

Your Name

Your Signature

Student ID #

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Quiz Section

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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	25	
2	10	
3	9	
4	9	
5	9	

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

1. (25 total points) Evaluate the following integrals. Simplify your answers where possible.

(a) (5 points) $\int_0^2 x^3 e^{x^2} dx$

(b) (5 points) $\int \frac{\cos x}{\sin x} \ln(\sin x) dx$

(c) (5 points) $\int x(x+1)^{2005} dx$

(d) (5 points) $\int \frac{dx}{\sqrt{x^2 - 2x - 3}}$

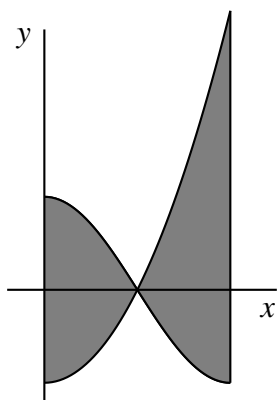
(e) (5 points) $\int \frac{x^4 + 4}{x^3 + 2x^2} dx$

2. (10 total points)

(a) (5 points) For b positive, evaluate the integral $\int_0^b \frac{dx}{x^2 + 8x + 12}$. Simplify your answer.

(b) (5 points) Evaluate the improper integral $\int_0^\infty \frac{dx}{x^2 + 8x + 12}$, or if it doesn't converge, explain why.

3. (9 points) The shaded region in the picture is bounded by the curves $y = \cos(\frac{\pi}{2}x)$, $y = x^2 - 1$, $x = 0$, and $x = 2$. Find its area.

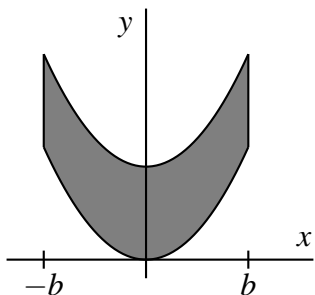


4. (9 points) Let $f(t) = \int_1^{t^2} \sqrt{1+s^4} ds$ and let $g(x) = \int_1^x f(t) dt$. Find $g''(2)$.

5. (9 points) A bucket of water is hanging on a rope 16 feet down a well; the bucket weighs 20 pounds, and the rope weighs 0.5 pounds per foot. How much work is done in pulling the bucket half way to the top of the well?

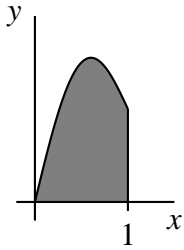
6. (10 total points) Let b be a positive number, and consider the region bounded by the curves $y = x^2$, $y = x^2 + 1$, $x = -b$, and $x = b$.

(a) (5 points) Find the y -coordinate of the center of mass of this region, in terms of b .



- (b) (5 points) Because of the symmetry of this region, the x -coordinate of the center of mass is 0. For small values of b , say $b < M$, the center of mass is in the region, while for $b > M$, the center of mass is outside of the region. Find M .

7. (10 total points) Consider the region bounded by $y = x + \sin(\pi x)$, $y = 0$, and $x = 1$.

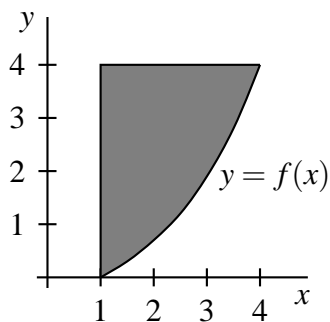


- (a) (5 points) Set up an integral for the volume of the solid obtained by rotating this region about the y -axis. DO NOT EVALUATE.

- (b) (5 points) Set up an integral for the volume of the solid obtained by rotating this region about the x -axis. DO NOT EVALUATE.

8. (9 total points) A turkey has an internal temperature of 60 degrees F. At 12:00 pm it is placed in an oven whose temperature is at 380 degrees.
- (a) (3 points) Newton's Law of Cooling states the rate of cooling (or heating) of an object is proportional to the temperature difference between the object and its surroundings. Use Newton's Law of Cooling to write down a differential equation and initial condition for the internal temperature y of the turkey at time t . Take $t = 0$ to be the time it is placed in the oven. Your equation should involve an unknown constant k .
- (b) (3 points) After 2 hours, it is observed that the temperature of the turkey is 140 degrees. Use this to find the constant k and the temperature y as a function of time t .
- (c) (3 points) At what time will the temperature equal 170 degrees? [For this problem, give a decimal answer.]

9. (9 points) The region between the curve $y = f(x)$, the line $x = 1$, and the line $y = 4$ is rotated around the line $x = 1$. A formula for $f(x)$ is not known; however, we do have the following picture of the region and a table of values:



x	1	1.5	2	2.5	3	3.5	4
$f(x)$	0	.3	.7	1.2	1.9	2.8	4

Use Simpson's Rule to approximate the volume of this solid of revolution. [For this problem, give a decimal answer.]