Name: ____________________________

Mailbox number:____________________

Math 131 Multivariate Calculus

Second Test

You may refer to one sheet of notes on this test. You may leave your answers as expressions such as $e^2\sqrt{\dfrac{\sin^2(\pi/6)}{1-\ln 10}}$ if you like. Show all your work for credit. Points for each problem are in square brackets.

1. [20; 10 points each part] Consider the path in $\mathbf{R}^2$ given by $\mathbf{x}(t) = (t^2, \frac{2}{3}(2t+1)^{3/2})$ for $0 \le t \le 4$.

a. Write down an integral which gives the length of that path.

b. Evaluate that integral

2. [15] Show that the vector field $\mathbf{F}(x, y, z) = (10x + 2xz^2, 28y^3, 2x^2z)$ is irrotational.

3. [15] Calculate the Hessian matrix $Hf(\mathbf{a})$ for the scalar field $f(x, y, z) = x^3+x^2y-yz^2+2z^4$ at the point $\mathbf{a} = (1, 0, 1)$.

4. [12] Give an example function $f : \mathbf{R}^2 \to \mathbf{R}$ which has a saddle point at $\mathbf{a} = (1, 1)$.

5. [15] Use Lagrange multipliers to identify the critical points of the function $f(x, y) = 5x + 2y$ subject to the constraint $5x^2 + 2y^2 = 14$.

6. [12] Evaluate the double integral $\displaystyle\int_0^2 \int_0^{x^2} (x - y)\, dy\, dx$.

7. [12] Set up a double integral to compute the volume of a solid whose base is the plane region D bounded by $x = 2$, $x = 5$, and $x + y = 2$, and $y = x^2$; and whose height at a point (x, y) in that region is given by $f(x, y) = ye^x$. Do not evaluate the integral.

#1.[20]	
#2.[15]	
#3.[15]	
#4.[12]	
#5.[15]	
#6.[12]	
#7.[12]	
Total	