Sequence and Series

- Infinite Sequence
- Positive Series
  - n-th term Test, Integral Test $\Rightarrow$ p-series Test
  - Ordinary Comparison Test & Limit Comparison Test
  - Geometric Series $\Rightarrow$ Ratio Test & Root Test
- Alternating Series —— Conditional Convergence & Absolute Convergence
- Power Series
  - Domain of Convergence
  - Formal Power Series (MacLaurin Series, Taylor Expansion, Binomial Expansion)

Multivariate Functions $\mathbb{R}^n \to \mathbb{R}$

- Vector Space & $\mathbb{R}^3$
  - dot product in $\mathbb{R}^n$, cross product in $\mathbb{R}^3$, lines, planes, arc length, curvature, $\cdots$
  - quadric surfaces in $\mathbb{R}^3$

Limit and Continuity.

- Differentiation
  - Tangent Plane/Linear Approximation[1], Partial Derivative[2], Differential[3]
  - Derivative wrt. its parameter[(4)] / Gradient & Directional Derivative[(4)] $\Rightarrow$ Taylor Expansion[6] $\Rightarrow$ Quadratic Approx.[7] $\Rightarrow$ Local Extrema ($n = 2$)[8]
  - (4) $\Rightarrow$ Find Extrema: Lagrange Multipliers[9]
  - Chain Rule for Multi-variable Functions[5]
- Multiple Integration
  - Ways to Cut —— Orthogonal Coordinate Systems
  - (Polar in $\mathbb{R}^2$, Cylinderical & Spherical Coordinates in $\mathbb{R}^3$)
  - Application: Volume, Surface Area, Center of Mass, Inertia, etc.
- Vector Calculus (if time allowed)
  - Gradient, Divergence, Curl
  - Path Integral (vs. 1st order ODE)
    - potential, conservative vector field
    - (vs. exact differential equation)
  - Surface Integral
    - Divergence Theorem
    - Stokes' Theorem $\Rightarrow$ Green's Theorem in $\mathbb{R}^2$