

Answer Key 1

Math 20-550: Calculus

Name:_____

Exam II October 24, 2006

Class time (MWF):_____

Please sign the honor statement if you agree:

"I strictly followed the Notre Dame Honor Code during this test."

Your Signature _____

number right times 6 = _____

11.

12.

13.

You start with: 10 points

Total Score _____

1. • b c d e

6. • b c d e

2. • b c d e

7. • b c d e

3. • b c d e

8. • b c d e

4. • b c d e

9. • b c d e

5. • b c d e

10. • b c d e

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1. a b c d e6. a b c d e2. a b c d e7. a b c d e3. a b c d e8. a b c d e4. a b c d e9. a b c d e5. a b c d e10. a b c d e

1. Let $f(x, y, z) = (\sqrt{2})e^{x^2+y^2-z^2}$ and $P = (3, 4, 5)$. Find the maximum rate of change at P .

- (a) 20 (b) -20 (c) 10 (d) $10e$ (e) $20e$

2. Let $f(x, y) = (1 + xy)(x + y)$. Find all critical points of $f(x, y)$.

- (a) $(1, -1), (-1, 1)$ (b) $(1, -1), (-1, -1)$
(c) $(1, 1), (-1, 1)$ (d) $(1, 1), (-1, -1)$
(e) $(1, 1), (1, -1), (-1, -1), (-1, 1)$

3. The point $(1, 1)$ is a critical point of $f(x, y) = x^2 + y^2 + \frac{1}{x^2y^2}$. This critical point $(1, 1)$ of $f(x, y)$ is

- (a) a local minimum point;
- (b) a saddle point;
- (c) a local maximum point;
- (d) neither maximum nor minimum;
- (e) indeterminant type;

4. Find the maximum volume of a rectangular box such that the sum of lengths of its 12 edges is 24.

- (a) 8
- (b) 12
- (c) $(12)^3$
- (d) 1
- (e) 0

5. Find the maximum value of $f(x, y, z) = xyz$ subject to $x^2 + 2y^2 + 3z^2 = 6$.

- (a) $\frac{2}{\sqrt{3}}$ (b) 1 (c) $-\frac{2}{\sqrt{3}}$ (d) 0 (e) 6

6. Find the volume of the solid bounded by the surface $z = 6 - xy$ and the plane $x = 2$, $x = -2$, $y = 0$, $y = 3$ and $z = 0$.

- (a) 72 (b) 36 (c) 6 (d) 3 (e) 0

7. Find $\int \int_D \frac{2y}{x^2 + 1} dA$ where $D = \{(x, y) \mid 0 \leq x \leq 1, 0 \leq y \leq \sqrt{x}\}$.

- (a) $\frac{1}{2} \ln 2$ (b) $\ln 2$ (c) 1 (d) 0 (e) $-\frac{1}{2} \ln 2$

8. Find the equation of tangent plane at the point $(1, 2, 3)$ to the surface

$$x^2 + \frac{y^2}{2} + \frac{z^2}{3} = 6$$

- (a) $x + y + z - 6 = 0$ (b) $x + 2y + 3z - 14 = 0$ (c) $x + \frac{y}{2} + \frac{z}{3} - 3 = 0$
(d) $3x + 2y + z - 6 = 0$ (e) $x + y + z - 1 = 0$

9. A lamina occupies the part of the unit disk in the first quadrant. If the density function is $\rho(x, y) = \sqrt{x^2 + y^2}$, using polar coordinates find the total mass.

- (a) $\frac{\pi}{6}$ (b) $\frac{1}{6}$ (c) π (d) 1 (e) 2

10. Find the surface area of the part of the sphere $x^2 + y^2 + z^2 = 1$ that lies within the region $\Omega = \{(x, y, z) \mid x \geq 0, y \geq 0, z \geq 0\}$.

- (a) $\frac{\pi}{2}$ (b) π (c) 0 (d) 2π (e) 4π

11. The plane $4x - 3y + 8z = 5$ intersects the cone $z^2 = x^2 + y^2$ in an ellipse. Find the highest point on the ellipse.

12. Evaluate the integral $\int_0^8 \int_{y^{\frac{1}{3}}}^2 e^{x^4} dx dy.$

13. Find the mass and the x -coordinate for center of mass of the lamina that occupies the region D and has the given density function $\rho(x, y) = x+y$, where D is the triangular region with the vertices $(0, 0)$, $(1, 1)$ and $(4, 0)$.

Please set up the integrals but do not solve.