MATH 220  Test 3  Fall 2019

Name ____________________________  NetID ____________________________  UIN ____________________________

Circle your TA discussion section.

> AD1, TR 11:00-12:50, Mina Nahvi  > ADJ, TR 9:00-9:50, Robert "Bob" Krueger
> AD2, TR 9:00-10:50, Adriana Morales  > ADK, TR 10:00-10:50, Sarah Simpson
> AD3, TR 1:00-2:50, Vincent Villalobos  > ADL, TR 11:00-11:50, Rocco Davino
> AD@, TR 9:00-9:50, Phuong "Sophie" Le  > ADM, TR 12:00-12:50, Dara Zirlin
> ADA, TR 8:00-8:50, Scott Harman  > ADN, TR 1:00-1:50, John "Connor" Grady
> AD2, TR 9:00-10:50, Lutian Zhao  > ADQ, TR 10:00-10:50, Saaber Pourmotabbed
> AD3, TR 2:00-2:50, Shuyu "Sonya" Xiao  > ADL, TR 11:00-11:50, Adriana Morales
> ADJ, TR 9:00-9:50, Robert "Bob" Krueger  > ADM, TR 12:00-12:50, Dara Zirlin
> ADK, TR 1:00-1:50, John "Connor" Grady  > ADN, TR 1:00-1:50, Scott Harman

• Sit in your assigned seat (circled below).
• Do not open this test booklet until I say START.
• Turn off all electronic devices and put away all items except a pen/pencil and an eraser.
• Remove hats and sunglasses.
• There is no partial credit on multiple-choice questions. For all other questions, you must show sufficient work to justify your answer.
• While the test is in progress, we will not answer questions concerning the test material.
• Do not leave early unless you are at the end of a row.
• Quit working and close this test booklet when I say STOP.
• Quickly turn in your test to me or a TA and show your Student ID.
1. (10 points) Evaluate the indefinite integral.

\[ \int \left( x^6 + 9 \cos(x) + 5 \sin(x) + 3 \csc(x) \cot(x) + 8 \sec(x) \tan(x) + 9 \sec^2(x) + 4 \csc^2(x) + 2 \right) \, dx \]

2. (10 points) Evaluate the indefinite integral.

\[ \int \frac{240x^5}{x^{12} + 25} \, dx \]
3. (10 points) Evaluate the indefinite integral.

\[ \int 81x (9x + 4)^{40} \, dx \]

4. (10 points) Evaluate the indefinite integral.

version 1: \[ \int \tan^6(x) \sec^4(x) \, dx \]

version 2: \[ \int \sec^5(x) \tan^3(x) \, dx \]
5. (10 points) Find the average value of the function \( f(x) = \frac{32x}{\sqrt{2x^2 + 49}} \) on the interval \([0, 4]\). Simplify your answer.

6. (10 points) Suppose that \( f(x) \) is a polynomial which satisfies the following conditions.

- \( \int_{2}^{9} f(x) \, dx = 30 \)
- \( \int_{4}^{9} f(x) \, dx = 34 \)

Evaluate the following quantities.

(a) \( \int_{2}^{4} (8f(x) + 5) \, dx \)

(b) \( \int_{3}^{4} 34xf(x^2 - 7) \, dx \)
7. (10 points) Given the function below, use a linear approximation to estimate \( f(5.02) \). Simplify and write your answer in decimal form.

\[
f(x) = \frac{1}{15} \ln (x^3 - 124) + 6x + 12
\]

8. (10 points) Evaluate the following limit. Be sure to use proper notation throughout your evaluation of this limit. Simplify your answer.

\[
\lim_{n \to \infty} \sum_{k=1}^{n} \left( \frac{60k}{n^2} + \frac{12}{n + 5} \right)
\]
9. (10 points) Let \( g(x) = 8x + \int_x^9 e^{t-25} \, dt \). Determine the \( x \)-value for each inflection point of \( g(x) \).
10. (10 points) The graphs of \( v(x) = 3e^x \) and \( w(x) = 12e^{-x} \) intersect at the point \((x, y) = (\ln(2), 6)\). Let \( R \) be the finite region bounded by \( v(x), w(x) \) and the \( y \)-axis. By integrating with respect to \( x \), set up, but do not evaluate, definite integrals which represent the given quantities.

(a) The volume of the solid obtained when \( R \) is revolved around the vertical line \( x = -4 \).

(b) The volume of the solid obtained when \( R \) is revolved around the horizontal line \( y = 15 \).
Students – do not write on this page!

1. (10 points) ______________________

2. (10 points) ______________________

3. (10 points) ______________________

4. (10 points) ______________________

5. (10 points) ______________________

6. (10 points) ______________________

7. (10 points) ______________________

8. (10 points) ______________________

9. (10 points) ______________________

10. (10 points) _____________________

TOTAL (100 points) ________________