

Your Name

--

Your Signature

--

Student ID #

--	--	--	--	--	--	--

Quiz Section

--	--

Professor's Name

--

TA's Name

--

- This exam is closed book. You may use one $8\frac{1}{2}'' \times 11''$ sheet of notes. Do not share notes.
- Give your answers in exact form, except as noted in particular problems.
- Graphing calculators are not allowed.
- In order to receive credit, you must **show all of your work**. If you do not indicate the way in which you solved a problem, you may get little or no credit for it, even if your answer is correct.
- Place

a box around your answer

 to each question.
- If you need more room, use the backs of the pages and indicate that you have done so.
- Raise your hand if you have a question.
- This exam has 9 pages, plus this cover sheet. Please make sure that your exam is complete.

Question	Points	Score
1	16	
2	16	
3	8	
4	8	
5	12	

Question	Points	Score
6	10	
7	8	
8	10	
9	12	
Total	100	

1. (16 total points) Evaluate the following integrals. Simplify your answers where possible.

(a) (8 points) $\int \sqrt{x} e^{\sqrt{x}} dx$

(b) (8 points) $\int \frac{1}{(t^2 + 2t + 2)^{3/2}} dt$

2. (16 total points) Evaluate the following integrals. Simplify your answers where possible.

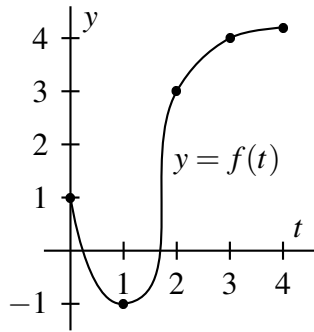
(a) (8 points) $\int_0^{\pi} \sin^4 \theta \, d\theta$

(b) (8 points) $\int_0^2 x\sqrt{16-x^4} \, dx$

3. (8 points) Evaluate the following integral. Simplify your answer where possible.

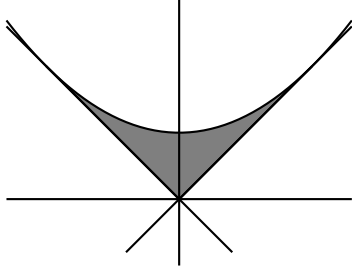
$$\int_1^{\infty} \frac{1 + e^x}{e^x(1 - e^x)} dx$$

4. (8 points) Suppose that the graph of f is as shown:



Let $G(x) = \int_x^{x^2+x} t f(t) dt$. Find $G'(1)$.

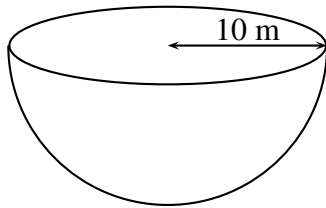
5. (12 total points) Let S be the region enclosed by the curves $y = x$, $y = -x$ and $2y = x^2 + 1$.



- (a) (6 points) Find the volume of the solid obtained by rotating S about the x -axis.

- (b) (6 points) Find the volume of the solid obtained by rotating S about the y -axis.

6. (10 points) A tank has the shape of an open-top hemisphere with radius 10 m that is full of water with density 1000 kg/m^3 . Set up an integral which computes the work required to empty the tank by pumping all of the water to the top of the tank. DO NOT EVALUATE THIS INTEGRAL.

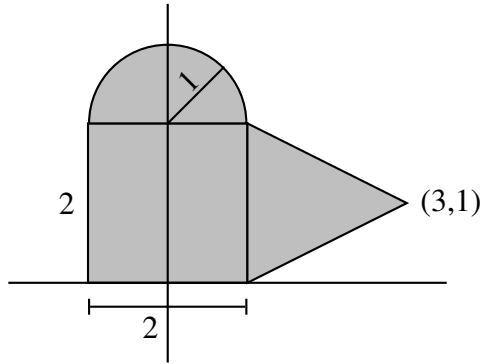


7. (8 total points)

- (a) (4 points) Set up but DO NOT EVALUATE an integral to compute the arc length of the curve $y = \sin^2(\pi x)$, for $0 \leq x \leq 1$.

- (b) (4 points) Approximate the length of the above curve via Simpson's rule with $n = 4$. SIMPLIFY THE SUM, but LEAVE YOUR ANSWER IN EXACT FORM.

8. (10 points) Find the x -coordinate of the centroid of the shaded region below.



9. (12 total points) A tank contains 100 liters of fresh water. Water containing s grams of salt per liter enters the tank at the rate of 5 liters/minute, and the well-mixed solution leaves at the same rate.
- (a) (6 points) Write down a differential equation for the amount of salt in the tank at time t . (This equation will contain s .)

- (b) (6 points) Suppose that after 10 minutes, the concentration of salt in the tank is 3 grams/liter. Find s .