MA 16200
FINAL EXAM Form 01
MAY 3, 2018

NAME _____ YOUR TA'S NAME _____

STUDENT ID # _____ RECITATION TIME _____

1. You must use a #2 pencil on the scantron

2. a. Write 01 in the TEST/QUIZ NUMBER boxes and darken the appropriate bubbles on your scantron.

b. **The color of your scantron MUST match the color of the cover page of your exam**

3. On the scantron sheet, fill in your TA's name and the course number.

4. Fill in your NAME and STUDENT IDENTIFICATION NUMBER and blacken in the appropriate spaces.

5. Fill in your four-digit SECTION NUMBER. If you do not know your section number, please ask your TA.

6. Sign the scantron sheet.

7. Fill in your name and your instructor's name on the question sheets above.

8. There are 25 questions, each one is worth 8 points. Blacken in your choice of the correct answer in the spaces provided for questions 1–25. Also circle your answers on the exam itself. Do all your work on the question sheets.

9. Turn in both the scantron sheets and the question sheets when you are finished.

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

11. NO CALCULATORS, PHONES, BOOKS, OR PAPERS ARE ALLOWED. Use the back of the test pages for scrap paper.

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. **ANY talking or writing during this time will result in an AUTOMATIC ZERO.**
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: _____

Useful formulas

$$\sin^2 x = \frac{1 - \cos 2x}{2}$$

$$\cos^2 x = \frac{1 + \cos 2x}{2}$$

$$\sin^2 x + \cos^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

1. The vector of length 2 whose direction is *opposite* that of $\langle 2, 3, 2\rangle$ is

A. $-2\langle 2, 3, 2\rangle$

B. $-\frac{1}{\sqrt{17}}\langle 2, 3, 2\rangle$

C. $-\frac{2}{\sqrt{17}}\langle 2, 3, 2\rangle$

D. $-\frac{2}{17}\langle 2, 3, 2\rangle$

E. $-\frac{2}{\sqrt{7}}\langle 2, 3, 2\rangle$

2. Choose t so that the vectors $\langle 3, 5, -1\rangle$ and $\langle t, -1, 1\rangle$ are orthogonal. Answer: $t =$

A. 0

B. 2

C. 1

D. -1

E. 3

3. Let $P = (1, 3, 2)$, $Q = (0, 1, 1)$, and $R = (-2, 2, 0)$. Which of the following vectors is perpendicular to the plane that contains the points P, Q, and R?

A. $3\hat{\mathbf{i}} - \hat{\mathbf{j}} - 5\hat{\mathbf{k}}$

B. $-6\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 10\hat{\mathbf{k}}$

C. $\hat{\mathbf{i}} - \hat{\mathbf{j}} + \hat{\mathbf{k}}$

D. $-2\hat{\mathbf{i}} - 2\hat{\mathbf{j}} - 2\hat{\mathbf{k}}$

E. None of the above

4. The volume of the solid obtained by rotating the area enclosed by the graphs of $y = x$ and $y = x^4$ about the y-axis is

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

B. $\frac{\pi}{9}$

C. $\frac{2\pi}{9}$

D. $\frac{2\pi}{15}$

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

5. $\int_0^1 xe^x \, dx =$

A. 1

B. -1

C. e

D. $\frac{e^2}{2}$

E. $2e$

6. $\int_0^{\pi/8} \sin^3(2x) \cos(2x) \, dx =$

A. 0

B. $\frac{1}{64}$

C. $\frac{1}{16}$

D. $\frac{1}{8}$

E. $\frac{1}{32}$

7. Use *integration by parts* to compute $\int_1^e \ln x \; dx$.

A. 1

B. -1

C. 0

D. e

E. $e - 1$

8. $\int_0^{\pi/2} \sin^2(3x) \; dx =$

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

B. $\frac{\pi}{4} - \frac{1}{12}$

C. $\frac{\pi}{4} + \frac{1}{12}$

D. $\frac{\pi}{4}$

E. None of the above

9. Evaluate $\displaystyle\int_2^3 \frac{3}{(x-1)(x+2)}\,dx$

A. $-\dfrac{33}{20}$

B. $-\dfrac{9}{20}$

C. $\ln\left(\dfrac{5}{2}\right)$

D. $\ln\left(\dfrac{8}{5}\right)$

E. $\ln\left(\dfrac{2}{5}\right)$

10. Evaluate $\displaystyle\int_4^\infty \frac{2x}{(x^2+9)^{1/3}}\,dx$

A. $7^{\frac{2}{3}}$

B. $\frac{3}{2}(7^{\frac{2}{3}})$

C. $9^{\frac{2}{3}} + 7^{\frac{2}{3}}$

D. $\frac{3}{2}(9^{\frac{2}{3}} + 7^{\frac{2}{3}})$

E. Integral diverges

11. What is the length of the curve $y = \frac{2}{3}x^{\frac{3}{2}}$ from $x = 0$ to $x = 3$?

A. $\frac{8}{3}$

B. 4

C. $\frac{14}{3}$

D. $\frac{16}{3}$

E. 7

12. The **sequence** $\left\{ \dfrac{\sin(\sqrt{2}\, n)}{n} \right\}$

A. converges to $\sqrt{2}$

B. converges to 1

C. converges to $\frac{1}{\sqrt{2}}$

D. converges to 0

E. diverges

13. The sum of $\frac{3}{2} + \frac{9}{16} + \frac{27}{128} + \frac{81}{1024} + \cdots$ is

A. $\frac{8}{5}$

B. $\frac{47}{20}$

C. $\frac{49}{20}$

D. $\frac{5}{2}$

E. $\frac{12}{5}$

14. For what values of x does the series $1 + \frac{1}{2^{x-1}} + \frac{1}{3^{x-1}} + \frac{1}{4^{x-1}} + \frac{1}{5^{x-1}} + \cdots$ converge?

A. No values of x

B. $x > 2$

C. $x \geq 1$

D. $x > 1$

E. All values of x

15. Consider the series $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{n^3}$. Which of the following statements are correct?

I. The series converges

II. $\displaystyle\sum_{n=\mathbf{10}}^{\infty} \frac{(-1)^n}{n^3} \leq \frac{1}{1000}$

III. The Ratio Test is inconclusive

A. All of them

B. None of them

C. I only

D. I and II only

E. III only

16. **How many** of the following series converge conditionally?

I. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{5n+1}$

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

III. $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \frac{n^2}{n^2+4}$

IV. $\displaystyle\sum_{n=2}^{\infty} \frac{(-1)^n}{n\ln(n)}$

A. 0

B. 1

C. 2

D. 3

E. 4

17. Find the interval of convergence for the series $\sum_{n=1}^{\infty} \frac{x^n}{n}$

A. $[-1, 1]$

B. $(-1, 1]$

C. $[-1, 1)$

D. $(-1, 1)$

E. $(-\infty, \infty)$

18. Find the Maclaurin series for $f(x) = \frac{x}{1+4x^2}$. Hint: use geometric series.

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

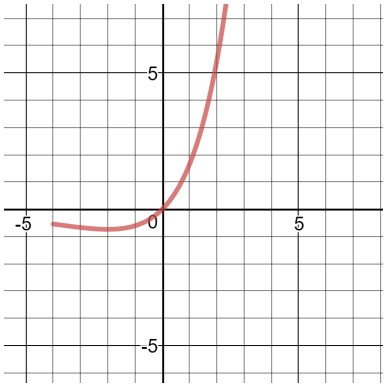
B. $\sum_{n=0}^{\infty} (-1)^n (2x)^{2n+1}$

C. $\sum_{n=0}^{\infty} (-2)^n x^{3n+3}$

D. $\sum_{n=0}^{\infty} 4^n x^{2n+1}$

E. $\sum_{n=0}^{\infty} (-4)^n x^{2n+1}$

19. Which of the following could be the Maclaurin series for the function graphed below?



A. $x + \frac{1}{2}x^2 + \frac{1}{8}x^3 + \cdots$

B. $x - \frac{1}{2}x^2 + \frac{1}{8}x^3 - \cdots$

C. $2x - \frac{4}{3}x^3 + \frac{4}{15}x^5 + \cdots$

D. $1 + \frac{1}{2}x + \frac{1}{8}x^2 + \cdots$

E. $-1 - \frac{1}{2}x - \frac{1}{8}x^2 - \cdots$

20. The equation of the line tangent to the parametric curve $x = t^3 + t$, $y = t^4 + 2t^2$ at $t = 1$ is

A. $y = 2x$

B. $y = 8x$

C. $y = 4x - 5$

D. $y = 8x + 13$

E. $y = 2x - 1$

21. The length of the curve described by the parametric equation $x = \cos^3 t$, $y = \sin^3 t$ for $0 \le t \le \frac{\pi}{2}$ is

A. $\displaystyle\int_0^{\frac{\pi}{2}} \sqrt{3\cos^2 t + 3\sin^2 t}\ dt$

B. $\displaystyle\int_0^{\frac{\pi}{2}} \sqrt{9\cos^4 t \sin^2 t + 9\sin^4 t \cos^2 t}\ dt$

C. $\displaystyle\int_0^{\frac{\pi}{2}} \sqrt{-3\cos^2 t \sin t + 3\sin^2 t \cos t}\ dt$

D. $\displaystyle\int_0^{\frac{\pi}{2}} \sqrt{9\cos^4 t + 9\sin^4 t}\ dt$

E. $\displaystyle\int_0^{\frac{\pi}{2}} \sqrt{\cos^6 t + \sin^6 t}\ dt$

22. What is the equation in polar form for the vertical line $x = 2$?

A. $r = 2\cos\theta$

B. $r = 2\sin\theta$

C. $r = 2\csc\theta$

D. $r = 2\sec\theta$

E. $r = 2\tan\theta$

23. The complex number $-5 - 5i$ expressed in polar form with the argument between 0 and 2π is

A. $5(\cos\frac{5\pi}{4} + i\sin\frac{5\pi}{4})$

B. $5\sqrt{2}(\cos\frac{5\pi}{4} + i\sin\frac{5\pi}{4})$

C. $5(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4})$

D. $-5(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4})$

E. $5\sqrt{2}(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4})$

24. The area of the region enclosed by the polar curve $r = \sin(2\theta)$, $0 \leq \theta \leq \frac{\pi}{2}$ is

A. 0

B. $\frac{1}{2}$

C. 1

D. $\frac{\pi}{8}$

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

25. Find the vertex of the conic section described by $x^2 + 4x - 4y + 8 = 0$

A. $(0, 2)$

B. $(2, -1)$

C. $(-2, 1)$

D. $(-2, -1)$

E. $(-1, 2)$