

EXAM 2

Math 103, Spring 2008-2009, Clark Bray.

You have 50 minutes.

No notes, no books, no calculators.

YOU MUST SHOW ALL WORK AND EXPLAIN ALL REASONING
TO RECEIVE CREDIT. CLARITY WILL BE CONSIDERED IN GRADING.

Good luck!

Name _____

ID number _____

1. _____

“I have adhered to the Duke Community
Standard in completing this
examination.”

2. _____

3. _____

Signature: _____

4. _____

5. _____

6. _____

7. _____

8. _____

Total Score _____ (/100 points)

1. (16 pts) The solid D is bounded by the surface with equation $z^2 - \ln(2 - x^2 - y^2) = 0$. Find the absolute maximum value of the function $f(x, y, z) = x^2 + y^2 + z^2$ over the solid D .

2. (12 pts) Classify the critical point $(1, 1)$ of the function $f(x, y) = (y - x^2)(2x - y - 1)$.
3. (12 pts) Find the unit vector representing the direction of fastest increase of the function $h(x, y, z) = e^{xyz}$ at the point $(1, 2, 3)$.

4. (12 pts) Use the total derivative to approximate the value of the function $P(x, y) = e^{xy} - x(y+1)^2$ at the point $(3.98, 0.01)$.

5. (12 pts) Suppose that $z = f(x, y)$ where f has continuous second partials, $x = u - 3v$, and $y = 3u + v$. Find the mixed second partial z_{uv} in terms of partials of f .

6. (16 pts) Compute the z -coordinate of the centroid of the solid region T , bounded by the surfaces $x = 0$, $y = 0$, $z = 0$, and $x + 2y + 4z = 4$.

7. (10 pts) Set up, but do not evaluate, an iterated integral representing the mass of the solid part of the first octant bounded by the coordinate planes, and the surfaces $y = 1$, $2x + y = 2$, and $x + z = 1$, where the density function is given by $\delta(x, y, z) = \ln(1 + x^2 + 3y^2 + 2z^2)$.
8. (10 pts) Set up, but do not evaluate, an iterated integral representing the moment of inertia around the z -axis of the region in the yz -plane bounded by the curves $y = z^2$ and $y = 18 - z^2$, where density is given by $\delta(x, y, z) = y^2$.