Ken Mei Week #10 Group 6 12/9/22

Part 1: Lesson 13 to 15

Geometric Series:

Theorem: Let $\sum_{n=1}^{\infty} ar^{n-1}$ be a geometric series

- If $|r|<1$ then the series converges to $\frac{a}{1-r}$
- If $|r|\geq 1$ then the series diverges

Integral Test:

Theorem (Integral Test): Let $\sum_{n=1}^{\infty} a_n$ be a series where each term a_n is positive

Let $f(x)$ be a continuous, decreasing function where $f(n)=a_n$ for all positive integers $1,2,3,\ldots$. Then either

- $\int_1^{\infty} f(x)\,dx$ and $\sum_{n=1}^{\infty} a_n$ both converge, or
- $\int_1^{\infty} f(x)\,dx$ and $\sum_{n=1}^{\infty} a_n$ both diverge

P-Series:

Theorem: Let $\sum_{n=1}^{\infty} \frac{1}{n^p}$ be a p-series where $p>0$

- If $p>1$ then the series converges
- If $p\leq 1$ then the series diverges

Definition: The series $\sum_{n=1}^{\infty} \frac{1}{n}$ (that is, the p-series where $p=1$) is known as the harmonic series

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Divergence Test:

Theorem (Divergence test): Consider the series $\sum_{n=1}^{\infty} a_n$

- If $\lim_{n \to \infty} a_n \neq 0$ then the series diverges