Definition 0.0.1. A **Riemann surface** is a one dimensional complex manifold

Theorem 0.0.2 (Riemann's removable singularity theorem)**.** f is holomorphic on $X \setminus \{a\}$ and bounded near a, then f is holomophic on X

Theorem 0.0.3 (Principle of analytic continuation)**.** X is connected, $X \xrightarrow{f} Y$ is holomorphic and $f \equiv c$ on some nondiscrete subset of X, then $f \equiv c$ on X

Remark 0.0.4. This does not apply to higher dimensions, for example, $f(z, w) = z$, but in higher dimensions, we have Theorem **??**

Theorem 0.0.5 (Local behaviour of holomorphic maps)**.** $X \xrightarrow{f} Y$ is a nonconstant holomorphic map, $a \in X$, $f(a) = b \in Y$. There are local charts $U \xrightarrow{\phi} \mathbb{C}$, $V \xrightarrow{\psi} \mathbb{C}$ of a, b such that $\psi f \phi^{-1} = z^k$ for some $k \geq 1$

Remark 0.0.6. If the **multiplicity** $k > 1$, a is a **branch point**

Theorem 0.0.7. $X \xrightarrow{f} Y$ is a proper nonconstant holomorphic map between Riemann surfaces, there exists some n such that f take every value $c \in Y$, counting multiplicities, n times

Theorem 0.0.8 (Radó's theorem)**.** A connected Riemann surface is second countable

Uniformization theorem

Theorem 0.0.9 (Uniformization theorem)**.** A simply connected Riemann surface is either $\mathbb{C}$, $\mathbb{P}$ or $\mathbb{H}^2$