APPM 1345
Exam 3
Spring 2023

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 Checklist

1. If you finish the exam before 7:45 PM:
   - Go to the designated area to scan and upload your exam to Gradescope.
   - Verify that your exam has been correctly uploaded and all problems have been labeled.
   - Leave the physical copy of the exam with your proctors.
2. If you finish the exam after 7:45 PM:
   - Please wait in your seat until 8:00 PM.
   - When instructed to do so, scan and upload your exam to Gradescope at your seat.
   - Verify that your exam has been correctly uploaded and all problems have been labeled.
   - Leave the physical copy of the exam with your proctors.

Formula

$$(f^{-1})'(x) = \frac{1}{f'(f^{-1}(x))}$$

1. (23 pts) Parts (a) and (b) are unrelated.

   (a) Find the inverse function of $g(x) = 6x^5$ 1.

(b) Consider the function $f(x) = 2x^5 + x^3 + 3x + 2$.

i. Explain why f is invertible, based on its derivative.

ii. Find an equation of the line that is tangent to the curve $y = f^{-1}(x)$ at the point $(8; 1)$.

2. (27 pts) Parts (a), (b) and (c) are unrelated.

   (a) Suppose 1=3 of a radioactive substance remains after decaying exponentially for 10 years. Find the half-life of the substance, including the correct unit of measurement. Fully support your answer.

(b) Identify all critical numbers of the function $h(x) = x^2 3^x$, if any.

(c) Rewrite the expression $e^{(5 \ln 2)t}$ so that it includes no logarithmic terms.

3. (24 pts) Evaluate the following derivatives using properties of logarithms and/or logarithmic differentiation. Do **not** fully simplify your answers, although they must be expressed as functions of x.

(a) $\dfrac{d}{dx}\left[\ln\left|\dfrac{(x-2)^{3=2}(\cos x+2)}{\sqrt{x^2+4}}\right|\right], \quad x > 2$

(b) $\dfrac{d}{dx}\,(x^6+1)^{\sin x}$

4. (26 pts) Evaluate the following integrals. Fully simplify your answers.

(a) $\int_4^9 \frac{dx}{\sqrt{x}(1-2\sqrt{x})}$

(b) $\int \cot x \, dx$

END OF TEST

Your Initials _____

ADDITIONAL BLANK SPACE

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