

INSTRUCTIONS: Books, notes, flying monkeys and electronic devices are not permitted. Write your (1) name, (2) instructor's name, and (3) recitation section on the front of your bluebook. Also make a scoring table, with places for 4 problems, plus a total score. Work all **4 problems**. Start each problem on a **new page**. Show your work. Box in your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

1. (35 points)

- a. Draw the region between the curve $y = 4x + x^2$ and the line $y = -x$ and use that region to answer the following questions.
- b. Write out the integral that would determine the area of the region between the two curves. Don't carry out the integration.
- c. Suppose you were to create squares above the region with the base of the squares perpendicular to the x-axis. Write the integral that would determine the volume created by slicing. Don't carry out the integration.
- d. Write the integral that would determine the volume created by rotating the region about the y-axis. Don't carry out the integration.
- e. Write the integral that would determine the volume created by rotating the region about the line $y = 5$. Don't carry out the integration.

2. Integrate the following: (27 points)

a) $\int \frac{x-5}{x^2+5x} dx$ b) $\int (x^2 - 3x)e^{5x} dx$ c) $\int e^{5\sinh x} \cosh x dx$

3. (18 points)

Consider the region between the two curves $y = x^2 - 4$ and the x-axis.

- a) Draw the region
- b) Find the center of mass of the region if the density is constant.

4. (20 points)

- a) Find the length of the curve $y = \cosh x$ on the interval $[0,4]$
- b) Solve the differential equation: $x \frac{dy}{dx} = \frac{\cos x}{x} - 2y, \quad x > 0$