

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, (3) APPM 1360, and (4) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and **BOX IN YOUR FINAL ANSWERS**. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books, class notes, calculators, and electronics of any kind are **NOT** permitted.

1. (15 points) Find the volume obtained by revolving the region between $y = \cosh(x)$, $y = \sinh(x)$, $x = 0$, and $x = \ln(2)$ about the x -axis.

2. (15 points) Find the area between $y = (x - a)^2$, $y = (x + a)^2$, and the x -axis.

3. (40 points) Consider the first-quadrant region between $y = 3x$, $y = 4 - x^2$, and the y -axis. In parts (a), (b), and (c), set up but **do not evaluate** the integrals necessary to calculate the volume of the solid found by revolving the region about the given line:
 - (a) Revolve about the y -axis, using the disc/washer method.
 - (b) Revolve about the y -axis, using the shell method.
 - (c) Revolve about the line $y = -1$, using the washer method.

 - (d) Evaluate your answer to either part (a) or part (b) above.

4. (20 points) Find the surface area obtained by revolving the line $y = \sqrt{2x + 3}$ about the x -axis from $x = 0$ to $x = \frac{5}{2}$.

5. (20 points) Find the length of the line $y(x) = \int_0^x \operatorname{csch}(t) dt$ from $x = \ln(2)$ to $x = \ln(3)$.

6. (15 points) Set up but **do not evaluate** the integrals necessary to find the center of mass of the region enclosed by $y = 9 - x^2$ and $y = 4 - \left(\frac{2x}{3}\right)^2$ with constant density δ . Show how to find the x and y coordinates of the center of mass from the integrals that you set up (for example by writing $\bar{x} = \dots$ and $\bar{y} = \dots$).