APPM 1360 Exam #4

Summer 2021: Carefully read the following important information.

- This exam is worth 150 points and has 7 questions.
- Write clearly, neatly and legibly, from left to right and top to bottom.
- Show **ALL** your work, simplifying and putting a box around your final answer.
- You must arrive at your answer through a logical, legible and understandable sequence of correct mathematical statements. Failure to do so will result in zero (0) points, regardless of whether or not you write the correct answer.
- Begin each problem on a new page.
- You are taking this exam in a proctored and honor code enforced environment. Thus, no calculators, cell phones (except for video of yourself in Zoom), or other electronic devices are permitted. Accessing any other resources (textbooks, notes, internet resources, fellow students, other humans, *etc.*) is strictly prohibited. This exam is being administered with the use of **PROCTORIO.**
- When finished, scan your exam into a single pdf file with problems in the order shown on the exam (page 1 is problem 1, page 2 is problem 2, *etc.*)
- You have the entire class period to complete the exam, scan your work into a single pdf file and upload that file to GRADESCOPE, indicating which page contains each problem. You have 10 minutes after the exam to submit your work to GRADESCOPE.
- Give yourself enough time to make sure your submission uploaded correctly, is readable and is COMPLETE. Unreadable exams will not be graded. We will not accept late missing portions of exams. Report technical problems to your proctor. Do not leave your Zoom meeting until given permission by the proctor.

Question	Points	Score
1	28	
2	24	
3	10	
4	20	
5	24	

Question	Points	Score
6	24	
7	20	
Total	150	

1. Evaluate the following integrals. Be sure to simplify your answers.

   (a) (14 points) $\int \ln(\sqrt{x})dx$

   (b) (14 points) $\int \frac{x+8}{x^2+x-2}dx$

2. Consider the region $\mathscr{R}$ in the first quadrant under the line $y = 2-x$. Set up but **do not evaluate** integrals to find the following quantities.

   (a) (12 points) The volume of the solid obtained by rotating the the region $\mathscr{R}$ about the line $x = -1$ using the Disk/Washer Method.

   (b) (12 points) The volume of the solid obtained by rotating the the region $\mathscr{R}$ about the line $x = -1$ using the Cylindrical Shells Method.

3. (10 points) Consider the curve defined by $x = \frac{1}{2}y^2$ on $0 \le x \le 2$. Set up but **do not evaluate** the surface area of the solid obtained by rotating the curve about the **x-axis**.

4. Does the sequence or series converge? If so, what does it converge to? Justify your answer and name any tests or theorems you use.

   (a) (10 points) $a_n = \frac{\ln n}{\sqrt[3]{n}}$

   (b) (10 points) $\sum_{n=1}^{\infty} \frac{5}{4^n}$

5. Consider the function $f(x) = \arctan(x)$.

   (a) (12 points) Show that the Maclaurin series of $f(x)$ has a radius of convergence of 1 using a relevant calculation.

   (b) (12 points) Find a power series representation for $g(x) = \frac{x}{2}\arctan(x^2)$ centered at 0.

6. Consider the parametric curve $\begin{array}{l} x(t) = (t-1)^2 \\ y(t) = t - t^2 \end{array}$ where $0 \le t \le 1$.

   (a) (12 points) Sketch the parametric curve. Mark the initial and terminal points.

   (b) (12 points) Set-up but **do not evaluate** the area under the curve using a parametric integral.

7. Consider the polar curve $r = \frac{2|\theta|}{\pi}$ for $-\pi \le \theta \le \pi$.

   (a) (10 points) Set-up but **do not evaluate** an integral to find the length of the curve.

   (b) (10 points) Set-up but **do not evaluate** the area bounded by the y-axis and $r(\theta)$ where $x \ge 0$.