Math 324 B - Fall 2018
Midterm exam 1
Monday, October 22nd, 2018

Name: ______________________________

Problem 1	12	
Problem 2	12	
Problem 3	12	
Problem 4	14	
Total	50	

- There are 4 questions on this exam. Make sure you have all four.
- **You must show your work on all problems.** The correct answer with no supporting work may result in no credit. Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.
- Give exact answers, and simplify as much as possible. For example, $\frac{\pi}{\sqrt{2}}$ is acceptable, but $\frac{1}{2}+\frac{3}{4}$ should be simplified to $\frac{5}{4}$.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- Any student found engaging in academic misconduct will receive a score of 0 on this exam.
- You have 50 minutes to complete the exam. Budget your time wisely!

GOOD LUCK!

1. (a) (12 points) Evaluate the integral

$$\iiint_E x\, dV,$$

where E is the region between the paraboloids $x = 8 - y^2 - z^2$ and $x = y^2 + z^2$. You should include a picture of E or of any relevant cross section of E.

2. (12 points) Use spherical coordinates to evaluate the integral

$$\iiint_E y\,dV,$$

where E is the part of the unit sphere $x^2 + y^2 + z^2 \leq 1$ lying inside the octant $x, y, z \leq 0$.

3. (12 points) Use the transformation $x = 2u + v, y = u + 2v$ to evaluate the integral

$$\iint_T (x - 2y)\, dA,$$

where T is the triangle in the xy plane with vertices $(0,0), (2,1)$ and $(1,2)$. Draw pictures of T and the transformed version of T in the uv plane.

4. (14 points) Consider the region $D \subset \mathbb{R}^2$ bounded by the curves $x, y \geq 0, x^2 + y^2 \leq 1$, and

$$(x+\alpha)^2 + (y-\alpha)^2 \leq 2\alpha^2, \text{ where } \alpha = \frac{1+\sqrt{3}}{2}.$$

Draw a picture of D, and give a parameterization of D in polar coordinates (i.e. describe D as a set of r and θ values).

Hint: the intersection of the two circles in the first quadrant occurs at $\theta = \pi/3$.