

Your Name

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Your Signature

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Student ID #

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Quiz Section

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Professor's Name

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TA's Name

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- This exam is closed book. You may use one $8.5'' \times 11''$ sheet of handwritten notes (both sides OK). Do not share notes. No photocopied materials are allowed.
- Give your answers in exact form (for example $\frac{\pi}{3}$ or $5\sqrt{3}$), except as noted in particular problems.
- A scientific calculator is allowed, but 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 in the table on p. 484 of the text (p. 506 if you have the 5th edition of Stewart) 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 9 pages, plus this cover sheet. Please make sure that your exam is complete.

Question	Points	Score
1	14	
2	14	
3	10	
4	8	
5	12	

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

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

(a) (7 points) $\int \sec^4(3x) dx$

(b) (7 points) $\int_3^{4.5} \sqrt{6x - x^2} dx$

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

(a) (7 points) $\int \frac{\sin x \cos x}{\sin^2 x + 5 \sin x + 6} dx$

(b) (7 points) $\int_4^{\infty} \frac{\ln x}{x^{3/2}} dx$

3. (10 total points) An object is moving on the x -axis with acceleration $a(t) = 2t + 4$ for $0 \leq t \leq 4$. Its velocity at time $t = 0$ is $v(0) = -5$.
- (a) (5 points) What is the displacement of the object between times $t = 0$ and $t = 4$?

- (b) (5 points) What is the total distance travelled by the object between times $t = 0$ and $t = 4$?

4. (8 total points) Determine if the following are **TRUE** or **FALSE**. You need not explain your answers. Each correct answer is +2 points, each wrong answer is -1 points, each blank answer is 0 points, but your total for this whole problem will not be less than 0 points. Put your **ANSWERS** in the **BOXES**.

(a) (2 points) The function $f(x) = \frac{e^x}{x}$ is a solution of the differential equation $x^2y' + xy = xe^x$.

Answer (T or F or leave blank):

(b) (2 points) $\frac{d}{dx} \int_2^{x^2+1} \ln(t) dt = \ln(x^2 + 1)$.

Answer (T or F or leave blank):

(c) (2 points) The arc length of the curve $y = \tan x$ for $0 \leq x \leq \frac{\pi}{4}$ is $\int_0^{\pi/4} \sqrt{1 + \sec^2 x} dx$.

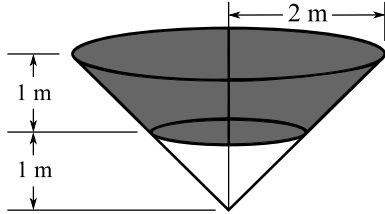
Answer (T or F or leave blank):

(d) (2 points) If f and f' are continuous on $[3, 7]$, then $\int_3^7 f'(u) du = f(7) - f(3)$.

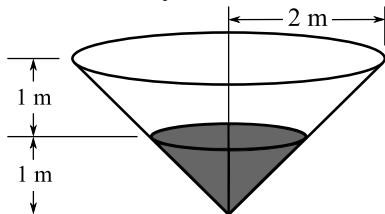
Answer (T or F or leave blank):

5. (12 total points) You want to dig a hole in the ground in the shape of an inverted circular cone with height 2 m and base radius 2 m. The dirt in the hole has density $\rho = 1676 \text{ kg/m}^3$, and the acceleration due to gravity is $g = 9.8 \text{ m/sec}^2$.

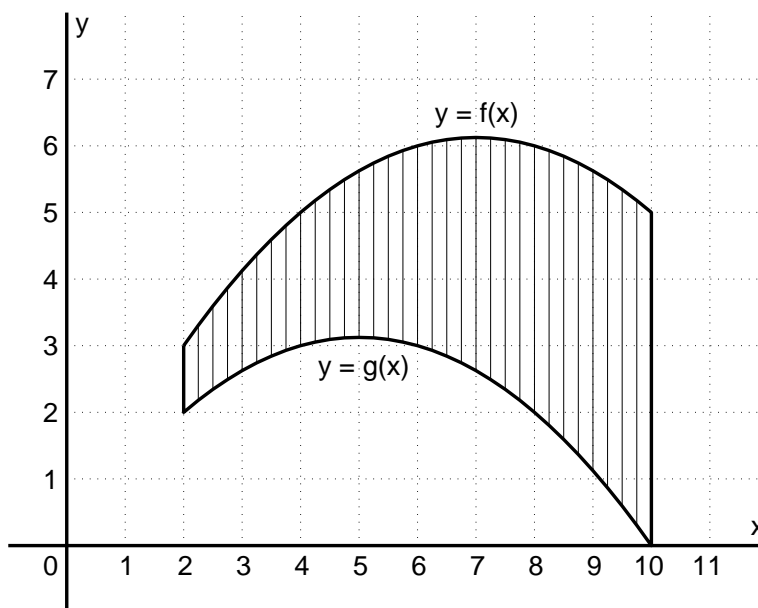
- (a) (6 points) Find the work required to remove the *top* 1 meter of dirt from the hole (moving it up to ground level). Give your answer in decimal form.



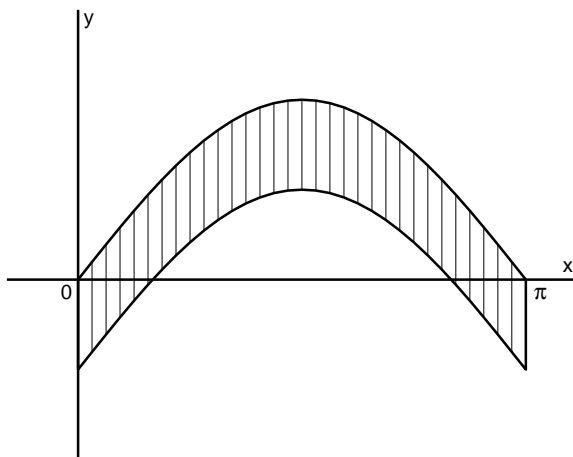
- (b) (6 points) Find the work required to remove the *bottom* 1 meter of dirt (moving it up to ground level). Give your answer in decimal form.



6. (10 points) Set up an integral (in terms of $f(x)$ and $g(x)$) for the volume of the solid of revolution that is obtained by rotating the region shown below around the x -axis. Then use Simpson's rule with $n = 4$ subintervals to approximate the volume. Show your work, and give your final answer as a decimal.



7. (10 points) Consider the region in the xy -plane bounded on the top by $y = \sin x$, on the bottom by $y = \sin x - \frac{1}{2}$, on the left by $x = 0$, and on the right by $x = \pi$. By symmetry, the x -coordinate of the centroid of this region is $\bar{x} = \frac{\pi}{2}$. Find the y -coordinate \bar{y} of the centroid of this region.



8. (10 points) Find the solution of the differential equation that satisfies the given initial condition.

$$\frac{dP}{dt} = \sqrt{Pt}, \quad P(4) = 1.$$

9. (12 total points) In 2009 (which we take to be $t = 0$, with t in years) there are 5000 wolves in a big forest area. In the absence of hunting, the wolf population would increase at the rate of 1% per year. However, hunters are killing wolves at the steady rate of 100 wolves per year.

(a) (4 points) Write a differential equation for $W(t)$.

(b) (4 points) Solve this differential equation and use the initial number of wolves to find a formula for $W(t)$.

(c) (4 points) In what year will the wolves in this forest area die out? Your answer should be some year in this century.