MA 16200
EXAM 3 INSTRUCTIONS
VERSION 01
November 13, 2018

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 question 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. 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.

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

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

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

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

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

Exam Policies

1. Students must take pre-assigned seats and/or follow TAs' seating instructions.
2. Students may not open the exam until instructed to do so.
3. No student may leave in the first 20 min or in the last 5 min of the exam.
4. Students late for more than 20 min will not be allowed to take the exam; they will have to contact their lecturer within one day for permission to take a make-up exam.
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 the above rules may result in score of zero.

Rules Regarding Academic Dishonesty

1. You are not allowed to seek or obtain any kind of help from anyone to answer questions on the exam. If you have questions, consult only your instructor.
2. You are not allowed to look at the exam of another student. You may not compare answers with anyone else or consult another student until after you have finished your exam, handed it in to your instructor and left the room.
3. You may not consult notes, books, calculators. You may not handle cell phones or cameras, or any electronic devices until after you have finished your exam, handed it in to your instructor and left the room.
4. Anyone who violates these instructions will have committed an act of academic dishonesty. Penalties for academic dishonesty can be very severe and may include an F in the course. All cases of academic dishonesty will be reported immediately to the Office of the Dean of Students.

I have read and understand the exam policies and the rules regarding the academic dishonesty stated above:

STUDENT NAME: ____

STUDENT SIGNATURE: ____

Questions

1. Determine which of the following statements are true and which are false.

(I) $\sum_{n=1}^{\infty} \frac{1}{n^2+1}$ is convergent by the ratio test.

(II) $\sum_{n=1}^{\infty} \frac{1}{n^2+1}$ is convergent by the limit comparison test with $\sum_{n=1}^{\infty} \frac{1}{n^2}$.

(III) $\sum_{n=1}^{\infty} \frac{1}{n^2+1}$ is convergent by the direct comparison test with $\sum_{n=1}^{\infty} \frac{1}{n^2}$.

A. I is true; II and III are false.

B. II is true; I and III are false.

C. II and III are true; I is false.

D. I and II are true; III is false.

E. I, II, and III are false.

2. Test the following series for convergence:

(I) $\sum_{n=1}^{\infty} \frac{1}{n+\sqrt{n}}$

(II) $\sum_{n=1}^{\infty} \frac{2^n}{n+3^n}$

(III) $\sum_{n=1}^{\infty} \frac{5-2\sqrt{n}}{n^3}$

A. I is divergent; II and III are convergent.

B. I and II are convergent; III is divergent.

C. I and III are divergent; II is convergent.

D. I, II and III are divergent.

E. I, II and III are convergent.

3. The series $\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2}$ is convergent by the Alternating Series Test. According to the Alternating Series Estimation Theorem what is the smallest number of terms needed to find the sum of the series with error less than $1/15$?

A. 1

B. 4

C. 5

D. 2

E. 3

4. Test the following series for convergence:

(I) $\sum_{n=1}^{\infty} \ln\left(1+\frac{1}{n^2}\right)$

(II) $\sum_{n=1}^{\infty} \sin\left(\frac{1}{n}\right)$

(III) $\sum_{n=1}^{\infty} \left(\sqrt{n^3}-\sqrt{n^3-1}\right)$

A. I is convergent; II and III are divergent.

B. I and III are convergent; II is divergent.

C. I and III are divergent; II is convergent.

D. I, II and III are divergent.

E. I, II and III are convergent.

5. Determine whether the following series are absolutely convergent, conditionally convergent, or divergent:

(I) $\sum_{n=1}^{\infty}(-1)^{n-1}\cos(\pi/n^2)$

(II) $\sum_{n=1}^{\infty}(-1)^{n-1}\sin(\pi/n^2)$

(III) $\sum_{n=1}^{\infty}\cos(\pi n)/n$

A. I and II are absolutely convergent; III is divergent.

B. I and II are conditionally convergent; III is divergent.

C. I and II are absolutely convergent; III is conditionally convergent.

D. I is divergent; II is absolutely convergent; III is conditionally convergent.

E. I and III are divergent; II is absolutely convergent.

6. For which of the following series the ratio test is inconclusive?

(I) $\sum_{n=1}^{\infty} \frac{10^n}{n!}$

(II) $\sum_{n=1}^{\infty} \frac{1}{n^2}$

(III) $\sum_{n=1}^{\infty} \frac{\ln(n)}{n}$

A. I only

B. II only

C. III only

D. I and II

E. II and III

7. The first three terms of the binomial series for $f(x) = (1 + 3x)^{-1/3}$ are

A. $1 - \frac{1}{3}x + \frac{4}{9}x^2$

B. $1 - 3x + 9x^2$

C. $1 - 2x + 4x^2$

D. $1 - \frac{1}{3}x + \frac{2}{9}x^2$

E. $1 - x + 2x^2$

8. Find the radius and interval of convergence of the power series $\sum_{n=1}^{\infty} (-1)^{n-1} \frac{1}{n} (x+3)^n$.

A. radius of convergence: 1; interval of convergence: (-4,-2)

B. radius of convergence: 1; interval of convergence: [-4,-2)

C. radius of convergence: ∞; interval of convergence: $(-\infty, \infty)$

D. radius of convergence: 1; interval of convergence: (-4,-2]

E. radius of convergence: 3; interval of convergence: (-6,0)

9. Find the power series for $f(x) = \dfrac{x}{2+3x}$.

A. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{3^n}{2^{n+1}} x^{n+1}$

B. $\displaystyle\sum_{n=0}^{\infty}(-1)^n 3^n x^{n+1}$

C. $\displaystyle\sum_{n=0}^{\infty} \frac{3^n}{2^{n+1}} x^{n+1}$

D. $\displaystyle\sum_{n=0}^{\infty} \left(\frac{3}{2}\right)^{n+1} x^{n+1}$

E. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{2^n}{3^{n+1}} x^n$

10. The Maclaurin series of $f(x) = x\cos x - \sin 3x$ is

A. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{2n - 3^{2n}}{(2n)!}\, x^{2n}$

B. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{n - 3^{n}}{(n)!}\, x^{n}$

C. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{2n + 1 - 3^{2n+1}}{(2n+1)!}\, x^{2n+1}$

D. $\displaystyle\sum_{n=0}^{\infty} \frac{n - 3^{n}}{(n)!}\, x^{n}$

E. $\displaystyle\sum_{n=0}^{\infty} \frac{2n - 3^{2n+1}}{(2n+1)!}\, x^{2n+2}$

11. The Maclaurin series of $f(x) = \int \ln(1+2x)\,dx$ is

A. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{1}{(n+1)(n+2)} x^{n+2} + C$

B. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{2^{n+1}}{n+1} x^{n+2} + C$

C. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{2^{n+1}}{(n+1)!} x^{n+2} + C$

D. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{2^{n+1}}{(n+1)(n+2)} x^{n+2} + C$

E. $\displaystyle\sum_{n=0}^{\infty}(-1)^n \frac{2^{n+1}}{(n+1)!(n+2)} x^{n+2} + C$

12. The Maclaurin series for $f(x) = \dfrac{x}{\sqrt{3+x}}$ is

A. $\displaystyle\sum_{n=0}^{\infty} \binom{-\frac{1}{2}}{n} \frac{1}{3^{n+\frac{1}{2}}}\, x^{n+1}$

B. $\displaystyle\sum_{n=0}^{\infty} \binom{-\frac{1}{2}}{n} 3^{n+\frac{1}{2}}\, x^{n+1}$

C. $\displaystyle\sum_{n=0}^{\infty} \binom{-\frac{1}{2}}{n} 3^{n+\frac{1}{2}}\, x^{n}$

D. $\displaystyle\sum_{n=0}^{\infty} \binom{-\frac{1}{2}}{n} \frac{1}{\sqrt{3}}\, x^{n+1}$

E. $\displaystyle\sum_{n=0}^{\infty} \binom{-\frac{1}{2}}{n} \frac{1}{3^{n+\frac{1}{2}}}\, x^{n}$