First Midterm Exam MAT 205, Fall 2000

PRINT your name:

problem	1	2	3	4	5	6	Total
possible	25	15	14	14	14	18	100
score							

Directions: There are 6 problems on 4 pages in this exam. Make sure that you have them all. 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. You may use a calculator, provided it does not do calculus.

1. *(25 points)* **Easy stuff:** If you can't do these, you are probably in trouble.

a. Let $\mathbf{A} = 2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$, and $\mathbf{B} = \mathbf{i} - 2\mathbf{j} - \frac{1}{2}\mathbf{k}$. Compute $\mathbf{A} - 2\mathbf{B}$.

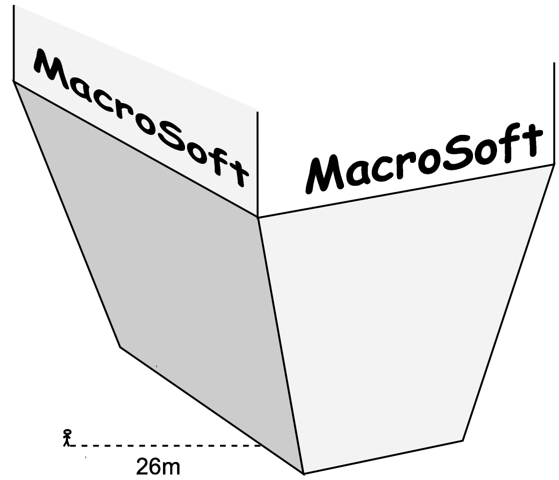
b. What is the length of the vector $\langle 3, -1, 1 \rangle$?

c. Let $\mathbf{A} = \langle -1, 0, 3 \rangle$ and $\mathbf{B} = \langle 3, -3, 4 \rangle$. Find $\mathbf{A} \cdot \mathbf{B}$.

d. What is the angle between the vectors $\left\langle \sqrt{6}, 1, 3 \right\rangle$ and $\langle 0, 1, 1 \rangle$?

e. Find a vector perpendicular to both $2\mathbf{i} + 3\mathbf{j}$ and $\mathbf{j} - \mathbf{k}$.

2. *(15 points)* Department of Justice Special Agent Orange 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 $22\frac{1}{2}$ meters and pull himself to it. He recalls, from careful study of the building plans, that the nearest face of the building is a flat plane, inclined outwards with a normal vector of $\left\langle 4, 2\sqrt{2}, -1 \right\rangle$ 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?



3.*(14 points)* Write the equation of the line containing the points $(1, 3, 1)$ and $(2, 0, -1)$.

4.*(14 points)* Write the equation of the plane that contains both the lines

$$\frac{x-1}{3} = \frac{y+2}{4} = -\frac{z}{2} \qquad \text{and} \qquad x = \frac{y+4}{2} = z+1$$

5.*(14 points)* Write the equation of the line tangent to the curve $\mathbf{R}(t) = \langle 1 + t^2, \sin t, e^t - 1 \rangle$ at the point $(1, 0, 0)$.

6. *(18 points)* Listed are six functions, labeled **a** through **f**. Underneath each surface below, write the letter of the function it is the graph of.

a. $(x+y)^2$

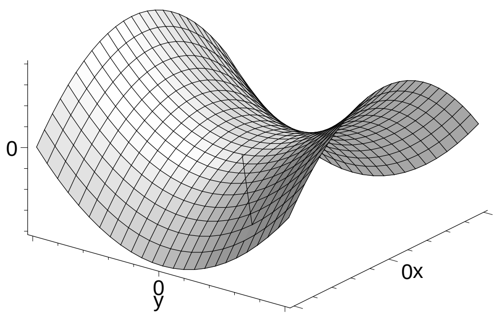
b. $\sqrt{x^2+y^2}$

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

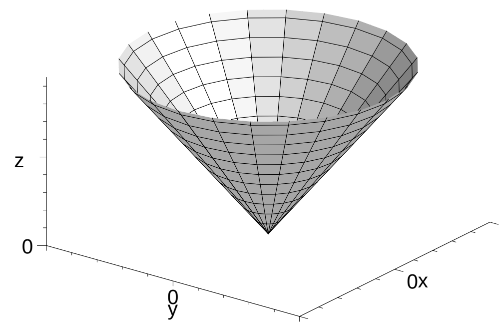
d. y^2-x^2

e. $e^{-1-x^2-y^4}$

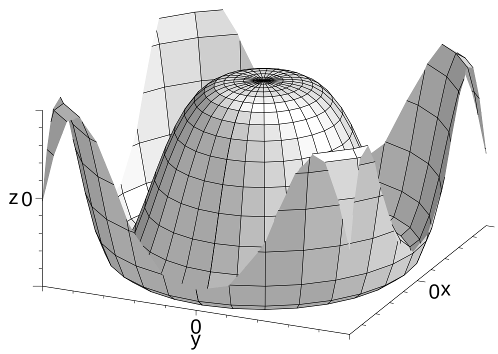
f. $\cos\left(\dfrac{(x-y)^2}{2}\right)$



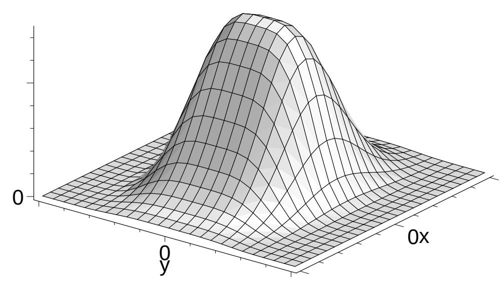
I



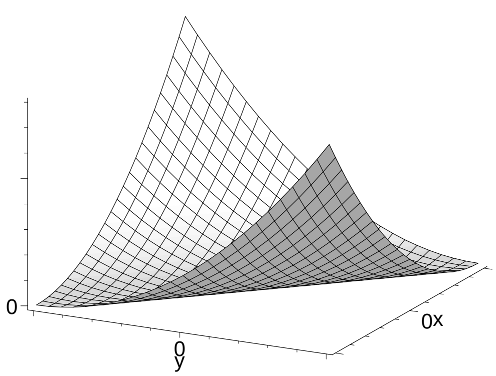
IV



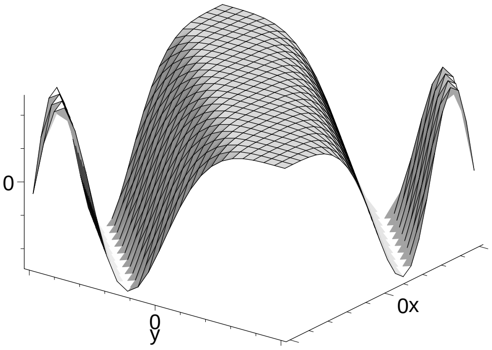
II



V



III



VI