

- A scantron is provided with this test. Fill in your ID information on the scantron now. Do not fold, staple or tear, etc., the scantron.
- This test consists of multiple-choice problems. Fill in the answers to the problems on the scantron. Return only the scantron. You may keep the test.
- Depending on your solution methods your answers may appear in a different form from the ones provided on the test. You are expected to be able to provide the appropriate manipulations to identify the correct answer.
- You may use one 8.5 × 11 inch note sheet prepared in advance. Note sheets may not be shared. If you do not bring a note sheet you will have to do without any help notes. You may not use any books, notebooks, additional note sheets nor note cards.
- You may use a simple scientific calculator or a modest graphics calculator on this test and you are expected to have one available. An overly elaborate calculator, laptop, handheld or notebook computer, or any device capable of extensive symbolic manipulation (other than your own brain) will not be allowed. Calculators and other equipment may not be shared.
- During the test be sure to check the board occasionally for corrections. Note $\log(x)$, $\ln(x)$ or $\log_e(x)$ means the natural logarithm of x . I will use $\log_{10}(x)$ to denote the logarithm base 10 of x .
- There are 9 multiple-choice problems worth 12 points each. The total number of points is 108 points.

Problem 1. One of the eigenvalues of the matrix

$$A = \begin{bmatrix} 5 & 2 & 6 \\ 3 & 0 & 3 \\ 6 & 2 & 5 \end{bmatrix}$$

is 12. Find a corresponding eigenvector. (In the list below v^T indicates the transpose of v .)

- A.)** $[0, -3, 1]^T$ **B.)** $[1, -3, 0]^T$
C.) $[2, 1, 2]^T$ **D.)** $[2, -2, 3]^T$ **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 1).

Problem 2. Find another eigenvalue of the matrix A in problem 1.

- A.)** -1 **B.)** -2
C.) -3 **D.)** -4 **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 2).

Problem 3. The series

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

- A.)** Converges absolutely **B.)** Converges, but only conditionally
C.) Diverges **D.)** Impossible to determine
E.) None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 3).

Problem 4. Sum the series

$$\sum_{n=2}^{\infty} \left(-\frac{3}{4}\right)^n.$$

Be sure to note the lower limit of summation.

- A.)** $\frac{4}{7}$ **B.)** $-\frac{3}{7}$
C.) $\frac{9}{28}$ **D.)** $-\frac{1}{9}$ **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 4).

Problem 5. Determine the convergence properties of the series

$$\sum_{n=0}^{\infty} \left(\frac{3n+9}{4n+1}\right)^n$$

- A.)** Converges absolutely **B.)** Converges, but only conditionally
C.) Diverges **D.)** Impossible to determine
E.) None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 5).

Problem 6. The series

$$\sum_{n=1}^{\infty} \frac{5^n}{4^n + 3^n}$$

- A.)** Converges absolutely **B.)** Converges, but only conditionally
C.) Diverges **D.)** Impossible to determine
E.) None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 6).

Problem 7. The series

$$\sum_{n=178}^{\infty} \frac{1}{n \log(n) \log(\log(n))}$$

- A.)** Converges by the ratio test **B.)** Converges by the root test
C.) Converges by the integral test **D.)** Diverges
E.) None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 7).

Problem 8. The series

$$\sum_{n=1}^{\infty} (-1)^n \frac{5^n 7^n}{6^{2n}}$$

- A.)** Converges absolutely **B.)** Converges, but only conditionally
C.) Diverges **D.)** Impossible to determine
E.) None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 8).

Problem 9. For a certain function $f(x)$ the Taylor polynomial of degree 6 about the origin is given by

$$p(x) = 2 - x + 5x^4 + 2x^6.$$

If

$$|f^{(7)}(\xi)| \leq 2.124$$

for each ξ in the interval $[-1/2, 1/2]$ use the Taylor remainder to estimate the maximum error

$$\max_{|x| \leq 0.5} |f(x) - p(x)|$$

in $p(x)$ on $[-1/2, 1/2]$ when viewed as an approximation of $f(x)$. Select the smallest bound . . .

- A.)** 9.7×10^{-8} **B.)** 1.5×10^{-6}
C.) 1.7×10^{-6} **D.)** 3.3×10^{-6} **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 9).

Use the backs of the test pages for scratch work.