1 Sequences and Series

1. Use $a_n = \frac{2}{n+1}$ for the following questions.

   (a) Write the sequence made up of the given terms. Calculate the first 3 terms of the sequence.

   (b) Write the series made up of the given terms. Calculate the first 3 partial sums.

2. Does the sequence you wrote above converge? If so, to what?

3. Does the series you wrote above converge?

4. Describe the difference between a sequence and a series.

2 Geometric Series

1. Which of the following are geometric series? How can you tell?
   (a) $\sum_{n=0}^{\infty} 3(\frac{3}{4})^n$
   (b) $\sum_{n=0}^{\infty} 3(\frac{3}{4})^{2n}$
   (c) $\sum_{n=0}^{\infty} 3(\frac{4}{3})^{n+1}$
   (d) $\sum_{n=0}^{\infty} 3(\frac{1}{4})^{n^2}$
   (e) $6 + 3 + 1.5 + .75 + \cdots$
   (f) $-16 + 9 - 4 + 1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{9} + \cdots$
   (g) $12 - 4 + \frac{4}{3} - \frac{4}{9} + \cdots$

2. $\sum_{n=0}^{\infty} 7(\frac{2}{3})^n$ is a geometric series.
   (a) Write down (expand) the first few partial sums of the given series.
   (b) What is the n^{th} partial sum of the given series?
   (c) What does the given series converge to?

3. $\sum_{n=3}^{\infty} 7(\frac{2}{3})^{2n}$ is a geometric series.
   (a) Write down (expand) the first few partial sums of the given series.
   (b) What is the n^{th} partial sum of the given series?
   (c) What does the given series converge to?

3 Integral Comparison

If possible, use the n^{th} term (divergence) test, the integral comparison test, or the p-series test to determine whether the following series converge or diverge. State which test you used, and if none of them apply, explain why.

1. $\sum_{n=1}^{\infty} \frac{\ln(n)}{n}$

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

3. $\sum_{n=2}^{\infty} \frac{n}{\ln(n)}$

4. $\sum_{n=1}^{\infty} \frac{1}{n^2}$

5. $\sum_{n=1}^{\infty} \frac{\sin(n)}{n^2}$

6. $\sum_{n=1}^{\infty} e^{-n}$

7. $\sum_{n=1}^{\infty} ne^{-n}$

8. $\sum_{n=1}^{\infty} \frac{e^n}{n}$

4 Comparison Tests

For each of the following series, try to determine if the series converges or diverges. For practice, try both the term-size comparison test and the limit comparison test to see if one or both or neither works, explaining why.

1. $\sum_{n=1}^{\infty} \frac{1}{n+\ln(n)}$

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

3. $\sum_{n=1}^{\infty} \frac{n^2+1}{\sqrt{n^7-n^3-4}}$

4. $\sum_{n=1}^{\infty} \frac{n^2+1}{\sqrt{n^6-n^3-4}}$

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

6. $\sum_{n=1}^{\infty} \frac{\sin(n)}{n^2}$

7. $\sum_{n=1}^{\infty} e^{-(n+1)}$

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