

University of California, Riverside
Department of Mathematics

Midterm
Mathematics 9B - First Year of Calculus
Sample 2

Instructions: This exam has a total of 100 points. You have 50 minutes. You must show all your work to receive full credit. You may use any result done in class. The points attached to each problem are indicated beside the problem. You are not allowed books, notes, or calculators. Answers should be written as $\sqrt{2}$ as opposed to 1.4142135....

1. Consider the region S bounded by $x = 1$, $x = 5$, $y = \frac{1}{x^2}$ and the x -axis.
 - (a) (10 points) Use four rectangles and a Riemann sum to approximate the area of the region S . Sketch the region S and the rectangles and indicate your rectangles overestimate or underestimate the area of S .
 - (b) (10 points) Find an expression for the area of the region S as a limit. Do not evaluate the limit.

2. This problem has three parts:
 - (a) (6 points) State the fundamental theorem of calculus.
 - (b) (7 points) Compute $\frac{d}{dx} \int_2^{\cos(x)} \sin t dt$
 - (c) (7 points) Evaluate $\int_0^{\pi/4} \sec^2 x dx$

3. Evaluate

- (a) (10 points)

$$\int_1^2 \left(2t + \frac{3}{t^2}\right) \left(4t^2 - \frac{5}{t}\right) dt$$

(b) (10 points)

$$\int_0^2 (x^3 + x) \sqrt{x^4 + 2x^2 + 4} dx$$

4. (20 points) A swimming pool in the shape of the lower half of a sphere of radius 10 ft is submerged into the ground. If the pool is filled with water, compute the amount of work required to pump the contents of the pool to ground level. You may assume that water has a weight density of 50 lb/ft³.
5. (20 points) Find the area of the region enclosed by the curve $y^2 = x$ and the line $x + y = 2$.