MA 16600
EXAM 2 INSTRUCTIONS
VERSION 01
March 4, 2013

Your name ______________________ Your TA's name ______________________

Student ID # ________________ Section # and recitation time ___________

1. You must use a #2 pencil on the scantron sheet (answer sheet).

2. Check that the cover of your exam booklet is GREEN and that it has VERSION 01 on the top. Write 01 in the TEST/QUIZ NUMBER boxes and blacken in the appropriate spaces below.

3. On the scantron sheet, fill in your TA's name (NOT the lecturer's name) and the course number.

4. Fill in your NAME and PURDUE ID NUMBER, and blacken in the appropriate spaces.

5. Fill in the four-digit SECTION NUMBER.

6. Sign the scantron sheet.

7. Write down YOUR NAME and TA's NAME on the exam booklet.

8. Blacken your choice of the correct answer in the spaces provided for each of the questions 1–12. Do all your work on the question sheets. Show your work on the question sheets. Although no partial credit will be given, any disputes about grades or grading will be settled by examining your written work on the question sheets.

9. There are 12 questions, each worth 8 points. The maximum possible score is

$8 \times 12 + 4$ (for taking the exam) $= 100$ points.

10. NO calculators, electronic device, books, or papers are allowed. Use the back of the test pages for scrap paper.

11. After you finish the exam, turn in BOTH the scantron sheet and the exam booklet.

12. If you finish the exam before 8:55, you may leave the room after turning in the scantron sheets and the exam booklets. If you don't finish before 8:55, you should REMAIN SEATED until your TA comes and collects your scantron sheets and exam booklets.

Questions

1. Evaluate the following integral

$$\int_0^{\pi/2} \sin^3 x \cos^2 x \ dx.$$

A. $\frac{3}{10}$

B. $\frac{1}{10}$

C. $\frac{2}{15}$ (correct)

D. $\frac{1}{15}$

E. $\frac{\pi}{6}$

2. Evaluate the following integral
$$\int_{\pi/4}^{\pi/3} \frac{\sec^4 x}{\tan^2 x} dx.$$

A. $\frac{2}{\sqrt{3}}$ (correct)

B. $\frac{\sqrt{3}-1}{2}$

C. $\frac{2}{\sqrt{3}} + 1$

D. $2\sqrt{3} - 1$

E. $2\sqrt{3}$

3. Compute

$$\int \frac{dx}{\sqrt{1+4x^2}}.$$

A. $\ln|x+\sqrt{1+4x^2}|+C$

B. $\frac{1}{2}\ln|2x+\sqrt{1+4x^2}|+C$ (correct)

C. $\frac{1}{2}\tan^{-1}(2x)+\sqrt{1+4x^2}+C$

D. $\tan^{-1}(2x)+\sqrt{1+4x^2}+C$

E. $\frac{1}{2}\ln|1+4x^2|+C$

4. Compute

$$\int x\sqrt{9x^2-4}\,dx.$$

A. $\frac{1}{27}(9x^2-4)^{3/2}+C$ (correct)

B. $\frac{1}{9}\ln\left|\frac{3x}{2}+\frac{\sqrt{9x^2-4}}{2}\right|+C$

C. $\frac{1}{18}\sec^{-1}(\frac{3x}{2})+C$

D. $\frac{1}{9}\tan^{-1}(\frac{3x}{2})+C$

E. $\frac{16}{27}\tan^3\theta+C$

5. Compute

$$\int \frac{3x^2 + 8x - 8}{x^2 + 2x - 3}\, dx.$$

A. $\frac{3}{4} \ln|x-1| + \frac{5}{4} \ln|x+3| + C$

B. $3x + \frac{3}{4} \ln|x-1| + \frac{5}{4} \ln|x+3| + C$ (correct)

C. $\frac{1}{4} \ln|x+1| + \frac{7}{4} \ln|x-3| + C$

D. $3x + \frac{1}{4} \ln|x+1| + \frac{7}{4} \ln|x-3| + C$

E. $3x + \ln|x^2 + 2x - 1| + C$

6. Compute

$$\int \frac{4x^2 + 3x + 4}{(x^2+1)^2}\, dx.$$

A. $4\tan^{-1} x - \frac{3}{2(x^2+1)} + C$ (correct)

B. $\tan^{-1} x + \frac{1}{2(x^2+1)} + C$

C. $4\tan^{-1} x + 3(\tan^{-1} x)^2 + C$

D. $4\ln|x^2+1| + 3\ln|(x^2+1)^2| + C$

E. $2\ln|x^2+1| - \frac{3}{2(x^2+1)} + C$

7. Evaluate the integral

$$\int_0^4 \frac{dx}{\sqrt{x}(4+x)}.$$

A. π

B. $\pi/2$

C. $\pi/3$

D. $\pi/4$ (correct)

E. $\frac{\sqrt{2}}{2}$

8. Evaluate the following *improper* integral

$$\int_0^9 \frac{dx}{(x-1)^{\frac{4}{3}}}.$$

A. $-\frac{9}{2}$

B. 9

C. $\infty - \infty$

D. 0

E. This improper integral diverges. (correct)

9. Find the exact length of the curve

$$y = \frac{x^3}{3} + \frac{1}{4x},\ 1 \leq x \leq 2.$$

A. $\frac{45}{16}$
B. $\frac{51}{16}$
C. $\frac{53}{24}$
D. $\frac{59}{24}$ (correct)
E. $\frac{8\pi}{3}$

10. The curve $y = \sqrt{9 - x^2}$, $-1 \leq x \leq 1$, is an arc of the circle $x^2 + y^2 = 9$.

Find the area of the surface obtained by rotating this arc about the x-axis.

A. 2π

B. 3π

C. 8π

D. 12π (correct)

E. 36π

11. Find the centroid of the region bounded by the line $y = x$ and the parabola $y = x^2$.

HINT: Use the following evaluation of the integrations if necessary.

$$\int_0^1 (x - x^2) = \frac{1}{6}$$

$$\int_0^1 (x^2 - x^3) = \frac{1}{12}$$

$$\int_0^1 (x^2 - x^4) = \frac{2}{15}$$

A. $\left(\frac{1}{2}, \frac{3}{5}\right)$

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

C. $\left(\frac{1}{3}, \frac{2}{5}\right)$

D. $\left(\frac{1}{2}, \frac{2}{5}\right)$ (correct)

E. $\left(\frac{1}{2}, \frac{4}{5}\right)$

12. Determine whether the following sequences are convergent or divergent.

(1) $\{a_n = \frac{(3n)!}{(5n)!}\}$

(2) $\{a_n = n^2 e^{-n}\}$

(3) $\{a_n = n \sin(\frac{3}{n})\}$

A. (1) convergent (2) convergent (3) convergent (correct)

B. (1) divergent (2) convergent (3) convergent

C. (1) convergent (2) divergent (3) convergent

D. (1) convergent (2) convergent (3) divergent

E. (1) convergent (2) divergent (3) divergent