Name: ______________________

4-digit code: ______________________

- Write your name and the last 4 digits of your SSN in the space provided above.
- The test has six (6) pages, including this one.
- Enter your answer in the box(es) provided.
- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given in parentheses at the right of the problem number.
- No books, notes or calculators may be used on this test.

Page	**Max. points**	**Your points**
2	20	
3	20	
4	25	
5	20	
6	15	
Total	100	

Problem 1 (10 pts)**.** Find a formula for the general term of the following sequences:

(a) $\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}, \ldots$

$x_n =$ ☐

(b) $1 - \frac{1}{2}, \frac{1}{3} - \frac{1}{2}, \frac{1}{3} - \frac{1}{4}, \frac{1}{5} - \frac{1}{4}, \ldots$

$x_n =$ ☐

Problem 2 (10pts)**.** Write out the first five terms of the sequence $\left\{ \frac{\ln n}{n} \right\}_{n=1}^{\infty}$
Determine whether the sequence converges, and if so find its limit.

First five terms: ☐

$\lim_{n\to\infty} x_n =$ ☐

Problem 3 (20 pts)**.** Determine whether the series converge, and if so find their sum:

(a) $\displaystyle\sum_{k=1}^{\infty}\left(-\frac{3}{2}\right)^{k+1}$

$$\sum_{k=1}^{\infty}\left(-\frac{3}{2}\right)^{k+1} = \boxed{}$$

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

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

Problem 4 (5 pts)**.** Apply the **divergence test** and state what it tells you about the series.

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

Problem 5 (10 pts)**.** Use the **integral test** to determine whether the series $\displaystyle\sum_{k=1}^{\infty}\frac{1}{1+9k^2}$ converges.

Problem 6 (10 pts)**.** Use the **ratio test** to determine whether the series $\displaystyle\sum_{k=1}^{\infty}\frac{3^k}{k!}$ converges. If the test is inconclusive, then say so.

Problem 7 (10 pts)**.** Use the **root test** to determine whether the series $\sum_{k=1}^{\infty} \left(\frac{k}{100}\right)^k$ converges. If the test is inconclusive, then say so.

Problem 8 (10 pts)**.** Classify the series $\sum_{k=1}^{\infty} \frac{k \cos k\pi}{k^2+1}$ as absolutely convergent, convergent or divergent.

Problem 9 (15 pts)**.** Find the MacLaurin series for $f(x) = xe^x$. Find the associated radius of convergence.