Name: _____

Signature: _____

Seat: _____

Math 2D 11AM Final Exam
Question Page

For the following questions, you should show your work if you want credit. Answer in the spaces provided on the following pages and mark your answer clearly. You are allowed a scientific calculator but nothing else (no graphing calculators!).

1. (10 points) Find the centroid (center of mass with constant density) of the lamina occupying the region of the xy-plane described in polar coordinates by

$$0 \leq r \leq 1 \text{ and } 0 \leq \theta \leq 3\pi/4.$$

2. (10 points) Find the **surface area** of the portion of the graph of $f(x, y) = 1+3x+2y^2$ above the triangle on the xy-plane with vertices $(0, 0)$, $(0, 1)$, $(2, 1)$.

3. (10 points) Show that the volume inside a hemi-sphere (a sphere cut in half) of radius 1 is equal to $\frac{2}{3}\pi$ by evaluating a triple integral in spherical coordinates.

4. (10 points) Set up but **do not evaluate** an iterated triple integral for the volume of the region in the first octant enclosed by the coordinate planes and the plane $2x+3y+4z = 4$.

5. (10 points) Consider the following double integral:

$$\iint_R (x - y)(y + 2x)dA$$

where R is the region bounded the lines

$$y - x = 0, \quad y - x = 1, \quad y + 2x = 0, \quad y + 2x = 1.$$

Rewrite this double integral using the new variables:

$$u = y - x \quad v = y + 2x.$$

I'll even give you x and y in terms of u and v:

$$x = \frac{v - u}{3} \qquad y = \frac{2u + v}{3}.$$

Don't bother computing the integral's numerical value.

6. (10 points) Find an equation of the tangent plane to the graph of

$$f(x, y) = 2x^2 + 3xy - 3y^3$$

at the point $(1, 2, -16)$.

7. (10 points) Find an equation of the plane passing through the three points

$$(1, 1, 1) \qquad (1, 3, -1) \qquad (2, 1, 0)$$

8. (10 points) Explain what first partial derivatives represent. Using ideas from Calculus I, explain why both first partial derivatives of a differentiable function of two variables $f(x, y)$ should equal zero at a local minimum of the function.

9. (10 points) Find the absolute maximum value of $f(x, y) = x + 3y$ on the ellipse

$$2x^2 + 3y^2 = 1.$$

10. (10 points) What is your favorite thing about multivariable calculus (excluding your professor)?

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$$\iint_R (x - y)(y + 3x)dA$$

where R is the region bounded the lines

$$y - x = 0, \quad y - x = 2, \quad y + 3x = 0, \quad y + 3x = 1.$$

Rewrite this double integral using the new variables:

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Don't bother computing the integral's numerical value.

6. (10 points) Find an equation of the tangent plane to the graph of

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at the point $(1, 1, 2)$.

7. (10 points) Find an equation of the plane passing through the three points

$$(1, 1, 1) \qquad (1, 3, -1) \qquad (-2, 1, 0)$$

8. (10 points) Explain what first partial derivatives represent. Using ideas from Calculus I, explain why both first partial derivatives of a differentiable function of two variables $f(x, y)$ should equal zero at a local minimum of the function.

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Don't bother computing the integral's numerical value.

6. (10 points) Find an equation of the tangent plane to the graph of

$$f(x, y) = 2x^2 + 3xy - 3y^3$$

at the point $(1, -1, 2)$.

7. (10 points) Find an equation of the plane passing through the three points

$$(1, 1, 1) \qquad (1, 3, -1) \qquad (2, 2, 1)$$

8. (10 points) Explain what first partial derivatives represent. Using ideas from Calculus I, explain why both first partial derivatives of a differentiable function of two variables $f(x, y)$ should equal zero at a local minimum of the function.

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Don't bother computing the integral's numerical value.

6. (10 points) Find an equation of the tangent plane to the graph of

$$f(x, y) = 2x^2 + 3xy - 3y^3$$

at the point $(2, 1, 11)$.

7. (10 points) Find an equation of the plane passing through the three points

$$(1, 1, 1) \qquad (1, 3, -1) \qquad (2, 1, 2)$$

8. (10 points) Explain what first partial derivatives represent. Using ideas from Calculus I, explain why both first partial derivatives of a differentiable function of two variables $f(x, y)$ should equal zero at a local minimum of the function.

9. (10 points) Find the absolute maximum value of $f(x, y) = 3x + 2y$ on the ellipse

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