

MA 16600
EXAM 3 INSTRUCTIONS
Version 11
April 20, 2022

Your Name _____ Your TA's Name _____

PUID # _____ Recitation # _____

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 11 on the top. Write 11 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 **RECITATION SECTION NUMBER**. Your number is a three-digit number. Put a 0 in the front to make it a four-digit number, and then fill it in.
6. **Sign the scantron sheet.**
7. Blacken your choice of the correct answer in the space provided for each of the questions 1-12. While you mark all your answers on the scantron sheet, you should show your work on the exam booklet. Although no partial credit will be given, any disputes about the grade or grading will be settled by examining your written work on the exam booklet.
8. There are 12 questions, each worth 8 points. The maximum possible score is:
$$(12 \times 8) + 4(\text{for taking the exam}) = 100$$
9. NO calculators, electronic devices, books, or papers are allowed. Use the back of the test for scratch paper.
10. After you finish the exam, turn in BOTH the scantron sheet and the exam booklet.
11. If you finish the exam before 7:25pm , you may leave the room after turning in the scantron sheet and the exam booklet. If you don't finish before 7:25pm , you should REMAIN SEATED until your TA comes and collects your scantron sheet and exam booklet.

Exam Policies

1. You are assigned an individual seat. Please sit in that seat.
2. Students may not open the exam until instructed to do so.
3. No student may leave in the first 20 minutes or the last 5 minutes of the exam.
4. Students that arrive more than 20 minutes late 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 must put down all writing instruments and remain in their seats, while the TAs will collect the scantron sheet and the exam booklet.
6. Any violation of the above rules may result in a score of zero.

Rules Regarding Academic Dishonesty

1. You are not allowed to seek or obtain any kind of help from anyone or 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 exam room.
3. You may not consult notes, books, calculators. You may not handle cell phones, cameras, smart watches, or any electronic devices until after you have finished your exam, handed it in to your instructor and left the exam 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 rules stated above:

STUDENT NAME _____

STUDENT SIGNATURE _____

Recitation Section numbers by TA:

1:30pm Lecture		
TA name	Time & Location	Section #
Connor Thompson	10:30am in PHYS 110	0208
Connor Thompson	11:30am in PHYS 110	0215
Connor Thompson	12:30am in PHYS 110	0222
Nikhil Mehra	4:30pm in PHYS 202	0229
Nikhil Mehra	3:30pm in PHYS 202	0236
Nikhil Mehra	2:30pm in PHYS 202	0243
Sarah Anderson	10:30am in PHYS 202	0250
Sarah Anderson	9:30am in PHYS 202	0257
Sarah Anderson	11:30am in PHYS 202	0264
Rishab Pandian	2:30pm in PHYS 110	0271
Rishab Pandian	1:30pm in PHYS 110	0278
Rishab Pandian	3:30pm in PHYS 110	0285

2:30pm Lecture		
TA name	Time & Location	Section #
Saikiran Polishetty	9:30am in HAMP 2101	0287
Saikiran Polishetty	7:30am in HAMP 2101	0288
Saikiran Polishetty	8:30am in HAMP 2101	0289
Stian Clem	8:30pm in PHYS 333	0290
Stian Clem	7:30pm in PHYS 333	0291
Stian Clem	9:30pm in PHYS 333	0292
Abishek Srinivasan	3:30pm in PHYS 333	0293
Abishek Srinivasan	4:30pm in PHYS 333	0294
Abishek Srinivasan	2:30pm in PHYS 333	0295
Rashmi Bhaskara	9:30am in PHYS 110	0296
Rashmi Bhaskara	7:30am in PHYS 110	0297
Rashmi Bhaskara	8:30am in PHYS 110	0298

1. Compute the following limit:

$$\lim_{n \rightarrow \infty} \frac{(2n)!}{(2n-1)!} \sin\left(\frac{3}{n}\right)$$

- A. 2
- B. 6
- C. The limit does not exist.
- D. 3
- E. 0

2. Compute the series:

$$\sum_{k=0}^{\infty} \frac{3 - 2^{k+1}}{10^k}$$

A. $\frac{5}{3}$

B. $\frac{35}{6}$

C. $\frac{25}{12}$

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

E. $\frac{5}{6}$

3. Which of the following series converge?

I. $\sum_{k=2}^{\infty} \frac{1}{k(\ln k)^2}$

II. $\sum_{k=1}^{\infty} \frac{2k}{\sqrt{k^2 + 1}}$

III. $\sum_{k=1}^{\infty} \left[\frac{1}{2^k} - \frac{1}{2^{k+1}} \right]$

- A. I and III only
- B. I and II only
- C. III only
- D. II and III only
- E. I, II, and III

4. Which of the following series converge?

I. $\sum_{k=1}^{\infty} \frac{\cos(k)}{k^3 + 2k}$

II. $\sum_{k=1}^{\infty} (-1)^{k+1} k^{1/k}$

III. $\sum_{k=1}^{\infty} \frac{\sqrt{k} + 2k\sqrt{k}}{k^3 + 2k - 1}$

- A. II and III only
- B. I only
- C. I, II, and III
- D. I and III only
- E. I and II only

5. Let $S = \sum_{k=1}^{\infty} \frac{(-1)^k}{k^3}$ and its partial sum $S_n = \sum_{k=1}^n \frac{(-1)^k}{k^3}$. According to the alternating series estimation theorem, what is the smallest n such that

$$|S - S_n| < 27 \times 10^{-9}$$

- A. $n = 333$
- B. $n = 3333$
- C. $n = 3$
- D. $n = 33333$
- E. $n = 33$

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

I.
$$\sum_{k=1}^{\infty} (-1)^{k+1} \cos\left(\frac{\pi}{k}\right)$$

II.
$$\sum_{k=1}^{\infty} (-1)^{k+1} \sin\left(\frac{\pi}{k^{1/3}}\right)$$

III.
$$\sum_{k=1}^{\infty} \frac{\cos(k\pi)}{k^3 + 1}$$

- A. I is divergent; II and III are absolutely convergent
B. I and II are divergent; III is absolutely convergent
C. I is divergent; II is conditionally convergent; III is absolutely convergent
D. I is divergent; II and III are conditionally convergent
E. I and III are absolutely convergent; II is divergent

7. For which of the following series is the Ratio Test inconclusive?

I.
$$\sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{\sqrt{k}}$$

II.
$$\sum_{k=1}^{\infty} \frac{5^k}{k!}$$

III.
$$\sum_{k=1}^{\infty} \frac{e^k}{k}$$

- A. I and II only
- B. III only
- C. I only
- D. II and III only
- E. I and III only

8. Find the value of p for which the series converges:

$$\sum_{k=1}^{\infty} \left(1 + \frac{p}{k}\right)^{k^2}$$

- A. $p > 1$
- B. $p < 0$
- C. $p > 0$
- D. The series does not converge for any value p
- E. $p < 1$

9. We compute the Taylor series for $f(x) = \frac{1}{x^3}$ centered at $a = 10$. What is the coefficient of $(x - 10)^3$ in the Taylor series?

A. $\frac{3!}{10^5}$

B. $-\frac{10^6}{3!}$

C. $-\frac{1}{(3!)10^5}$

D. $-\frac{1}{10^5}$

E. $\frac{1}{(3!)10^6}$

10. Find the Maclaurin series representing $f(x) = \ln(x + e)$.

A. $1 + \sum_{k=1}^{\infty} \frac{(k-1)!}{e^k} x^k$

B. $1 + \sum_{k=1}^{\infty} \frac{1}{ke^k} x^k$

C. $1 + \sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{e^{k+1}} x^k$

D. $1 + \sum_{k=1}^{\infty} \frac{(-1)^{k+1}(k-1)!}{e^k} x^k$

E. $1 + \sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{ke^k} x^k$

11. Find the interval of convergence of

$$\sum_{k=1}^{\infty} \frac{(x-3)^k}{k 2^k}$$

- A. $[-1, 5]$
- B. $(1, 5)$
- C. $(-3, 3)$
- D. $(-1, 5]$
- E. $[1, 5)$

12. Find the power series centered at 0 for:

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

A. $C + 2 \sum_{k=0}^{\infty} (-1)^k \frac{x^{k+4}}{k+4}$

B. $C + 2 \sum_{k=0}^{\infty} \frac{x^{4k+1}}{4k+1}$

C. $C + 2 \sum_{k=0}^{\infty} (-1)^k \frac{x^{k+5}}{k+5}$

D. $C + \sum_{k=0}^{\infty} \frac{x^{4k+2}}{k+2}$

E. $C + 2 \sum_{k=0}^{\infty} \frac{x^{k+5}}{k+5}$

Note: The letter C above represents the constant of integration.