Math 125
Exam 1
October 19, 2023

Name _____

Student ID #_____ Section _____

HONOR STATEMENT

"I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam."

SIGNATURE:_____

- This exam consists of a cover, a scratch sheet, five pages of questions, and another scratch sheet. If you put work on either scratch sheet and you want it to be graded, then you must clearly tell us in the problem to "see first scratch page" or "see last scratch page".
- You will have 80 minutes.
- On several questions, a final answer line is provided, please put your answer there. If there is no final answer line, then put a box around your final answer.
- You are allowed to use a Ti-30x IIS Calculator model ONLY (**no other calculators allowed**) and one 8.5 by 11 inch sheet of handwritten notes (front and back). All other sources are forbidden.
- Turn your cell phone OFF and put it away for the duration of the exam. You may not listen to headphones or earbuds during the exam.
- **You must show your work.** The correct answer with no supporting work may result in no credit.
- Leave your answer in exact form. Simplify standard trig, inverse trig, natural logarithm, and root values. Here are several examples: you should write $\sqrt{4} = 2$ and $\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$ and $\ln(1) = 0$ and $\tan^{-1}(1) = \frac{\pi}{4}$.
- Unless otherwise indicated, when rounding is necessary, you may round your final answer to two digits after the decimal.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- There may be multiple versions, you have signed an honor statement, and cheating is a hassle for everyone involved. If we find that you give an answer that is only appropriate for the other version of the exam and there is no work to support your answer, then you will get a zero on the entire exam and your work will be submitted to the academic misconduct board. JUST DO NOT CHEAT.

GOOD LUCK!

You may use this page for scratch-work or extra room.
All work on this page will be ignored unless you write and circle "see first scratch page" on the problem and you label your work.

1. (12 pts) Evaluate the integrals. If you do a substitution in a definite integral problem, show me that you can appropriately change the bounds for full credit. **Simplify your final answers.**

   (a) $\int (x^2+5)^2 - \sec(3x)\tan(3x)dx$

   (b) $\int_1^4 \frac{1}{\sqrt{x}\left(\sqrt{x}+1\right)^2}\,dx$

   (c) $\int \frac{3x^5}{2+x^3}\,dx$

2. (12 pts) The three problems below are NOT related. Give simplified exact form answers.

(a) Express the following Riemann sum as a definite integral: $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{\pi}{3n} \cos\left(\frac{\pi i}{3n}\right)$.
Then evaluate the integral.

Value of Integral = _____

(b) Find the value of the derivative of the function $F(x) = \int_{3\sqrt{x}}^{2x+1} t^2 e^t \, dt$ at $x = 1$.

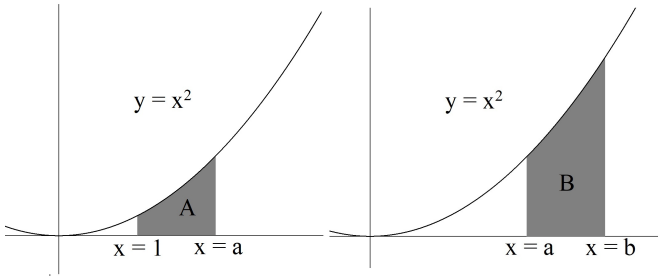
$F'(1)$ = _____

(c) Use the midpoint rule with $n = 3$ subdivisions to approximate $\int_4^{10} e^{t^2} \, dt$.
(You do NOT need to give a decimal. You can leave your answer expanded.)

$\int_4^{10} e^{t^2} \, dt \approx$

3. (12 pts) The two problems below are NOT related.

(a) Consider the function $y = x^2$. For positive constants a and b, let A be the depicted area under the curve from $x = 1$ to $x = a$ and let B be the area under the curve from $x = a$ to $x = b$, shown below. If the area of region B is two times the area of region A, give the formula for b in terms of a.



$b =$ _____

(b) Find the area of the region bounded by $x = 2y^2$ and $x - 4 = 2y$. (You must sketch a picture of the region and simplify your final answer for full credit)

Area = _____

4. (12 pts) The two parts below are NOT related.

(a) A particle is moving along the x-axis. The acceleration of the particle at time t seconds is given by

$$a(t) = 6t + 6 \text{ m/sec}^2,$$

and its initial velocity is $v(0) = -9$ m/sec. What is the **total distance** that the particle travels from $t = 0$ to $t = 3$ seconds?

Total Distance = _____ meters

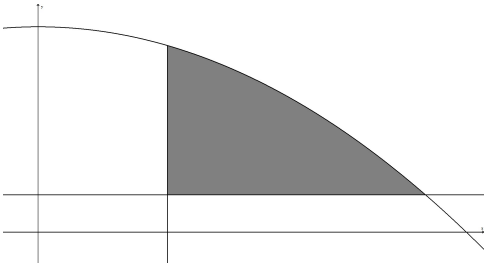
(b) A tomato is *dropped* from the top of a building. It hits the ground (next to your math instructor) with a downward velocity of 112 feet/sec. Assume the tomato accelerates at a constant 32 feet/sec^2 downward. Find the function for the height, $h(t)$ of the tomato t seconds after being dropped and give the height of the building? (*Hint: The time the tomato hits the ground is an unknown, label and find it.*)

$h(t)$ = _____

Building Height = _____ feet

5. (12 pts) For all parts below, consider the region R that is bounded on the left by $x = 1$, bounded on the bottom by $y = 2$ and bounded on the top by $y = 11 - x^2$ (shown below).

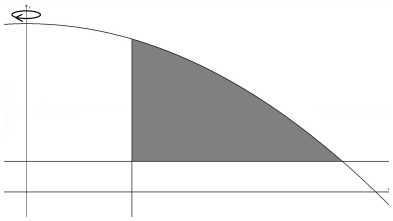
   (a) Set up BOTH the integrals (using dx and dy) that represent the AREA of this region. Include the correct bounds. (do NOT evaluate).



   Area set up (using dx) =

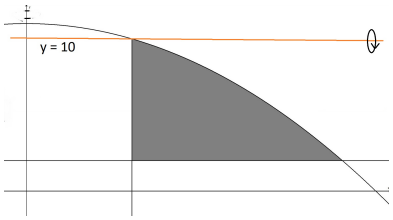
   Area set up (using dy) =

   (b) Set up (but do NOT evaluate) an integral for the VOLUME of the solid obtained by rotating R about the y-axis. Carefully include correct bounds and integrands (expect at least -2 per error, even small errors, so write your answers carefully!)



   VOLUME =

   (c) Set up (but do NOT evaluate) an integral for the VOLUME of the solid obtained by rotating R about the horizontal line $y = 10$.



   VOLUME =

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