Instructions:
1. Write your *Name, PID, Section Number,* and *Exam Version* on the *front* of your blue book.
2. Draw the following table on the inside cover of your blue book:

0	
1	
2	
3	
4	
$\sum$	

3. You may use one $8.5x11$ in. sheet of *handwritten* notes, but no books or other assistance during this exam.
4. No calculator, phones, or any other electronic devices are allowed during this exam.
5. Present your solutions clearly in your Blue Book:

(a) Carefully indicate the number and letter of each question and each part of a question.
(b) Present your answers in the same order as they appear in the exam.
(c) Start each problem on a new page.

6. Show all of your work. Unsupported answers will receive no credit.
7. Turn in your exam paper and your note sheet with your Blue Book.

0. (1 point.) Carefully read and follow the instructions.

1. Let $f(x, y) = (y^2 + x)\cos(x)$.

   (a) (2 points) Calculate $f(\frac{\pi}{2}, 3)$, and $f(0, 7)$.

   (b) (2 points) Is the point $(1, 1, 4\pi)$ on the graph of $f(x, y)$? Explain.

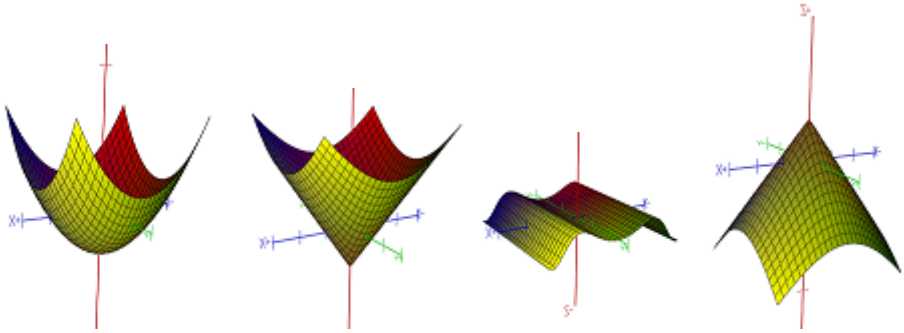
   (c) (2 points) Find two values of a so that $(a, 3, 0)$ is on the graph of $f(x, y)$.

2. Let
$$f(x, y) = \sqrt{x^2 + y^2} - 2.$$

   (a) (3 points) Write the equations for the *level curves* of $f(x, y)$ for the values $f(x, y) = 0$, -1, -2 and graph the resulting *contour diagram.*

(b) (2 point) Write the expression for the *level curve* $f(x, y) = -3$, describe the set of points that satisfy this equation, and explain what this means for the graph of $f(x, y)$.

(c) (1 points) Which of the following graphs could be the graph of $f(x, y)$. No work is necessary. Circle your answer.



3. Consider the three points:

$$P = (1, 2, 3),\ Q = (2, 1, -1),\ \text{and}\ R = (-1, 7, 9).$$

(a) (4 points)Find an equation for the plane containing P, Q, and R.

(b) (2 points)Calculate the area of the triangle ΔPQR.

4. Let

$$\vec{\mathbf{v}} = \langle -4, 8, 1\rangle,\ \text{and}\ \vec{\mathbf{u}} = \langle -6, 2, -1\rangle.$$

(a) (3 points) Calculate the cosine of the smallest angle θ between $\vec{\mathbf{v}}$ and $\vec{\mathbf{u}}$.

(b) (3 points) Let $\vec{\mathbf{w}} = \langle t^2, -t, -4\rangle$. For which values of t, if any, is $\vec{\mathbf{w}}$ perpendicular to $\vec{\mathbf{v}}$?