

Your Name: \_\_\_\_\_

Your TA: \_\_\_\_\_

Your Section Meeting time: \_\_\_\_\_

PROBLEM	POINTS	SCORE
I	10	
II	15	
III	20	
IV	15	
V	20	
VI	20	
TOTAL	100	

Show all your work: no work – no credit. Leave your answers in exact form (using  $\pi$ ,  $\sqrt{2}$  and similar numbers). Circle your answer. No calculators, no notes. Hand in your exam to your TA.

I. (10 points) Find the indefinite integral  $\int \frac{(1-x)^2}{x\sqrt{x}} dx$

II. (15 points) Find the indefinite integral  $\int \frac{x+2}{\sqrt{x^2+4x+5}} dx$

III. (20 points) Find the solution of the differential equation  $\frac{dy}{dx} = y^3 \sin^2 x \cos x$  with the initial condition  $y(0) = 1$ .

IV. (15 points) (a) Find the Riemann sum for the integral  $\int_0^{\pi/2} \sin x \, dx$  by dividing the interval  $[0, \pi/2]$  in 3 equal subintervals and taking for the sample points of the partition the left end point of each subinterval.

(b) Is the integral smaller or larger than the Riemann sum? Justify your answer without computing the integral.

- V. (20 points) Find the maximal possible area of a rectangle inscribed in a semicircle of radius 2. One side of the rectangle is along the diameter of the semicircle.

VI. (20 points) Let  $f(x) = x+1$  for  $-1 \leq x \leq 0$  and  $f(x) = \sqrt{1-x^2}$  for  $0 \leq x \leq 1$ .  
Compute  $\int_{-1}^1 f(x) dx$ . Hint: find the area under the graph.