

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 handwritten notes (both sides). 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. You may use any of the 20 integrals from the table on p. 506 of the text without deriving them. Show your work in evaluating any other integrals, even if they are on your note sheet.
- 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 11 pages, plus this cover sheet. Please make sure that your exam is complete.

Question	Points	Score
1	14	
2	14	
3	7	
4	8	
5	8	
6	7	

Question	Points	Score
7	8	
8	8	
9	8	
10	10	
11	8	
Total	100	

1. (14 total points) Evaluate the following integrals.

(a) (7 points) $\int \frac{dx}{x^3 + x^2}$

(b) (7 points) $\int \frac{(x+7)dx}{x^2 + 6x + 13}$

2. (14 total points) Evaluate the following integrals. Leave your answers in exact form: do not use decimal expansions.

(a) (7 points) $\int_0^{\sqrt{5}} \frac{x^3 dx}{\sqrt{9-x^2}}$

(b) (7 points) $\int_1^4 \frac{\tan^{-1}(\sqrt{t})}{\sqrt{t}} dt$ (Recall that $\tan^{-1} = \arctan$.)

3. (7 points) Evaluate the following integral.

$$\int \frac{x}{(x^2 + 2x - 3)^{3/2}} dx$$

4. (8 points) Determine whether the following improper integral is convergent or divergent. Evaluate it if it is convergent.

$$\int_0^{\infty} x^3 e^{-x^2} dx$$

5. (8 total points) An object is moving along the x -axis, with acceleration at time $t \geq 0$ given by $a(t) = \frac{-2000}{(t+2)^3}$ ft/sec². At time $t = 0$, its velocity is 240 ft/sec.
- (a) (4 points) At what time $t \geq 0$ does the object reverse direction?

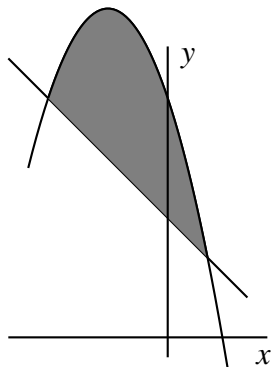
- (b) (4 points) Find the total distance traveled by the object from $t = 0$ to $t = 18$ sec.

6. (7 points) Let R be the region enclosed by the curves

$$y = |x|, \quad y = x^2 - 2.$$

Sketch R and find its area.

7. (8 total points) Let R be the region bounded by $y = -x^2 - 3x + 6$ and $x + y - 3 = 0$; see the picture.



- (a) (4 points) Set up an integral for the volume obtained by rotating R about the vertical line $x = 3$.
DO NOT EVALUATE THE INTEGRAL.

- (b) (4 points) Set up an integral for the volume obtained by rotating R about the horizontal line $y = 0$.
DO NOT EVALUATE THE INTEGRAL.

8. (8 total points)

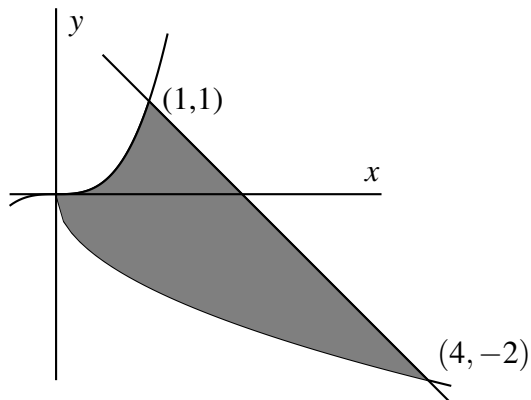
(a) (4 points) Set up but DO NOT EVALUATE an integral to compute the arc length of the curve $y = x^3$, for $0 \leq x \leq 1$.

(b) (4 points) Approximate the length of the above curve using the trapezoidal rule with $n = 5$. Do not simplify the sum: leave your answer in exact form.

9. (8 points) Consider the region bounded by the curves

$$y = x^3, \quad x + y = 2, \quad y = -\sqrt{x}.$$

The area of this region is $49/12$. Find the x -coordinate of its center of mass. Leave your answer in exact form: do not use decimal expansions.



10. (10 points) At time $t = 0$, a tank contains 100 gallons of pure gasoline. A mixture whose volume is 30% ethanol and 70% gasoline is pumped into the tank at a rate of 2 gallons per minute. The solution is kept thoroughly mixed and drains from the tank at the same rate. Find a formula for the number of gallons of ethanol in the tank after t minutes.

11. (8 points) Find the function $y(x)$ which satisfies $\frac{dy}{dx} = \frac{x(y^2 + 1)}{\sqrt{x^2 - 1}}$ such that $y = 1$ when $x = \sqrt{2}$.