APPM 1350 **Exam 3** **Spring 2020**

YOU ARE ON YOUR HONOR NOT TO RECEIVE UNAUTHORIZED HELP ON THE EXAM. YOU ARE NOT ALLOWED A CALCULATOR, NOTES, TEXTBOOK, HELP FROM ANOTHER PERSON, OR USE OF ANY ELECTRONIC DEVICES OTHER THAN TO ATTEND THE ZOOM MEETING, SCROLL PAGES OF THE PDF OF THE EXAM, AND UPLOAD YOUR FINISHED EXAM TO CANVAS WHEN YOU FINISH.

- **Show all work and simplify your answers!** Name any theorem that you use. Limit problems should not be evaluated using L'Hopital's Rule. Answers with no justification will receive no points unless the problem explicitly states otherwise.
- **If you finish before 7:15, you must check out with your proctor. Your exam must be uploaded to Canvas no more than 10 minutes after your check out time.**
- Stay in the Zoom meeting until your exam is finished uploading to Canvas. This way we can help you if you run into any technical issues.

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0. Write the exam room identification number in the top left corner of the first page of your exam solution. Your exam will not be graded if this is not included.

1. (25 pts) Compute the following

   (a) $\displaystyle\int_0^3 \sqrt{9-x^2}dx$ (Hint: Use geometry)

   (b) $\displaystyle\int_{-\pi}^{\pi/2} \sin(x)\sin(\cos(x))dx$

   (c) $\displaystyle\frac{d}{dx}\int_1^{x^2} (t^3-4t)dt$

   (d) $\displaystyle\int_{-\pi/2}^{\pi/2} x\sin^2(x^8)\cos(x^8)dx$

2. (15 pts) The following problems are unrelated.

   (a) Find the slant asymptote of $f(x) = \dfrac{x^2+6x-4}{3x-6}$.

   (b) Find the value(s) c such that $f(c) = f_{ave}$ given $f(x) = -x^2+2x+2$ on the interval $[0,3]$

3. (25 pts) The following problems are unrelated.

   (a) We wish to design a box with a square base and a surface area of 108 square inches. What dimensions will produce a box with maximum volume?

   (b) Use one step of Newton's method to approximate the location of the local minimum to $f(x) = (x+1)^4 - 32(x+1)$ with $x_0 = 0$.

   (c) A car is initially moving at a velocity of 20 meters/s and begins to decelerate $a(t) = -3\sqrt{t}$ meters/s^2. How far does the car move after 4 seconds relative to its position at $t = 0$?

4. (15 pts) In this problem, define the function $g(x) = \int_2^x \frac{4}{t} dt$.

   (a) Compute $g(2)$ and $g'(2)$.

   (b) Show that $g'(x) = -\frac{d}{dx}\left[g\left(\frac{1}{x}\right)\right]$

5. (20 pts) The following problems are unrelated.

   (a) Consider the definite integral $\int_1^4 x^2 - 2x \; dx$

      (i) Approximate the integral with R_3, the right Riemann sum consisting of three terms.

      (ii) Write down the right Riemann sum with n terms, R_n. Use the formulas provided to evaluate the Riemann sum.

   (b) Compute $\lim_{n\to\infty} \sum_{i=1}^{n} \left[3\left(\frac{2i}{n}\right)^3 - \left(\frac{2i}{n}\right)^2 + 2\right] \frac{2}{n}$ by evaluating a definite integral.

Formulas

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