

## Selected Problems taken from Homework from Notes Sec 11.2 parts 1,2

We have learned two tests for testing convergence/divergence of a SERIES:

- **Geometric Series Test:** a geometric series is convergent if and only if the ratio is between -1 and 1.
- **Divergence Test:** if the sequence does not converge to 0, the series diverges.
- **Harmonic Series Test:** the harmonic series diverges.

1. (Pick one) Determine whether the **geometric series** is convergent or divergent. If it is convergent, find its sum.

a.  $2 + 0.5 + 0.125 + 0.03125 + \dots$

b.  $\sum_{k=0}^{\infty} (-\pi)^k e^{-k}$

c.  $\sum_{k=2}^{\infty} \frac{2^{3k+1}}{3^{2k-1}}$

2. Consider the infinite series  $\sum_{k=1}^{\infty} \ln\left(\frac{k+1}{k}\right)$ .

a. Determine whether the sequence  $\{a_n\}$  is convergent or divergent.

b. Determine whether the series  $\sum_{n=1}^{\infty} a_n$  is convergent or divergent (if possible).

Determine whether we can apply one of the three tests we've learned.

- Can we apply the Geometric Series Test?
- Is the Divergence Test conclusive?
- Can we apply the Harmonic Series Test?

3. Let  $a_n = \frac{n}{2n+1}$

a. Determine whether the sequence  $\{a_n\}$  is convergent or divergent.

b. Determine whether the series  $\sum_{n=1}^{\infty} a_n$  is convergent or divergent (if possible).

- Can we apply the Geometric Series Test?
- Is the Divergence Test conclusive?
- Can we apply the Harmonic Series Test?

4. (Pick one) Attempt to determine whether the series  $\sum_{n=1}^{\infty} a_n$  is convergent or divergent

using some of the three tests we've learned (possibly none of them works). If it is convergent (geometric series), find its sum.

a.  $\frac{1}{3} + \frac{1}{6} + \frac{1}{9} + \frac{1}{12} + \frac{1}{15} + \dots$

b.  $\frac{1}{3} + \frac{2}{9} + \frac{1}{27} + \frac{2}{81} + \frac{1}{243} + \frac{2}{729} + \dots$

c.  $\sum_{n=1}^{\infty} \frac{n(n+2)}{(n+3)^2}$

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5. (Pick one) Attempt to determine whether the series  $\sum_{n=1}^{\infty} a_n$  is convergent or divergent using some of the three tests we've learned (possibly none of them works). If it is convergent (geometric series), find its sum. You can use Desmos/ WolframAlpha to plot your sequence.

d.  $\sum_{n=1}^{\infty} \frac{2^n + 3^n}{5^n}$

e.  $\sum_{n=1}^{\infty} \sqrt[n]{2}$

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

6. (Do at least one) Attempt to determine whether the series  $\sum_{n=1}^{\infty} a_n$  is convergent or divergent using some of three tests we've learned (possibly none of them works). If it is convergent (geometric series), find its sum. You can use Desmos/ WolframAlpha to plot your sequence.

g.  $\sum_{n=1}^{\infty} \frac{1}{1 + \left(\frac{2}{3}\right)^n}$

h.  $\sum_{n=1}^{\infty} (\cos 1)^n$

i.  $\sum_{n=1}^{\infty} \arctan n$

7. (Pick one) Attempt to determine whether the series  $\sum_{n=1}^{\infty} a_n$  is convergent or divergent using the geometric series test or divergence test (possibly none of them works). If it is convergent (geometric series), find its sum.

j.  $\sum_{n=1}^{\infty} \left(\frac{3}{5^n} + \frac{2}{n}\right)$

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

l.  $\sum_{n=1}^{\infty} n \sin\left(\frac{1}{n}\right)$

m.  $\sum_{n=1}^{\infty} \left[ \frac{5}{n(n+1)} - (-1)^n \frac{3}{2^n} \right]$