Test #2B 100 points Math 200 Name:______________________________________

Simplify your final answers. Show organized work. Defend all answers.

1) $z = 2x - y - 1$ is the tangent plane for $f(x, y)$ at the point P = (5, 3).

1a) What is $f(5,3)$?________(2 points)

1b) What is $\nabla f(5,3)$?_____________ (3 points)

1c) Approximate $f(5.2, 2.9)$ using differentials. (5 points)

1d) If x = 3 + 2cos(t) and y = 3 + sin(t), then what is $\frac{df}{dt}$ when x = 5 and y = 3? (5 points)

2) Sketch the region of integration for I = $\int_0^1 \int_y^{2y} f(x, y)\, dxdy$ and then write I as an integral expression with the order of integration switched. (10 points)

3) Find I_y, for the rectangular lamina $[-2,2]\times[0,1]$ if its density equals y grams per square meter. (10 points)

4a) Show that $\vec{F}=(3x^2-6y^2)\hat{\mathbf{i}}+(-12xy+4y)\hat{\mathbf{j}}$ is a gradient field. (5 points)

4b) Find a potential function for $\vec{F}=(3x^2-6y^2)\hat{\mathbf{i}}+(-12xy+4y)\hat{\mathbf{j}}$ using a method from class. (5 points)

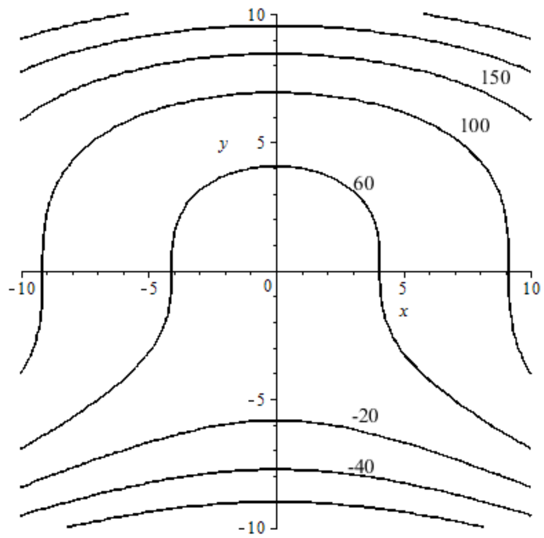
4c) Find $\int_C \vec{F}\cdot d\vec{r}$ if C is the curve parameterized by $x=1+t^3(1-t)^3$ and $y=t$ for $0\le t\le 1$. (5 points)

5) Find the equation of the tangent plane to the surface $xz + y\ln(z) = 5$ at the point P = $(5,3,1)$. (5 points)

6) The contour map on the right is for z = f(x, y).

6a) Sketch the $\nabla f(0,-7)$ on the contour plot.
(5 points)

6b) Estimate $D_{\hat{\mathbf{i}}} f(0,-5)$. Show work. (5 points)



7) Find the volume of the solid that is inside $x^2 + y^2 = 9$, below the plane $z = x$, and above z = 0.
(10 points)

8a) Is $\vec{F} = (x^2 + 9y^2)\hat{\mathbf{i}} + 4x\hat{\mathbf{j}}$ path independent? YES NO (circle one) (2 points)

8b) Is the domain of $\vec{F} = (x^2 + 9y^2)\hat{\mathbf{i}} + 4x\hat{\mathbf{j}}$ simply connected? YES NO (circle one) (2 points)

8c) Find the work done by $\vec{F} = (x^2 + 9y^2)\hat{\mathbf{i}} + 4x\hat{\mathbf{j}}$ on a particle that moves once **counterclockwise** on the ellipse $x^2 + 9y^2 = 9$. (6 points)

9) Find the center of mass for the lamina that is half an annulus $1 \le x^2 + y^2 \le 9$ and $y \ge 0$ if its density equals $\dfrac{y}{x^2 + y^2}$ grams per square meter. (15 points)