

Your Full Name (please PRINT clearly)

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Student ID #

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PLEASE READ these instructions:

- Do not open the test until instructed to do so.
- Once the exam starts, check that you have a complete exam: there should be 3 double-sided sheets of paper, containing this cover page and 6 problems on 5 pages.
- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ page of handwritten notes. Do not share notes.
- Only a Ti-30x IIS calculator is allowed. You may not use headphones or any other electronic devices. Please turn OFF your cell phone and put it away.
- Remember to **SHOW ALL YOUR WORK**. If your work is incorrect, incomplete, or unreadable, you may receive little credit, even if the answer itself happens to be correct.
- Do not write too close to the edge of pages – please stay within the page borders. Exams will be scanned and the far edges may not be readable.
- Simplify your answers as much as possible but leave them in exact form (e.g. $\pi\sqrt{2} + \frac{1}{2}$), unless otherwise instructed. Place a box around your final answer to each question.
- Raise your hand if you have a question.
- You may use any of the following integral formulas without deriving them. **Show your work in evaluating other integrals, even if they are on your sheet of notes.**

Question	Points	Score
1	12	
2	6	
3	7	
4	10	
5	7	
6	8	
Total	50	

Table of Integration Formulas Constants of integration have been omitted.

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|---|---|
| <p>1. $\int x^n dx = \frac{x^{n+1}}{n+1} \quad (n \neq -1)$</p> <p>3. $\int e^x dx = e^x$</p> <p>5. $\int \sin x dx = -\cos x$</p> <p>7. $\int \sec^2 x dx = \tan x$</p> <p>9. $\int \sec x \tan x dx = \sec x$</p> <p>11. $\int \sec x dx = \ln \sec x + \tan x$</p> <p>13. $\int \tan x dx = \ln \sec x$</p> <p>17. $\int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right)$</p> | <p>2. $\int \frac{1}{x} dx = \ln x$</p> <p>4. $\int b^x dx = \frac{b^x}{\ln b}$</p> <p>6. $\int \cos x dx = \sin x$</p> <p>8. $\int \csc^2 x dx = -\cot x$</p> <p>10. $\int \csc x \cot x dx = -\csc x$</p> <p>12. $\int \csc x dx = \ln \csc x - \cot x$</p> <p>14. $\int \cot x dx = \ln \sin x$</p> <p>18. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right), \quad a > 0$</p> |
|---|---|

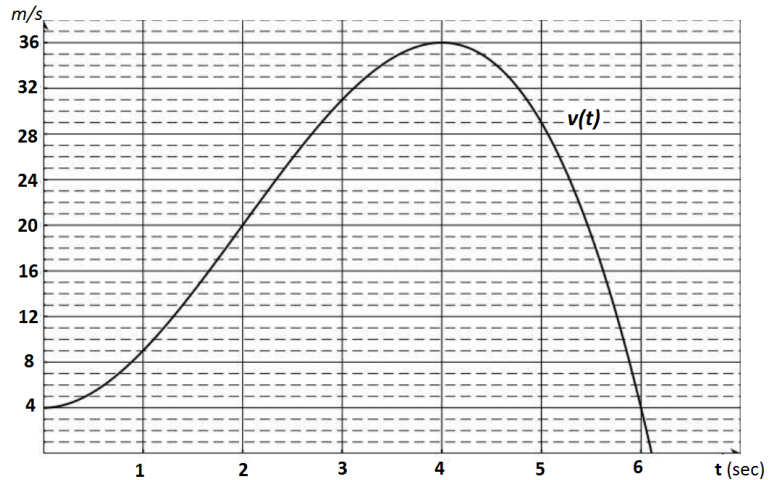
1. Evaluate the following integrals. Show work. Simplify and BOX your final answer.

(a) (6 points) $\int_0^{1/2} \frac{e^{2t}}{e^{4t} + 3} dt$

(b) (6 points) $\int \frac{25}{x^3 + 5x} dx$

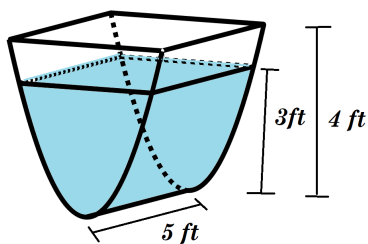
2. (6 points) The graph on the right shows the velocity $v(t)$ in m/s at t seconds, of an object moving in a straight line.

Use Simpson's Rule with $n = 6$ subintervals to approximate the distance the object travels from $t = 0$ to $t = 6$ seconds.



3. (7 points) A vat is of the shape shown below. The vertical ends of the vat are bounded below by the curve $y = x^2$. The vat is of length 5 feet, height 4 feet, and it is partially filled with olive oil, to a level 3 feet above its bottom. Oil weighs 50 lbs/ft³.

SET UP (do NOT compute) an integral equal to the work required to pump all the oil to the top of the vat. Draw a "slice", and indicate the main steps in your process of setting up the integral.



4. (a) (8 points) Compute the average value of the following function over the interval $[0, \pi/4]$:

$$f(x) = \frac{x \sin(x)}{\cos^3(x)}$$

- (b) (2 points) Suppose $g(x)$ is some continuous function and its average value on $[a, b]$ is g_{ave} . Circle the correct answer. You need not justify.

$\int_a^b (g(x) - g_{ave}) dx$ is: A) > 0 , B) $= 0$, C) < 0 , D) It depends.

5. (7 points) Does the following improper integral converge or diverge? Note that this integral is both Type I and Type II. If it converges, compute its value. If it diverges, show why. Make sure to use limits and show all steps.

$$\int_0^{\infty} \frac{e^{-\sqrt{x}}}{\sqrt{x}} dx$$

6. (8 points) Evaluate the following integral. Simplify and box your answer.

$$\int \sqrt{5 - 4x - x^2} dx$$