

APPM 1345

Exam 3

Spring 2026

Name		
Instructor	Richard McNamara	Section 150

This exam is worth 100 points and has **5 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.

Formula

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

1. (21 pts) Parts (a) and (b) are unrelated.

(a) Find the average value f_{ave} of the function $f(x) = \cos x - \sin x$ on the interval $[0, \pi/4]$.

(b) Find all values of x , if any, at which the value of the following function $u(x)$ is exactly equal to the average value of $u(x)$ on the specified interval. Fully simplify your answer. State “none” if none exist.

$$u(x) = x^{1/3}, \quad 0 \leq x \leq 8$$

2. (22 pts) Evaluate the following integrals.

(a) $\int x(x+3)^{1/4} dx$ (Express your answer in terms of x .)

(b) $\int_0^{\pi/3} \sin x \cdot \cos^2 x dx$ (Fully simplify your answer.)

3. (17 pts) Parts (a) and (b) are unrelated.

(a) Find the inverse function of $g(x) = (8 - x^3)^{1/2}$ for $0 \leq x \leq 2$. You may assume that $g(x)$ is one-to-one.

(b) Consider the function $h(x) = x^7 + 3x^5 + 5x^3 + 7x + 9$.

- i. Explain why h is invertible, based on its derivative.
- ii. For what value of x does $h(x) = 9$?
- iii. Determine the value of $(h^{-1})'(9)$. (*Hint:* Do not attempt to identify the function $h^{-1}(x)$.)

4. (24 pts) Parts (a) and (b) are unrelated.

(a) Evaluate $\int_0^2 \frac{x^3 + 1}{x^4 + 4x + 1} dx$.

- (b) Find the derivative $y'(x)$ for the function $y = (\cos x + 2)^{\cos x + 2}$. Do not fully simplify your answer, although it must be expressed solely as a function of x .

Hint: Apply logarithmic differentiation.

5. (16 pts) Parts (a) and (b) are unrelated.

- (a) Consider the function $w(x) = x^{-3} \cdot 3^{-x}$. Identify all values of x , if any, for which $w'(x) = 0$. If there are no such values, state “none” and explain why.

- (b) Solve the following equation for t : $2 = \frac{7}{3 + 5e^{-2t}}$.

END OF EXAM

Your Initials _____

ADDITIONAL BLANK SPACE

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