Math 324 D - Winter 2018
Midterm exam 1
Friday, January 26, 2018

Name: ____

Problem 1	10	
Problem 2	14	
Problem 3	14	
Problem 4	12	
Total	50	

- There are 4 problems 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. (10 points) Consider the region $D = \{(x, y) \in \mathbb{R}^2 : y \geq 1, x^2 + y^2 \leq 4\}$. Draw a picture of D, and evaluate

$$\iint_D \frac{y^2}{x^2 + y^2}\, dA.$$

2. (14 pts) Suppose there is a cylindrical can of beer occupying the region

$$\{(x, y, z) \in \mathbb{R}^3 : y^2 + z^2 \leq 1, 0 \leq x \leq 4\}.$$

A nervous freshman is swirling the can, concentrating the beer near the edge. Assume the beer has density function $f(x, y, z) = x^2y^2$. Find the total volume of beer in the can by integrating f over the region occupied by the can.

3. (14 points) Find the volume of the "ice cream cone" region

$$E = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 + z^2 \leq 1, z \geq 0, z^2 \geq x^2 + y^2\}$$

using spherical coordinates. (No credit will be awarded for using any other coordinate system!)

4. (12 pts) Consider the region E bounded by the planes $z = 0, x = 0, x + 2y + 3z = 6$ and $y = z + 1$. Paramaterize **but do not evaluate** the integral

$$\iiint_E xyz\, dV$$

in the two orders given below.

(a) (6 points)

$$\int_{\_\_\_\_}^{\_\_\_\_} \int_{\_\_\_\_}^{\_\_\_\_} \int_{\_\_\_\_}^{\_\_\_\_} \_\_\_\_\_\_\_\_ \, dx\, dy\, dz$$

(b) (6 points)

$$\int_{\_\_\_\_}^{\_\_\_\_} \int_{\_\_\_\_}^{\_\_\_\_} \int_{\_\_\_\_}^{\_\_\_\_} \_\_\_\_\_\_\_\_ \, dy\, dz\, dx$$