APPM 1360 FINAL EXAM

Summer 2022: 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	16	
3	10	
4	24	
5	24	

Question	Points	Score
6	24	
7	24	
Total	150	

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

   (a) (14 points) $\int_{-2}^{2} \frac{1}{x^2} dx$

   (b) (14 points) $\int t^5 \sin(t^3) dt$

2. Given the following differential equation $\frac{dy}{dx} = \frac{x^2}{y}$ with the initial conditions $y(0) = -5$.

   (a) (8 points) Solve explicitly for the general solution $y(x)$.

   (b) (8 points) From the general solution $y(x)$ derived in part (a), solve for the constant of integration c.

3. (10 points) Consider the curve defined by $y = \sec(x)$ on $0 \le x \le \frac{\pi}{4}$. Set up but **do not evaluate** the surface area of the solid obtained by rotating the curve about the y-**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) (12 points) $a_n = \frac{3^{n+2}}{5^n}$

   (b) (12 points) $\sum_{n=2}^{\infty} \frac{\sqrt{n}}{\ln(n)}$

5. Consider the function $f(x) = \frac{1}{1+x^2}$.

   (a) (12 points) Write the function $f(x)$ as a Maclauren series.

   (b) (12 points) Using your answer from part (a), write $g(x) = \tan^{-1}(x)$ as a Maclauren Series.

6. (a) (12 points) Find the tangent line to the parametric curve $x = te^{t^2} + 1, y = \cos^2(t) - 2t$, at the point $t = 0$.

   (b) (12 points) Consider the parametric cuve $x = \sin^2(t), y = \sin(3t)$ bounded by $0 \le t \le \frac{\pi}{3}$. Set-up but **do not evaluate** the area under the curve using a parametric integral.

7. These two questions are not related.

   (a) (12 points) Consider the polar curve $r = \theta + \sin\theta$ for $0 \le \theta \le \frac{\pi}{2}$. Set-up but **do not evaluate** an integral to find the length of the polar curve.

   (b) (12 points) Set-up but **do not evaluate** the area of one rose petal, given by the equation $r = \cos(3\theta)$. Graph given below for reference.