MATH 220  
Test 3  
Spring 2014

Name ________________________________  
NetID __________________

- Sit in your assigned seat (circled below).
- Circle your TA discussion section.
- 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.
- You must show sufficient work to justify each 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.

文明城市

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FRONT OF ROOM – 100 Gregory Hall
1. (15 points) Let **R** be the finite region bounded by the graphs of \( y = 3 \sin x \) and \( y = 2x + 6 \) on the interval \([0, 2\pi]\). Set up, but do not evaluate, definite integrals which represent the given quantities. Use proper notation.

(a) The area of **R**.

(b) The volume of the solid obtained when **R** is revolved around the vertical line \( x = 9 \).

(c) The volume of the solid obtained when **R** is revolved around the horizontal line \( y = -5 \).
2. (8 points) Fill in the missing information to show that the definite integral can be expressed as the limit of a right Riemann sum. The only variables appearing in your limit should be \( n \) and \( k \). You do not need to evaluate this limit.

\[
\int_{0}^{17} \ln (x^4 + 29) \, dx = \lim_{n \to \infty} \sum_{k=1}^{n} \left[ \right]
\]

3. (9 points) Suppose that \( f(x) \) is a polynomial which satisfies the following conditions.

- \( \int_{0}^{1} f(x) \, dx = -4 \)
- \( \int_{1}^{2} f(x) \, dx = 10 \)
- \( \int_{0}^{8} f(x) \, dx = -9 \)

Evaluate the following quantities.

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

(b) \( \int_{0}^{2} (17f(x) + 19) \, dx \)

(c) \( \int_{0}^{1} 54x^2 f(x^3 + 1) \, dx \)
4. (10 points) Evaluate the indefinite integral.

\[ \int \left( x^{13} - \frac{15}{\sqrt{1-x^2}} + 14 \csc x \cot x + 4x^{-1} + 36 \right) \, dx \]

5. (10 points) Evaluate the definite integral. Simplify your answer.

\[ \int_{0}^{\ln 3} 20e^{4x} \, dx \]
6. (8 points) Evaluate the indefinite integral.

\[ \int x^{13} (x^7 + 9)^{241} \, dx \]

7. (10 points) Evaluate the indefinite integral.

\[ \int \cot^3 x \csc^{37} x \, dx \]
8. (10 points) Let \( g(x) = \int_{(2x+3)^5}^{120} \sin \left( t^4 + 8 \right) \, dt \). Determine \( g'(x) \).

9. (10 points) A function \( f(x) \) has derivative \( f'(x) = 10e^{2x} - 6\sin x + 22 \). Find a formula for \( f(x) \) given that its graph goes through the point \((0,100)\).
10. (10 points) Use a linear approximation to estimate $\sqrt{\frac{1}{e}}$ and write your answer either in decimal form or as a simplified fraction.
Students – do not write on this page!

1. (15 points) ______________________

2. (8 points) ______________________

3. (9 points) ______________________

4. (10 points) ______________________

5. (10 points) ______________________

6. (8 points) ______________________

7. (10 points) ______________________

8. (10 points) ______________________

9. (10 points) ______________________

10. (10 points) _____________________

TOTAL (100 points) ________________