APPM 1350 **Exam 3** **Summer 2020**

On the front page please write your name and clearly label each problem This exam is worth 100 points and has 4 questions on both sides of this paper.

- Make sure all of your work is on separate sheets of paper. Nothing on this exam sheet will be graded. Please begin each problem on a new page.
- **Show all work and simplify your answers!** Name any theorem that you use. Answers with no justification will receive no points unless the problem explicitly states otherwise.
- Notes, papers, calculators, cell phones, and other electronic devices are not permitted, except for a computer for proctoring through Zoom.
- You must use methods that we have learned in class thus far to solve the problems. (Dominance of powers is not valid)

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1. (20 pts) Unrelated, short answer questions.
   (a) Given $x_1 = 1$ and $f(x) = -x^3 - x^2 + 4$, find x_2 using Newton's method.
   (b) Find f (generalized anti-derivative):
      i. $f'(x) = x^{2/3} + \frac{1}{x^3} + \frac{1}{\sqrt{x}}$
      ii. $f''(\theta) = \theta + \sin(\theta) - \cos(\theta)$

2. (13 pts) A person standing on the edge of a cliff throws a ball upward at 10 m/s. The ball hits the ground below at 90 m/s. Assume that the ball experiences a constant acceleration of 10 m/s^2 downward. How tall is the cliff? Use anti-differentiation.

3. (22 pts) Let $f(x) = x^2 + x$ on the interval $[-1, 0]$.
   (a) Set up the Riemann sum for this function and the given interval. Use n equally spaced subintervals and right endpoints.
   (b) Simplify the sum. (i.e. find a value that no longer has summations)
   (c) Using limit rules, evaluate the limit of the simplified sum as $n \to \infty$.
   (d) Compute using a definite integral.

4. (12 pts) Using the Fundamental Theorem of Calculus, find $f'(x)$ if

$$f(x) = \int_{\cos(x)}^{x^3} \frac{\sin(t)}{t} dt$$

TURN OVER—More problems on the back!

5. (33 pts) Find the following:

(a)
$$\int \frac{x}{\sqrt{x^2+1}} dx$$

(b)
$$\int_0^{\pi/3} \frac{\sin(\theta)}{\cos^3(\theta)}\, d\theta$$

(c) The average value of $f(t) = \frac{1}{t^2} + t$ on $[1, 3]$.

Formulas: $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$ $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$ $\sum_{i=1}^{n} i^3 = \left[\frac{n(n+1)}{2}\right]^2$