

D1.1.1: Complex numbers**L1.1.3**

properties of complex numbers

Remark

\mathbb{C} is a field.

D1.1.5 and D1.1.7

polar and exp forms

L1.1.6

de moivre

L1.1.9

conjugate properties

L1.1.10 – 11: Triangle inequalities**D1.1.12: Argument of z** **P1.1.14**

properties of $\arg z$

Remark

set addition

D1.2.1: Open and closed ϵ -discs

Let $z_0 \in \mathbb{C}$ and $\epsilon > 0$.

1. An **open** ϵ -disc centred at z_0 is:

$$D_\epsilon(z_0) := \{z \in \mathbb{C} : |z - z_0| < \epsilon\}.$$

2. A **closed** ϵ -disc centred at z_0 is:

$$\overline{D}_\epsilon(z_0) := \{z \in \mathbb{C} : |z - z_0| \leq \epsilon\}.$$

A **punctured** ϵ -disc centred at z_0 is:

$$D'_\epsilon(z_0) := \{z \in \mathbb{C} : 0 < |z - z_0| < \epsilon\}.$$

D1.2.2: Open sets

Let $U \subset \mathbb{C}$. Set U is **open** if:

$$\forall z_0 \in U; \exists \epsilon > 0 : D_\epsilon(z_0) \subseteq U.$$

Subset F is **closed** if $\mathbb{C} \setminus F$ is open.

A **neighbourhood** of point $z_0 \in \mathbb{C}$ is an open set that contains z_0 .

L1.2.3

Punctured disc $D'_\epsilon(z_0)$ is open.

D1.2.4: Limit points

Let $S \subseteq \mathbb{C}$. z_0 is a **limit point** of S if:

$$\forall \epsilon > 0; D'_\epsilon(z_0) \cap S \neq \emptyset.$$

The **closure** of S is set \overline{S} and contains S and **all** its limit points.

L1.2.6

Let $S \subseteq \mathbb{C}$. S is closed **iff** $S = \overline{S}$.

D1.2.7: Bounded sets

Let $S \subseteq \mathbb{C}$. Set S is **bounded** if:

$$\forall z \in S; \exists M > 0 : |z| \leq M.$$

D1.2.8: ϵ -N convergence

Let $\mathbb{N} = \{0, 1, 2, \dots\}$.

Let $(z_n)_{n \in \mathbb{N}} \subseteq \mathbb{C}$ be a sequence and $z \in \mathbb{C}$. Then $\lim_{n \rightarrow \infty} z_n = z$ if:

$$\begin{aligned} &\forall \epsilon > 0; \exists N \in \mathbb{N} : \forall n \geq N \\ &\implies |z_n - z| < \epsilon. \end{aligned}$$

L1.2.9**L1.2.10****D1.2.11: Cauchy sequences****L1.2.12**

seq conv iff cauchy

L1.2.15: Bolzano-Weierstrass**Remark**

define a complex valued function

D1.3.1: Bounded functions**D1.3.2: ϵ - δ convergence****L1.3.3 ?****L1.3.4**

results on function limits

L1.3.5

limit algebra

D1.3.6: ϵ - δ continuity**L1.3.7****L1.3.8**

composition of functions are also continuous

L1.3.9**L1.3.10**