Name _____ Penn ID _____

PRINT First and Last name **LEGIBLY** 8 Large digits on your **PennCard**

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Math 104 Final Exam Spring 2022

Show all work on the given paper. A correct answer with little or no supporting work will receive little or no credit. Show work that will convince me that you know how to do each problem.

There are 10 questions, each worth 10 points.

You have 120 minutes to complete the exam. After you have finished the exam, please sign the academic integrity statement below:

Academic Dishonesty Definitions

Activities that have the effect or intention of interfering with education, pursuit of knowledge, or fair evaluation of a student's performance are prohibited. Examples of such activities include but are not limited to the following definitions:

A. **Cheating**: using or attempting to use unauthorized assistance, material, or study aids in examinations or other academic work or preventing, or attempting to prevent, another from using authorized assistance, material, or study aids. *Example*: using a calculator in a quiz or exam, altering a graded exam, and resubmitting it for a better grade, etc.
B. **Plagiarism**: using the ideas, data, or language of another without specific or proper acknowledgment. *Example*: copying another person's paper, article, or computer work and submitting it for an assignment, cloning someone else's ideas without attribution, failing to use quotation marks where appropriate, etc.
C. **Fabrication**: submitting contrived or altered information in any academic exercise. *Example*: making up data for an experiment, fudging data, citing nonexistent articles, contriving sources, etc.
D. **Multiple submission**: submitting, without prior permission, any work submitted to fulfill another academic requirement.
E. **Misrepresentation of academic records**: misrepresenting or tampering with or attempting to tamper with any portion of a student's transcripts or academic record, either before or after coming to the University of Pennsylvania. *Example*: forging a change of grade slip, tampering with computer records, falsifying academic information on one's resume, etc.
F. **Facilitating academic dishonesty**: knowingly helping or attempting to help another violate any provision of the Code. *Example*: working together on a take-home exam, etc.
G. **Unfair advantage**: attempting to gain unauthorized advantage over fellow students in an academic exercise. *Example*: gaining or providing unauthorized access to examination materials, obstructing or interfering with another student's efforts in an academic exercise, lying about a need for an extension for an exam or paper, continuing to write even when time is up during an exam, destroying or keeping library materials for one's own use, etc.

If a student is unsure whether his action(s) constitute a violation of the Code of Academic Integrity, then it is that student's responsibility to consult with the instructor to clarify any ambiguities.

I have read the above definitions and my signature below indicates that I have not violated Penn's Code of Academic Integrity.

_____

Signature

1. Determine whether the integral converges or diverges. If it converges, find it's value.

$$\int_1^{\infty} \frac{e^{1/x} + 1}{x^2} dx$$

2. Find the arclength of the curve given by the parametric equations

$x = \frac{1}{2}t^2,\ y = \frac{1}{3}(2t+1)^{3/2},$ for $0 \leq t \leq 4$

3. Find the expected value of the random variable with probability density function

$$f(x) = \begin{cases} 4e^{-2x}, & 0 \le x \le \frac{1}{2}\ln 2 \\ 0, & \text{otherwise} \end{cases}$$

4. Compute the value of the integral below.

$$\int_0^{\frac{\pi}{2}} 45 \sin^2(x) \cos^3(x)\, dx$$

5. Compute the value of the integral below.

$$\int_0^1 \frac{12\sqrt{3}}{(4-x^2)^{3/2}}\,dx$$

6. Compute the value of the integral below.

$$\int_{\frac{3}{2}}^{2} \frac{1}{2x^2 - 3x + 1} dx$$

7. Determine whether each of the following series converges or diverges.

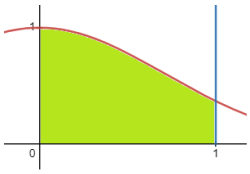
I. $\sum_{n=2}^{\infty} \frac{2n + \sqrt{n} - 5}{\sqrt{4n^3 + 3n^2 + 8}}$

II. $\sum_{n=1}^{\infty} \frac{e^n (n+2)^2}{3^n \sqrt{n}}$

8. Find the interval of convergence for

$$\sum_{n=1}^{\infty} \frac{(x+2)^n}{2^{n+1}\sqrt{n}}$$

9. The region bounded above by $y = e^{-x^2}$, bounded below by the x-axis, for $0 \leq x \leq 1$ is graphed below.
Set up an integral to find the volume resulting from rotating the region around the x-axis.



Find the Taylor series at $x = 0$ for the function inside the integral and use the first three nonzero terms to estimate the integral.

10. Let $f(x) = e^{-2x}$

Find T_3, the third degree Taylor polynomial centered at $a = 1$ for $f(x)$.

Suppose that we use this Taylor polynomial centered at $a = 1$ to approximate $f(x) = e^{-2x}$ one the interval $[0,2]$. Find a numerical upper bound for the error, (the remainder R_3) on this interval.

Scrap paper. If you want us to grade what is on this page, then you must clearly state so on the problem page. You also must write the problem number on this page. **Do not rip this page off.**

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