APPM 1345
Exam 2
Spring 2025

Name	
Instructor Richard McNamara	**Section** 150

This exam is worth 100 points and has **4 problems**.

Make sure all of your work is written in the blank spaces provided. If your solutions do not fit, there is additional space at the end of the test. Be sure to **make a note** indicating the page number where the work is continued or it will **not** be graded.

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.

End-of-Exam Procedure

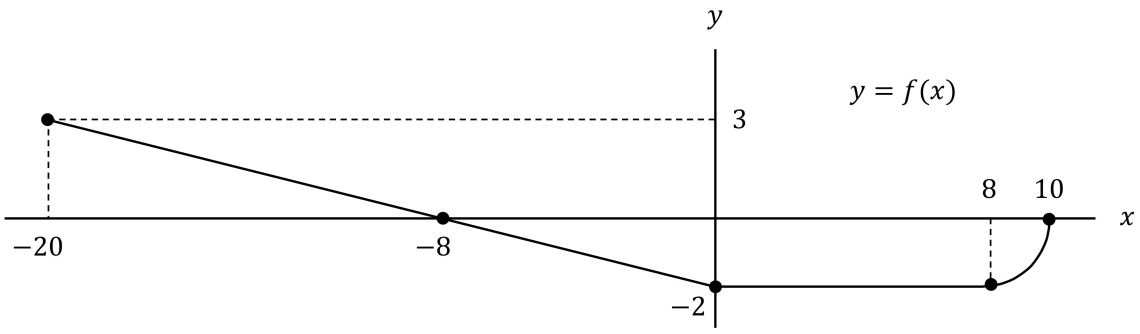
1. Go to the designated area to scan and upload your exam to Gradescope.
2. Verify that your exam has been correctly uploaded and all problems have been labeled.
3. Hand the physical copy of your exam to a proctor.
4. Have a proctor swipe your BuffOne card.

Formulas

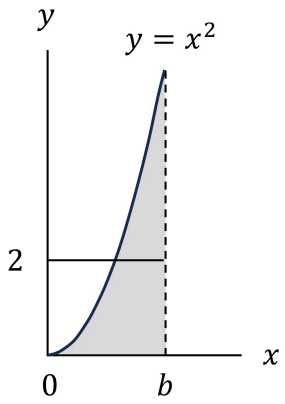
$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2} \qquad \sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6} \qquad \sum_{i=1}^{n} i^3 = \left[\frac{n(n+1)}{2}\right]^2$$

1. (15 pts) Parts (a) and (b) are not related.

   (a) The graph of $y = f(x)$, which consists of two line segments and a quarter circle, is depicted below on the interval $[-20, 10]$. Determine the average value of $f(x)$ on the interval $[-20, 10]$.



(b) For what value of $b > 0$ is the area of the shaded region in the following graph equal to the area of the rectangle whose corners are located at $(0, 0)$, $(b, 0)$, $(0, 2)$, and $(b, 2)$?



2. (16 pts) Parts (a) and (b) are not related.

(a) Evaluate the following derivative. Do **not** simplify your answer.

$$\frac{d}{dx}\int_{x^5+1}^{\tan x} \frac{1}{t^4+3}\,dt$$

(b) For the following function $g(x)$, find the value of $g'(\pi/2)$. Fully simplify your final answer.

$$g(x) = \int_{\pi/2}^{5x-\pi/2} \sqrt{\cos t + 8}\,dt$$

3. (34 pts) Parts (a), (b), and (b) are not related.

(a) Evaluate $\displaystyle\int \frac{\sin x}{(2\cos x - 1)^{5/6}}\, dx.$

(b) Evaluate $\displaystyle\int (x+1)(x-1)^{20}\, dx$

(c) Let $v(t) = \dfrac{1+t^2}{\sqrt{2+3t+t^3}}$ meters per second represent the velocity function of a particle. Determine the distance traveled by the particle from $t = 0$ second to $t = 2$ seconds. Include the correct unit of measurement.

4. (35 pts) Parts (a), (b), and (c) are not related.

   (a) Find the numerical value of the lower Riemann sum (**not** the left Riemann sum) for the function $p(x) = x^2 - 2x - 3$ on the interval $[-4, 8]$ using $n = 3$ equal subintervals.

(b) Find an expression for the right-hand Riemann sum R_n for the function $h(x) = \sqrt{x}$ on the interval $[2, 16]$ using n equal subintervals.

Your final answer should be in the form of a summation. Do **not** simplify the expression or evaluate the limit of the summation.

(c) Evaluate the following limit using summation formulas and fully simplify your final answer. Do not use L'Hôpital's Rule or a dominance of powers argument when evaluating the limit.

$$\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{i^3}{n^3} \cdot \frac{1}{n} + 3 \cdot \frac{i}{n} \cdot \frac{1}{n} \right)$$

END OF EXAM

Your Initials _____

ADDITIONAL BLANK SPACE

If you write a solution here, please clearly indicate the problem number.