MATH 212 - *Multivariable Calculus - Spring 2018* - **EXAM3 (14.7-14.9, 15.1-15.7)**
Tuesday, Apr. 24, 11:45AM-1:00PM

Name: ________________________ *Section 04*

Books, notes, and electronic devices are not permitted. Turn off cell phones.
Present your answers and supporting work neatly and clearly.
Sign the pledge below.

I, ______________________________, have neither given nor received unauthorized help in this exam.

FOR FULL CREDIT, CIRCLE YOUR FINAL ANSWERS AND SHOW YOUR WORK.

Problem 1	
Problem 2	
Problem 3	
Problem 4	
Problem 5	
Problem 6	
TOTAL	

Problem 1 (20pts)**.** Using a double integral and a convenient change of variables, calculate the volume of the solid consisting of the region above the elliptic paraboloid $z = 4x^2 + 25y^2$ and below the plane $z = 100$.

Problem 2 (20pts)**.** The curve C is parametrized by $\vec{r}(t) = \langle e^{t(1-t)}, \sin(\pi t), t^4 \rangle$, with $t \in [0, 1]$. A particle moving along C is acted on by a force field represented by $\vec{F} = \langle 2xy + z, x^2 + ze^{yz}, x + ye^{yz} \rangle$. Compute the amount of work that it takes for a particle to move along the curve C.

Problem 3 (15pts)**.** The surface S is the part of the paraboloid $z = 5 - x^2 - y^2$ that lies above the plane $z = 1$, oriented upward. Find the flux through S of the vector field $\vec{F} = \langle z - x^2, 2xy, 2 + x \rangle$.

Problem 4 (15pts)**.** The curve C starts at the point $(3, 0)$, follows the circle of center $(0, 0)$ and radius 3 in the counterclockwise direction to the point $(0, 3)$, then goes down the y-axis to the point $(0, 2)$, and ends at the point $(2, 0)$ after following the circle of center $(0, 0)$ and radius 2 in the clockwise direction. Calculate

$$\int_C xy\,dx + x^2\,dy.$$

Problem 5 (15pts)**.** Compute the flux of the vector field $\vec{F} = \langle x - x^2, 2xy, 2 + z^2 \rangle$ through the inward oriented sphere of center $(0, 0, 2)$ and radius 2.

Problem 6 (15pts)**.** Consider the points $A(1,1,0)$, $B(0,2,-1)$ and $C(-1,1,4)$. Let T be the triangle ABC, oriented counterclockwise as seen from above. Find the work of $\vec{F} = \langle e^x z + y, z + 5x, e^x + 3y \rangle$ along T.