Name ______________________ 10–digit PUID ______________________

Recitation Instructor ______________________ Recitation Section Number __________

Lecture's Name ______________________

Instructions:

1. Academic Integrity
   a. Students may not open the exam until instructed to do so.
   b. Students must obey the orders and requests by all proctors, TAs, and lecturers.
   c. No student may leave in the first 20 minutes of in the last 10 minutes of the exam.
   d. Books, notes, calculators, or any electronic devices are not allowed on the exam, and they should not even be in sight in the exam room. Students may not look at anybody elses test, and may not communicate with anybody else except, if they have a question, with their TA or lecturer.
   e. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
   f. Any violation of these rules and any act of academic dishonesty may result in severe penalties. Additionally, all violators will be reported to the Office of the Dean of Students.

   I have read and understand the exam rules stated above:

   STUDENT NAME (print): ______________________

   STUDENT SIGNATURE: ______________________

2. Fill in all the information requested above. On the scantron sheet fill in your name, student ID number, and the section number of your recitation with an extra 0 at the left. Blacken the correct circles.
3. This booklet contains 12 problems. Problems 1 through 12 are worth 7 points each. Problems 13 and 14 are worth 8 points each. The maximum score is 100 points.
4. For each problem mark your answer on the scantron sheet and also circle it in this booklet.
5. Work only on the pages of this booklet.

Mark **TEST 01** on your scantron!

1. $\int \sec^4 x \tan^2 x \, dx$

A. $\dfrac{\sec^5 x}{5} - \dfrac{\sec^3 x}{3} + C$

B. $\dfrac{\sec^4 x}{4} - \dfrac{\sec^2 x}{2} + C$

C. $\dfrac{\tan^5 x}{5} - \dfrac{\tan^3 x}{3} + C$

D. $\dfrac{\tan^5 x}{5} - \dfrac{\tan^7 x}{7} + C$

E. $\dfrac{\tan^3 x}{3} + \dfrac{\tan^5 x}{5} + C$

2. Compute $\int_0^{\frac{\pi}{4}} \tan^3 x \, dx$

A. $\dfrac{\pi}{6}$

B. $\dfrac{1}{2} - \dfrac{\pi}{4}$

C. $\dfrac{1}{2} - \ln\sqrt{2}$

D. $\dfrac{1}{2} + \dfrac{\pi}{6}$

E. $\ln\sqrt{2}$

3. Which integral arises after making a suitable substitution to compute $\int \sqrt{4-x^2}\,dx$

A. $\int 2\sec\theta\tan^2\theta d\theta$

B. $\int 4\sec^2\theta\tan\theta d\theta$

C. $\int 4\cos^2\theta d\theta$

D. $\int 2\sin\theta\cos\theta d\theta$

E. $\int 2\sec^3\theta d\theta$

4. Which substitution should be used to compute $\int \sqrt{\frac{4x^2-9}{x}}\,dx$

A. $x = \frac{3\tan\theta}{2}$

B. $x = \frac{1}{2}\sec\theta$

C. $x = \frac{3\sec\theta}{2}$

D. $x = \frac{3}{2}\sin\theta$

E. $x = 3\tan\theta$

5. $\int_0^1 x\sqrt{1+x^2}\,dx$

A. $2\sqrt{2}-1$

B. $\frac{1}{3}\left(\sqrt{2}-1\right)$

C. $\frac{2}{3}(\sqrt{2}-1)$

D. $\frac{1}{3}\left(2\sqrt{2}-1\right)$

E. $\sqrt{2}-1$

6. Compute $\int_1^2 \frac{dx}{\sqrt{2-x}}$

A. 2

B. $2\sqrt{2}-1$

C. $\sqrt{2}-1$

D. $\sqrt{2}$

E. 1

7. $\int_0^1 \frac{x^2 - x + 1}{(x^2+1)^2}\, dx =$

A. $\frac{\pi}{4} - \frac{1}{4}$

B. $\frac{\pi}{4} + \frac{1}{4}$

C. $\frac{\pi}{4} + \frac{1}{2}$

D. $\frac{\pi}{4} - \frac{1}{2}$

E. $\frac{\pi}{4} - 1$

8. Evaluate $\int \frac{\cos 2x \; dx}{3\sin 2x + 6\sin^2 2x}$ using the integral below

$$\int \frac{du}{u(a+bu)} = \frac{1}{a}\ln\left|\frac{u}{a+bu}\right| + C$$

A. $\frac{1}{3}\ln\left|\frac{\sin 2x}{3+6\sin 2x}\right| + C$

B. $\frac{1}{2}\ln\left|\frac{\sin 2x}{3+6\sin 2x}\right| + C$

C. $\ln\left|\frac{\sin 2x}{3+6\sin 2x}\right| + C$

D. $2\ln\left|\frac{\sin 2x}{3+6\sin 2x}\right| + C$

E. $\frac{1}{6}\ln\left|\frac{\sin 2x}{3+6\sin 2x}\right| + C$

9. At 20 foot intervals, going west to east, 5 measurements are taken of the width (in feet) of a small pond. The table below gives the results. Using Simpson's Rule with $n = 4$, approximate the surface area of the pond.

West 20, 25, 25, 30, 20 East

A. $\frac{5,000}{3}$ ft^2

B. $2,000$ ft^2

C. $\frac{16,000}{9}$ ft^2

D. $\frac{6,200}{3}$ ft^2

E. $\frac{1,550}{3}$ ft^2

10. Which of the following improper integrals converge?

I. $\int_1^\infty e^{-x}\,dx$ II. $\int_1^\infty \frac{1}{x}\,dx$ III. $\int_0^1 \frac{1}{\sqrt{x}}\,dx$ IV. $\int_0^3 \frac{1}{x-2}\,dx$

A. only II and IV

B. only I and III

C. only I and II

D. only II and III

E. only III and IV

11. Find the exact length of the curve $y = \ln(\sec x)$, $0 \le x \le \dfrac{\pi}{3}$.

A. $\ln\left|\dfrac{1}{\sqrt{3}} - \sqrt{3}\right|$

B. $\ln\left|2 - \dfrac{1}{\sqrt{3}}\right|$

C. $\ln\left|2 + \dfrac{1}{\sqrt{3}}\right|$

D. $\ln|2 + \sqrt{3}|$

E. $\ln|2 - \sqrt{3}|$

12. The curve $y = x^2$, $0 \le x \le \dfrac{1}{2}$ is rotated about the y–axis. Find the exact area of the surface of revolution.

A. $\dfrac{\pi}{6}\left(2^{3/2} - 1\right)$

B. $\dfrac{\pi}{12}\left(2^{3/2} - 1\right)$

C. $\dfrac{\pi}{3}\left(2^{3/2} - 1\right)$

D. $\dfrac{\pi}{8}\left(2^{3/2} - 1\right)$

E. $\pi\left(2^{3/2} - 1\right)$