This contains some preliminary information that we will use later in the course.

**Definitions.**

- An $\epsilon$–**neighborhood** (or just **neighborhood**) of a point $z_0 \in \mathbb{C}$ is the set of all points $z \in \mathbb{C}$ such that $|z - z_0| < \epsilon$.

- A **deleted neighborhood** of a point $z_0 \in \mathbb{C}$ is the set of all points $z \in \mathbb{C}$ such that $0 < |z - z_0| < \epsilon$ (i.e., it is the set of all points in an $\epsilon$–neighborhood of $z_0$ except $z_0$, itself).

**Definitions.** Let $S$ be a set in the complex plane.

1. $z_0$ is an **interior point** of $S$ whenever there exists a neighborhood of $z_0$ that contains only points in $S$.

2. $z_0$ is an **exterior point** of $S$ whenever there exists a neighborhood of $z_0$ that contains no points in $S$.

3. $z_0$ is a **boundary point** of $S$ if every neighborhood of $z_0$ contains at least one point in $S$ and at least one point not in $S$. The set of all boundary points of $S$ is the **boundary** of $S$.

**Example.**

**Definitions.** Let $S$ be a set in the complex plane.

1. $S$ is **open** if it contains none of its boundary points.

2. $S$ is **closed** if it contains all of its boundary points.

3. The **closure** of $S$ is the closed set consisting of all points in $S$ together with the boundary of $S$. 
Example.

Sets can be neither open nor closed.

Example.

Definitions.

(1) An open set \( S \) is connected if each pair of points \( z_1, z_2 \in S \) can be connected by a polygonal line, consisting of a finite number of line segments joined end to end, that lies entirely in \( S \).

(2) A nonempty, open set that is connected is a domain.

Example.

Definition. A set \( S \) is bounded if there exists \( R \in \mathbb{R} \) such that every point of \( S \) lies in \( |z| = R \). Otherwise, \( S \) is unbounded.