Math 20C (Shenk). Summer, 2011. Exam 2.

(10 points per problem. Maximum = 100 points)

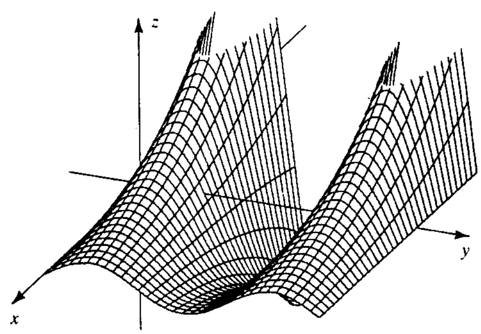
Name ____ Section ________

Work alone and use no books, notes, or calculators. Show your work with your answers on 8.5"×11" paper and staple the pages to the exam when you turn them in.

Problem 1 An object is traveling clockwise around the circle $x^2 + y^2 = 25$ in an xy-plane with distances measured in feet. When it is at $(4, 3)$, it is traveling 10 feet per second and is slowing down 5 feet per second^2.
(a) (5 points) What is its velocity vector at that point?
(b) (5 points) What is its acceleration vector at that point?

Problem 2 Does Figure 2 show the graph of **(a)** $f(x, y) = e^{-y} \sin x$, **(b)** $f(x, y) = e^{-x} \sin y$, **(c)** $f(x, y) = e^{-x}e^y$, or **(d)** $f(x, y) = \sin x \sin y$? Justify your answer.

FIGURE 1



Problem 3 The table below gives the equivalent human age $A = A(t, w)$ of a dog that is t years old and weighs w pounds. **(a)** What does $A(10, 60)$ represent? **(b)** What does $A_w(10, 60)$ represent and, based on the table, what is its approximate value?

$A(t, w) =$ EQUIVALENT HUMAN AGE

	$t = 6$	$t = 8$	$t = 10$	$t = 12$	$t = 14$	$t = 16$
$w = 80$	45	55	66	77	88	99
$w = 50$	42	51	60	69	78	87
$w = 20$	40	48	56	64	72	80

(Over)

Scores:

1	2	3	4	5	6	7	8	9	10	Total

Problem 4 Draw the level curve of $g(x, y) = xy$ through the point $(2, 1)$ and ∇g at that point.

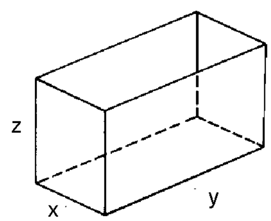
Problem 5 Find the derivative $\dfrac{\partial^2}{\partial x \partial y}[e^{2x+3y}]$.

Problem 6 What is the directional derivative of $f(x, y) = \sin x + \cos y$ at $(1, 1)$ in the direction toward the origin?

Problem 7 Find the two unit vectors that are perpendicular (normal) to the surface $x^2 + y^3 + z^4 = 3$ at the point (1,1,1).

Problem 8 A rectangular box with no top (Figure 2) is to be manufactured so that it has a volume of one-half cubic foot. What dimensions should it have to minimize the total area of the bottom and four sides? (You may assume that the minimum exists.)

FIGURE 2



Problem 9 Find the critical points of $f = x^4 - 4x + xy - y$ and use the Second-Derivative Test to clasify them.

Problem 10 **(a)** (7 points) Use Lagrange multipliers to find the minimum value of $f(x, y) = x^2 + 2y^2$ on the line $2x + y = 9$. **(b)** (3 points) Why does f not have a maximum value on the line?