

Math 126
Exam 4
December 13, 2006

Name: _____

1. Your exam contains 5 questions and 6 pages; Please make sure you have a complete exam.
2. The entire exam is worth 100 points. Point values for problems vary and these are clearly indicated. You have 2 hours for this exam.
3. Make sure to ALWAYS SHOW YOUR WORK; you will not receive any partial credit unless all work is clearly shown. If in doubt, ask for clarification.
4. If you need extra space, use an extra attached sheet and clearly indicate this.
5. You are allowed one 8.5×11 sheet of handwritten notes (both sides). Graphing and scientific calculators are allowed.
6. Leave answers in exact form (as simplified as possible) or round to 4 decimal places.

Problem	Total Points	Score
1	25	
2	15	
3	15	
4	30	
5	15	
Total	100	

1. (25 pts.) The temperature T in a room is measured in $^{\circ}\text{C}$ at a given point (x, y) where x and y are in feet. Values of the function $T = f(x, y)$ are given in the following table.

	15	20	25
10	25°	23°	22°
20	26°	21°	16°
30	27°	17°	10°

- (a) (10 pts.) Use the table to find a linear approximation of the function f when x is near 20 and y is near 20.

- (b) (5 pts.) Estimate the value of $f(18, 22)$.

- (c) (10 pts.) Suppose a heat-dependent bug is sitting at $(20, 20)$. What is the approximate rate of change of the temperature if the bug moves toward the point $(24, 17)$? Include units in your answer.

2. (15 pts.) Let $w = x^2ze^{2y}$ where x , y , and z are functions of s and t . For the values $s = -4$ and $t = 3$, we have the following information:

$$x = 2 \quad y = 0 \quad z = 3$$

$$\frac{\partial x}{\partial s} = 2 \quad \frac{\partial y}{\partial s} = 3 \quad \frac{\partial z}{\partial s} = 4$$

$$\frac{\partial x}{\partial t} = -1 \quad \frac{\partial y}{\partial t} = 0 \quad \frac{\partial z}{\partial t} = 2$$

Find $\frac{\partial w}{\partial t}$ when $s = -4$ and $t = 3$.

3. (15 pts.) Find an equation of a tangent plane to the surface $z^2 - 4x^2 + y^2 = 2$ at the point $(2, 3, -3)$.

4. (30 pts.) Sam and Frodo are on a pleasant day hike on Mount Doom. The shape of the mountain is given by the equation $z = 5000 - \frac{1}{2}x^2 + 10x - \frac{1}{4}y^2 + 15y$, where x , y , and z are in meters. Sam and Frodo are currently standing at the coordinates $(-30, -40, 3250)$.

- (a) (10 pts.) What is the direction of steepest ascent? What is the maximum rate of ascent?

(b) (10 pts.) Find a nonzero direction $\vec{v} = \langle a, b \rangle$ for which the rate of ascent is zero from the point that Sam and Frodo are standing.

(c) (10 pts.) How tall is Mount Doom, i.e., what is the maximum z -value?

5. (15 pts.) Find the local maximum and minimum values and saddle points of the function $f(x, y) = 2x^3 + 5x^2 + xy + \frac{1}{2}y^2$.