

Name: _____ Section Number: _____

TA Name: _____ Section Time: _____

Math 20C.
Midterm Exam 2
May 17, 2004

You may use one page of notes, but no other assistance on this exam.

Read each question carefully, answer each question completely, and show all of your work.

Evaluate integrals using methods discussed in the course and show your calculations.

Write your solutions clearly and legibly; no credit will be given for illegible solutions.

If any question is not clear, ask for clarification.

1. (4 points) Determine if

$$u(x, y) = e^x [x \cos(y) - y \sin(y)]$$

is a solution to Laplace's equation $u_{xx} + u_{yy} = 0$.

#	Score
1	
2	
3	
4	
5	
Σ	

2. (4 points) Let $f(x, y) = x^3 - 3xy^2$.

(a) Find the gradient of f at the point $(1, 2)$.

(b) Find the two unit vectors in the directions in which the directional derivative of f at $(1, 2)$ is zero.

3. (4 points) The temperature at a point (x, y) is $T(x, y)$, measured in degrees Celsius, and satisfies $T_x(2, 3) = 8$ and $T_y(2, 3) = 6$. A scarab beetle crawls so that its position after t seconds is given by $x = \sqrt{2+t}$, $y = 2 + \frac{1}{2}t$, where x and y are measured in centimeters. How fast is the temperature rising on the beetle's path after 2 seconds?

4. (4 points) Find the point on the plane $2x + y - 3z = 2$ which is closest to the point $(1, 2, -4)$.

5. (4 points) Evaluate the double integral

$$\iint_R (3 - y) \, dA,$$

where $R = [0, 6] \times [0, 3]$.