

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. (For example, $\pi\sqrt{2}$ is an exact answer; the decimal approximation 4.44288 is not.)
- 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 10 pages, plus this cover sheet. Please make sure that your exam is complete.

Question	Points	Score
1	14	
2	14	
3	6	
4	10	
5	10	
6	8	

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

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

(a) (7 points) $\int_0^{\pi/4} t \cos^2(t) dt$

(b) (7 points) $\int \frac{3x+5}{(x-1)^2(x+1)} dx$

2. (14 total points) Evaluate the following integrals.

(a) (7 points) $\int \frac{x^2}{\sqrt{2x-x^2}} dx$

(b) (7 points) $\int w^5 \sqrt{w^3-1} dw$

3. (6 points) Let

$$E(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt,$$

and let

$$G(x) = E(\sqrt{x}).$$

Compute $G'(x)$.

4. (10 total points) A particle is moving along a straight line with acceleration given by $a(t) = -2 \sin t$. At time $t = 0$, its velocity is $v_0 = 1$.
- (a) (5 points) If the particle is at the position $s(\pi) = 0$ at $t = \pi$, find the position function $s(t)$.

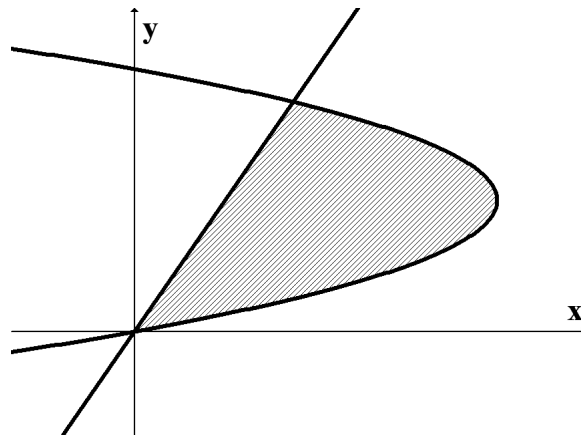
- (b) (5 points) Find the **total distance** traveled by the particle from the time $t = 0$ to $t = \pi$.

5. (10 total points)

Let R be the region bounded by the curves

$$y = 2x \quad \text{and} \quad x = 4y - y^2,$$

as shown at the right.



(a) (5 points) Set up, **but do not evaluate**, an integral for the volume of the solid obtained by rotating R about the x -axis.

(b) (5 points) Set up, **but do not evaluate**, an integral to compute the volume of the solid obtained by rotating R about the vertical line $x = -2$.

6. (8 points) Hooke's law states that the force required to maintain a spring stretched x units beyond its natural length is proportional to x . The work required to stretch the spring from 2 feet beyond its natural length to 4 feet beyond its natural length is 18ft-lb. How far beyond its natural length can the spring be stretched with a force not exceeding 24 pounds?

7. (10 total points)

(a) (4 points) Set up a definite integral for the arclength of the curve $y = e^{-x^2}$ for $0 \leq x \leq 1$. **Do not evaluate the integral.**

(b) (6 points) Give an approximate value for the arclength by using Simpson's rule with $n = 4$ subintervals to approximate the integral in part (a). Leave your answer in exact form.

8. (10 total points) Let R be the region bounded by the curves

$$y = 4 - (x - 2)^2, \quad y = 0, \quad x = 1 \quad \text{and} \quad x = 3.$$

(a) (4 points) Find the area of R .

(b) (6 points) Find the centroid of R .

9. (8 points) Find the solution $y(x)$ for $x > 0$ of the initial value problem

$$xy^2 \frac{dy}{dx} = 3 + 2x^2, \quad y(1) = 2.$$

10. (10 points) When a cake is removed from an oven, the temperature of the cake is 210° F. The cake is left to cool at room temperature (70° F.), and after 30 minutes, the temperature of the cake is 140° F. According to Newton's law of cooling, the rate of change of temperature of a body is proportional to the temperature difference between the body and the environment. Set up and solve a differential equation to determine when the temperature of the cake will be 100° F.