MATH 152, FALL 2021
COMMON EXAM II - VERSION B

LAST NAME(print): ______________________ FIRST NAME(print): ______________________

INSTRUCTOR: ______________________

SECTION NUMBER: ____________

DIRECTIONS:

1. The use of a calculator, laptop or computer is prohibited.
2. TURN OFF cell phones and put them away. If a cell phone is seen during the exam, your exam will be collected and you will receive a zero.
3. In Part 1 (Problems 1-15), mark the correct choice on your ScanTron using a No. 2 pencil. The scantrons will not be returned, therefore *for your own records, also record your choices on your exam!*
4. In Part 2 (Problems 16-19), present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer.* You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
5. Be sure to *write your name, section number and version letter of the exam on the ScanTron form.*
6. **Again. The use of a calculator, laptop or computer is prohibited.**

THE AGGIE HONOR CODE

"An Aggie does not lie, cheat, or steal, or tolerate those who do."

Signature: ______________________________

FOR INSTRUCTOR USE ONLY

Question	Points Awarded	Points
1-15	ScanTron	60
16		12
17		8
18		12
19		8
TOTAL		100

Part 1: Multiple Choice (4 points each)

1. Which statement is true about the integral $\int_1^\infty \frac{3\sin^2 x}{x^2}\, dx$?

   (a) The integral converges by comparison to $\int_1^\infty \frac{1}{x}\, dx$

   (b) The integral converges by comparison to $\int_1^\infty \frac{3}{x^2}\, dx$

   (c) The integral diverges by comparison to $\int_1^\infty \frac{3}{x^2}\, dx$

   (d) The integral diverges by comparison to $\int_1^\infty \frac{1}{x}\, dx$

   (e) None of these

2. Determine whether the following series converges or diverges. If it converges, find the sum.

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

   (a) Converges to 0
   (b) Converges to 3
   (c) Converges to 1
   (d) Converges to $\frac{3}{2}$
   (e) Diverges

3. The recursive sequence given below is bounded and increasing. Determine whether the sequence converges or diverges. If it converges, find the limit of the sequence.

$$a_1 = 4, \quad a_{n+1} = 8 - \frac{15}{a_n}$$

   (a) 3
   (b) 4
   (c) 5
   (d) 8
   (e) The sequence diverges.

4. Evaluate $\int_0^1 \frac{4x^2+5}{2x+1}\,dx$

(a) $6\ln 3$
(b) $4\ln 3$
(c) $3\ln 3$
(d) $2\ln 3$
(e) None of these

5. Which of the following sequences converges?

$$\text{(i) } a_n = \cos\left(\frac{1}{n}\right) \qquad \text{(ii) } a_n = \frac{(-1)^n 3n}{n+1} \qquad \text{(iii) } a_n = \ln(n^2+1) - \ln n$$

(a) Only (i) converges
(b) Only (ii) converges
(c) Only (i) and (iii) converge
(d) Only (i) and (ii) converge
(e) All three sequences diverge

6. Which of the following integrals is equivalent to $\int \frac{1}{(x^2-4x+5)^{3/2}}\,dx$?

(a) $\int \cos^3\theta\ d\theta$
(b) $\frac{1}{9}\int \cos\theta\ d\theta$
(c) $\frac{1}{27}\int \cos^3\theta\ d\theta$
(d) $\int \cos\theta\ d\theta$
(e) $\int \sec\theta\ d\theta$

7. Which sequence is both bounded and increasing?

(a) $a_n = \ln n$
(b) $a_n = \sin(2n\pi)$
(c) $a_n = e^{-n}$
(d) $a_n = 1 - \frac{2}{n}$
(e) None of these

8. The integral $\int_0^1 \ln x \, dx$

(a) converges to -1
(b) converges to 0
(c) converges to e
(d) converges to 1
(e) diverges

9. After an appropriate substitution, the integral $\int \sqrt{9 - x^2} \, dx$ is equivalent to which of the following?

(a) $3 \int \tan\theta \, d\theta$
(b) $9 \int \sec\theta \tan^2\theta \, d\theta$
(c) $3 \int \cos\theta \, d\theta$
(d) $9 \int \sec^3\theta \, d\theta$
(e) $9 \int \cos^2\theta \, d\theta$

10. The integral $\int_0^\infty e^{-2x}\,dx$

(a) converges to $\frac{1}{4}$
(b) converges to $\frac{1}{2}$
(c) converges to 0
(d) converges to 2
(e) diverges

11. Use the Remainder Estimate for the Integral Test to determine the minimum number of terms needed to approximate the sum of the series $\sum_{n=1}^{\infty} \frac{1}{n^3}$ to within $\frac{1}{80}$.

(a) 5 terms
(b) 8 terms
(c) 6 terms
(d) 4 terms
(e) 7 terms

12. Which statement is true about the integral $\int_0^4 \frac{2}{(x-3)^2}\,dx$?

(a) Converges to $\frac{8}{3}$
(b) Converges to $-\frac{8}{3}$
(c) Converges to $\frac{4}{3}$
(d) Converges to $-\frac{4}{3}$
(e) Diverges

13. Which of the following integrals is equivalent to $\int \sqrt{4x^2 - 9}\, dx$?

(a) $2 \int \sec\theta \tan^2\theta \, d\theta$

(b) $2 \int \sec^2\theta \tan\theta \, d\theta$

(c) $\frac{9}{2} \int \tan\theta \, d\theta$

(d) $\frac{9}{2} \int \sec^2\theta \tan\theta \, d\theta$

(e) $\frac{9}{2} \int \sec\theta \tan^2\theta \, d\theta$

14. Write out the form of the partial fraction decomposition of the function

$$f(x) = \frac{x^3 - 2x^2 - 5x + 4}{(x+2)^2(x^2-1)(x^2+5x+7)}$$

(a) $\frac{A}{x+2} + \frac{B}{(x+2)^2} + \frac{C}{x-1} + \frac{D}{x+1} + \frac{Ex+F}{x^2+5x+7}$

(b) $\frac{Ax+B}{(x+2)^2} + \frac{Cx+D}{x^2-1} + \frac{Ex+F}{x^2+5x+7}$

(c) $\frac{A}{(x+2)^2} + \frac{B}{x-1} + \frac{C}{x+1} + \frac{Dx+E}{x^2+5x+7}$

(d) $\frac{A}{x+2} + \frac{B}{(x+2)^2} + \frac{Cx+D}{x^2-1} + \frac{Ex+F}{x^2+5x+7}$

(e) $\frac{A}{(x+2)^2} + \frac{B}{x^2-1} + \frac{Cx+D}{x^2+5x+7}$

15. Consider the series $\sum_{n=1}^{\infty} a_n$ whose n-th partial sum is given by $s_n = \frac{2}{3 - e^{-2n}}$. What is $\sum_{n=1}^{\infty} a_n$?

(a) 2

(b) 1

(c) $\frac{1}{3}$

(d) $\frac{2}{3}$

(e) 0

Part 2: Work Out

Directions: Present your solutions in the space provided. *Show all your work* neatly and concisely and *box your final answer.* You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

16. (12 pts) Evaluate $\int \frac{1}{x^2\sqrt{x^2+4}}\,dx$.

17. (8 pts) Consider the following series

$$\sum_{n=1}^{\infty} \frac{1-3^{n-1}}{3^{2n}}$$

(a) Determine whether the series converges or diverges, and state the reason.

(b) If it converges, find its sum. If it diverges, write DIVERGES.

18. (12 pts) Evaluate $\int \frac{-2x+4}{(x^2+1)(x+1)}\,dx$

19. (8 pts) Use the Integral Test to determine whether $\sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2}$ converges or diverges. Support your answer.