Name: _____

I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Georgia Tech community. By signing my name below I pledge that I have neither given nor received help on this exam.

Pledged: _____

Problem	Possible Score	Earned Score
1	20	
2	15	
3	15	
4	15	
5	20	
6	15	
Total	100	

Remember that you must SHOW YOUR WORK to receive credit!

Good luck!

2. [15 points] Given that y is defined implicitly in terms of x by:

$$y = \sin(3x + 4y),$$

find $\frac{dy}{dx}$.

3. [15 points] Determine whether or not the function $f(x,y) = e^{-2y}\cos(2x)$ satisfies the two-dimensional Laplace equation:

$$\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0.$$

4. [15 points] Consider the function:
$$f(x, y) = \ln(x^2 + y^4).$$

a. Find the gradient of f.

b. Find the directions $\vec{u}$ where $D_{\vec{u}}f(P_0) = 0$, where $P_0(1, 1)$.

5. [20 points] Consider the function:

$$f(x, y) = x^3 + y^3 + 6x^2 - 3y^2 - 5.$$

a. Find the critical points of f.

b. Use the Second Derivative Test to classify each critical point as a saddle point, a local minimum, or a local maximum.

6. [15 points] Find the point on the sphere $x^2 + y^2 + z^2 = 4$ that is farthest from the point $(-1, -1, -1)$.

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1. [20 points] Find the volume of the region in space bounded above by the surface $z = 4\cos(x)\sin(y)$ and below by the rectangle: $0 \leq x \leq \pi/6$, $0 \leq y \leq \pi/4$.

2. [20 points] Given the integral below:

$$\int_0^3 \int_1^{e^x} \frac{1}{y}\, dy\, dx.$$

a). Sketch the region of integration and write an equivalent double integral with the order of integration reversed.

b). Use either one of the two versions of the integral to compute its value.

3. [20 points] Compute:

$$\iint_R \frac{\ln(x^2 + y^2)}{x^2 + y^2} \, dA,$$

where R is the region in the xy-plane given by:

$$1 \le x^2 + y^2 \le e^6; \ x > 0; \ y > 0.$$