Name: _____

Problem 1	5	
Problem 2	5	
Problem 3	4	
Problem 4	6	
Total	20	

- 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.

- Use the backs of pages *for scratch work only.*

- 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. Consider the set of points $E \subset \mathbb{R}^3$ given by

$$E = \{(x, y, z) : y^2 + z^2 \leq 4x^2 \text{ and } 0 \leq x \leq 1\}.$$

(a) What do you get if you take a slice of E in the plane $x = a$ for $a \in (0, 1)$? (Describe the shape in words.)

(b) Find the surface area of E.

(c) Find the volume of E.

2. Let D be the region in the x-y plane bounded by the curves $y = \frac{x}{2}$ and $y^2 - 2y = x$.

   (a) Draw a picture of D.

   (b) Write down a parameterization of D in cartesian coordinates.

   (c) Set up and evaluate the integral

   $$\iint_D \frac{1}{y} \, dA$$

   using your parameterization from part b.

3. Let S denote the ball of radius 1 centered about the point $(0, 0, -1)$ in $\mathbb{R}^3$. Write down a parameterization of S in spherical coordinates, and use it to evaluate the integral

$$\iiint_S z^2 \, dV.$$

4. Consider the tetrahedron $T \subset \mathbb{R}^3$ bounded by the planes $x = 0, z = 0, z = 2y$ and $2x + 2y + z = 4$. Set up the triple integral

$$\iiint_T xz \, dV$$

with the two given orders of integration. **You do not need to evaluate the integrals.**

(a) $dx \, dy \, dz$.

(b) $dy \, dz \, dx$.