the border of the domain D. Find first parametric equations for each of the curves that define the border of D. Do that work on page 4. Label them accordingly in the diagram above.

(d) On each of the curves that define the border of D, find candidates for absolute maximum and absolute minimum. Do the work on page 5, and report those points (with their values) here.

Candidates for Maxima

Point(s)	value

Candidates for Minima

Point(s)	value

(e) Where are the absolute maxima and minima of f on D? What are their values?

max: [   ]   min: [   ]

Scratch paper for part (c) of Problem 1.

Scratch paper for part (d) of Problem 1.