

MA 16200  
EXAM 2 Form 01  
March 12, 2020

NAME \_\_\_\_\_ YOUR TA'S NAME \_\_\_\_\_

STUDENT ID # \_\_\_\_\_ RECITATION TIME \_\_\_\_\_

Be sure the paper you are looking at right now is GREEN! Write the following in the TEST/QUIZ NUMBER boxes (and blacken in the appropriate spaces below the boxes): 

01
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You must use a #2 pencil on the mark-sense sheet (answer sheet). On the mark-sense sheet, fill in your TA's name and the COURSE number. Fill in your NAME and STUDENT IDENTIFICATION NUMBER and blacken in the appropriate spaces. Fill in your four-digit SECTION NUMBER. If you do not know your section number, ask your TA. Sign the mark-sense sheet.

There are 12 questions, each worth 8 points (you will automatically earn 4 point for taking the exam). Blacken in your choice of the correct answer in the spaces provided for questions 1–12. Do all your work in this exam booklet. Use the back of the test pages for scrap paper. Turn in both the scantron and the exam booklet when you are finished.

If you finish the exam before 8:50, you may leave the room after turning in the scantron sheet and the exam booklet. You may not leave the room before 8:20. If you don't finish before 8:50, you MUST REMAIN SEATED until your TA comes and collects your scantron sheet and your exam booklet.

### EXAM POLICIES

1. Students may not open the exam until instructed to do so.
2. Students must obey the orders and requests by all proctors, TAs, and lecturers.
3. No student may leave in the first 20 min or in the last 10 min of the exam.
4. 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 else's test, and may not communicate with anybody else except, if they have a question, with their TA or lecturer.
5. 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.
6. 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: \_\_\_\_\_

STUDENT SIGNATURE: \_\_\_\_\_

1. Compute the value of the integral  $\int_1^e 2x \ln x \, dx$ .

- A.  $\frac{1}{2}$
- B.  $\frac{1 - e^2}{2}$
- C.  $\frac{1 + e^2}{2}$
- D.  $\frac{3e^2 - 1}{2}$
- E.  $\frac{e^2}{2}$

2. Which of the following is the value of the integral  $\int \frac{x^2}{x^2 + 1} \, dx$ ?

- A.  $x - \tan^{-1} x + c$
- B.  $\frac{x}{x^2 + 1} + c$
- C.  $\frac{1}{2} \ln(x^2 + 1) + c$
- D.  $\frac{x^3}{3} + x + c$
- E.  $x + \tan^{-1} x + c$

3. Which of the following is the value of the integral  $\int \cos^3 x \sqrt{\sin x} \, dx$ ?

A.  $\frac{2}{3} \cos^{3/2} x - \frac{2}{7} \cos^{7/2} x + c$

B.  $\sin x - \frac{1}{3} \sin^3 x + c$

C.  $\frac{2}{3} \sin^{3/2} x - \frac{1}{3} \sin^3 x + c$

D.  $\frac{2}{3} \sin^{3/2} x + \frac{2}{7} \sin^{7/2} x + c$

E.  $\frac{2}{3} \sin^{3/2} x - \frac{2}{7} \sin^{7/2} x + c$

4. Which of the following is the value of the integral  $\int \tan^{-1} x \, dx$ ?

A.  $\ln(\tan x) + c$

B.  $\ln(\sin x) + c$

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

D.  $x \tan^{-1} x + \frac{1}{2} \ln(x^2 + 1) + c$

E.  $x \tan^{-1} x - 2 \ln(x^2 + 1) + c$

5. An olympic size swimming pool is 50 meters long, 25 meters wide and 2 meters deep. Assume that the pool is filled with water. How much work is done pumping all of the water out of the pool? Use the approximate values  $1000 \text{ kg/m}^3$  for the density of water and  $10 \text{ m/s}^2$  for acceleration due to gravity.

- A.  $80,000(25)^2 \text{ J}$
- B.  $80,000(25)^3 \text{ J}$
- C.  $20,000(25)^3 \text{ J}$
- D.  $40,000(25)^2 \text{ J}$
- E.  $40,000(25)^3 \text{ J}$

6. Compute the integral  $\int_2^3 \frac{x+5}{x^2+x-2} dx$ .

- A.  $\ln(16/5)$
- B.  $\ln(9/5)$
- C.  $\ln(8/5)$
- D.  $\ln(12/5)$
- E.  $\ln(4/5)$

7. A trigonometric substitution of the form  $x = \sin \theta$ ,  $x = \tan \theta$  or  $x = \sec \theta$  is used to compute the integral  $\int_{\sqrt{2}}^2 \frac{1}{x^3 \sqrt{x^2-1}} dx$ . Which of the following integrals will be generated by this substitution?

A.  $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \cos^2 \theta d\theta$

B.  $\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \cos^2 \theta d\theta$

C.  $\int_0^{\frac{\pi}{4}} \cos^2 \theta d\theta$

D.  $\int_0^{\frac{\pi}{6}} \cos^2 \theta d\theta$

E.  $\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \cos^2 \theta d\theta$

8. A partial fraction decomposition is used to write  $\frac{1}{x^2(x-1)^2}$  as a sum of partial fractions:

$$\frac{1}{x^2(x-1)^2} = \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x-1} + \frac{D}{(x-1)^2},$$

where  $A$ ,  $B$ ,  $C$  and  $D$  are constants. What is  $A + B + C + D$ ?

A.  $-2$

B.  $2$

C.  $1$

D.  $0$

E.  $-1$

9. Compute the improper integral  $\int_0^\infty xe^{-5x} dx$ .

- A.  $\frac{1}{5}$
- B. The integral is divergent.
- C.  $\frac{1}{10}$
- D.  $\frac{6}{5}$
- E.  $\frac{1}{25}$

10. Each of the following statements is either true or false. Determine which are true and which are false.

- (i)  $\int_0^1 \ln(x) dx$  is divergent
- (ii)  $\int_1^\infty \frac{1}{x^p} dx$  is convergent for  $p > 1$
- (iii)  $\int_1^\infty \frac{1}{\sqrt{x}} dx$  is convergent

- A. (i) and (ii) are true; (iii) is false
- B. (i) is true; (ii) and (iii) are false
- C. (ii) is true; (i) and (iii) are false
- D. (i) and (iii) are true; (ii) is false
- E. (ii) and (iii) are true; (i) is false

11. Which of the following sequences converge?

- (i)  $\left\{\frac{n^2}{n^3+1}\right\}_{n=1}^{\infty}$
- (ii)  $\left\{\frac{1+(-1)^n}{2}\right\}_{n=1}^{\infty}$
- (iii)  $\left\{\frac{\cos n}{n+1}\right\}_{n=1}^{\infty}$

- A. All of them
- B. (ii) only
- C. (i) only
- D. (ii) and (iii) only
- E. (i) and (iii) only

12. How many of the following statements are correct?

- (i)  $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = 0$
- (ii)  $\lim_{n \rightarrow \infty} e^{-n} = 0$
- (iii)  $\lim_{n \rightarrow \infty} \tan^{-1}(n) = \frac{\pi}{2}$
- (iv)  $\lim_{n \rightarrow \infty} \frac{n}{n+1} = 1$

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4