MATH 307 First Midterm

October 6, 2010

Name: _____ **ID:** _____

Question:	1	2	3	4	5	Total
Points:	16	15	15	16	12	74
Score:						

There are 5 problems on 6 pages in this exam (not counting the cover sheet). Make sure that you have them all.

You may use a calculator if you wish, provided your calculator does not do calculus. However, it is unlikely to be of much help.

Do all of your work in this exam booklet, and cross out any work that the grader should ignore. You may use the backs of pages, but indicate what is where if you expect someone to look at it. **Books, extra papers, and discussions with friends are not permitted.** If you wish to use your psychic abilities to read my mind for the answers, you may do so. However, remember that I may be deliberately thinking of the *wrong* answers during the test.

You have about 79 minutes and 47 seconds to complete this exam.

When you complete this exam, if there is sufficient time it is strongly recommended that you go back and reexamine your work, both on this exam and in your life up until now, for any errors that you may have made.

1. (a) Find the point of intersection of the lines

$$\langle 2+t, -1-2t, 4+t \rangle \qquad \text{and} \qquad \langle -1-2s, -1+s, -1-3s \rangle$$

(b) Write the equation of the plane containing the two lines

$$\langle 2+t, -1-2t, 4+t \rangle \qquad \text{and} \qquad \langle -1-2s, -1+s, -1-3s \rangle$$

You may express this either in vector/parametric form, or as an equation in x, y, and z. Note that this can be done even if you couldn't do the first part.

5 pts. 2. (a) Give all real values of a for which the matrix $\begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & a \\ 2 & a & 1 \end{pmatrix}$ has no inverse.

5 pts. (b) Find the inverse of the matrix $\begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 2 & 1 & 1 \end{pmatrix}$. If the matrix has no inverse, say why not.

5 pts. (c) Find all solutions to the system of equations $\begin{cases} x & +y & & = 2 \\ x & +y & +z & = 1 \\ 2x & +y & +z & = 2 \end{cases}$.

3. Department of Justice Special Agent Orange, while investigating charges of anti-competitive business practices, walks due east out of the MacroSoft corporate office building for a distance of exactly 26 meters. He pauses for a moment to tie his shoe, and suddenly he finds himself surrounded by an advancing wall of flames! He can't move, and there is no ground-based escape.

However, he has his HookShot™ grappling hook with him, which he can fire at any fixed object within 22.5 meters and pull himself to it. He recalls from his careful study of the building plans that the nearest face of the building is a flat plane, inclined outwards with a normal vector of $\langle 4, 2\sqrt{2}, -1 \rangle$ relative to east (that is, in the coordinate system where east is $\langle 1, 0, 0 \rangle$). How far is Agent Orange from the nearest part of the building face? Can he escape, or is he toast?

26m
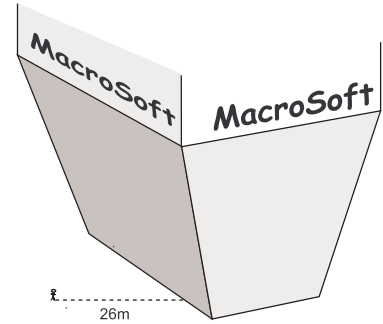
8 pts. 4. (a) For the function $F : \mathbb{R}^2 \to \mathbb{R}^3$ given by $F(x, y) = \langle x \cos(xy), x \sin(y), 2y \rangle$, find the partials $F_x(x, y)$ and $F_y(x, y)$.

8 pts. (b) Write the equation of a plane tangent to the parametric surface $\langle s \cos(st), s \sin(t), 2t \rangle$ at the point $(-1, 0, 2\pi)$.

5. Listed are six functions, labeled **a** through **f**. Underneath each surface below, write the
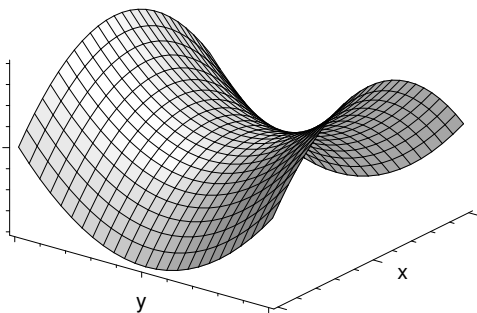letter of the function it is the graph of.

a. $(x+y)^2$

b. $\sqrt{x^2+y^2}$

c. $\cos\left(x^2+y^2\right)$

d. $y^2 - x^2$

e. $e^{-1-x^2-y^4}$
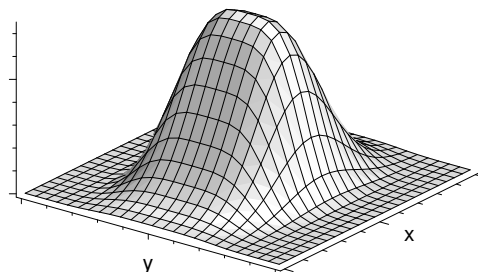
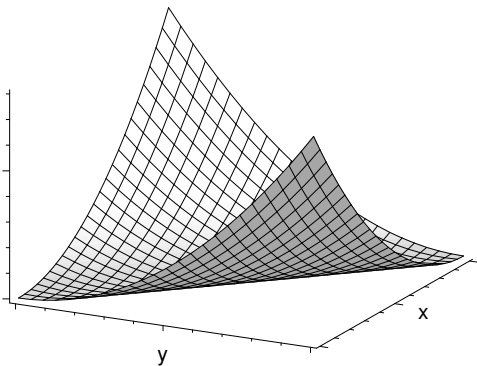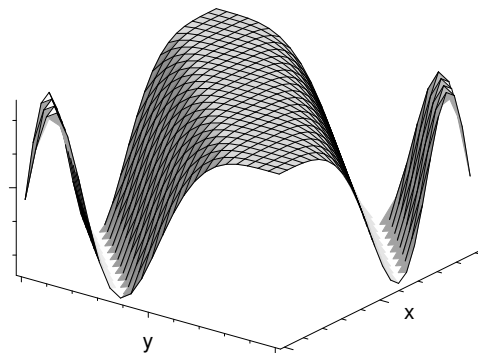**f.** $\cos\left(\dfrac{(x-y)^2}{2}\right)$

I
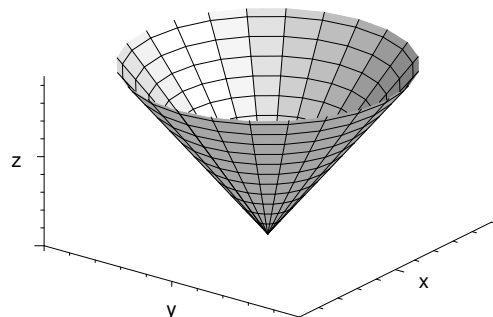
IV
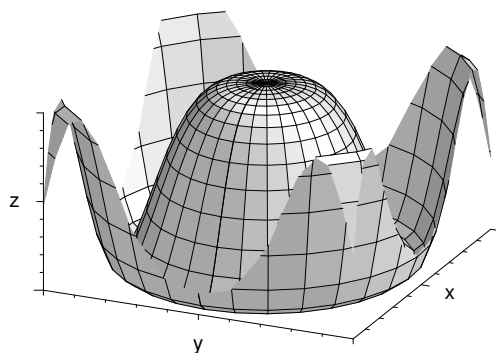
II

V

III

VI

This page was once a tree, and once it was blank. Now it is neither. You can make it less blank if you like. Turning it back into a tree is more effort, but also more worthwhile.