

Figures Mathematical Techniques For Engineers

Complex Analysis

Felix Claeys, Brecht Verbeken, Simon Verbruggen

October 9, 2025

2.1.1 Continuity Definition

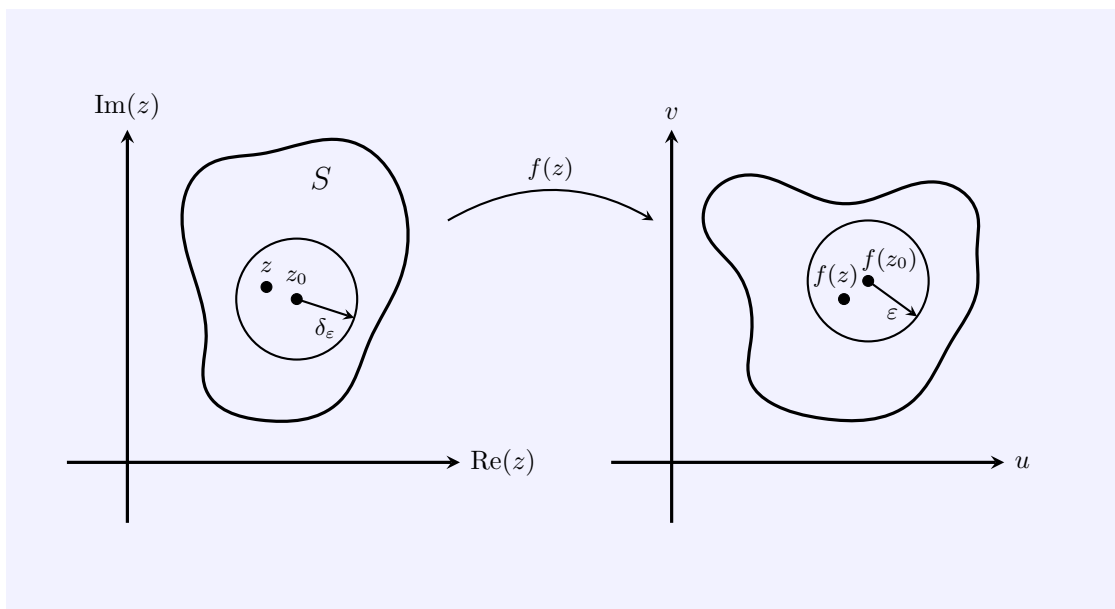


Figure 1: The function f is continuous in z_0 if $(\forall \varepsilon > 0)(\exists \delta_\varepsilon > 0)(\forall z \in S)(|z - z_0| < \delta_\varepsilon \implies |f(z) - f(z_0)| < \varepsilon)$.

2.4 Geometrical Interpretation Of The Complex Derivative

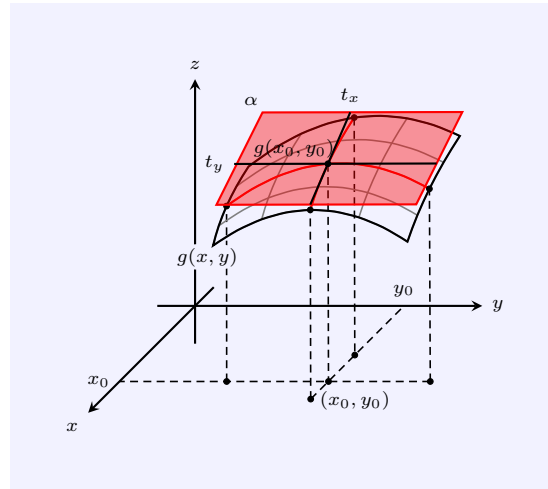


Figure 2: In every point $g(x_0, y_0)$ of a surface $g(x, y)$, a tangent plane can be drawn (red). The tangent lines t_x, t_y are oriented according to the x - and y -axis, respectively. They have a slope which corresponds to the partial derivatives $\frac{\partial}{\partial x}$ and $\frac{\partial}{\partial y}$, respectively.

3.2.12 Symmetry of points

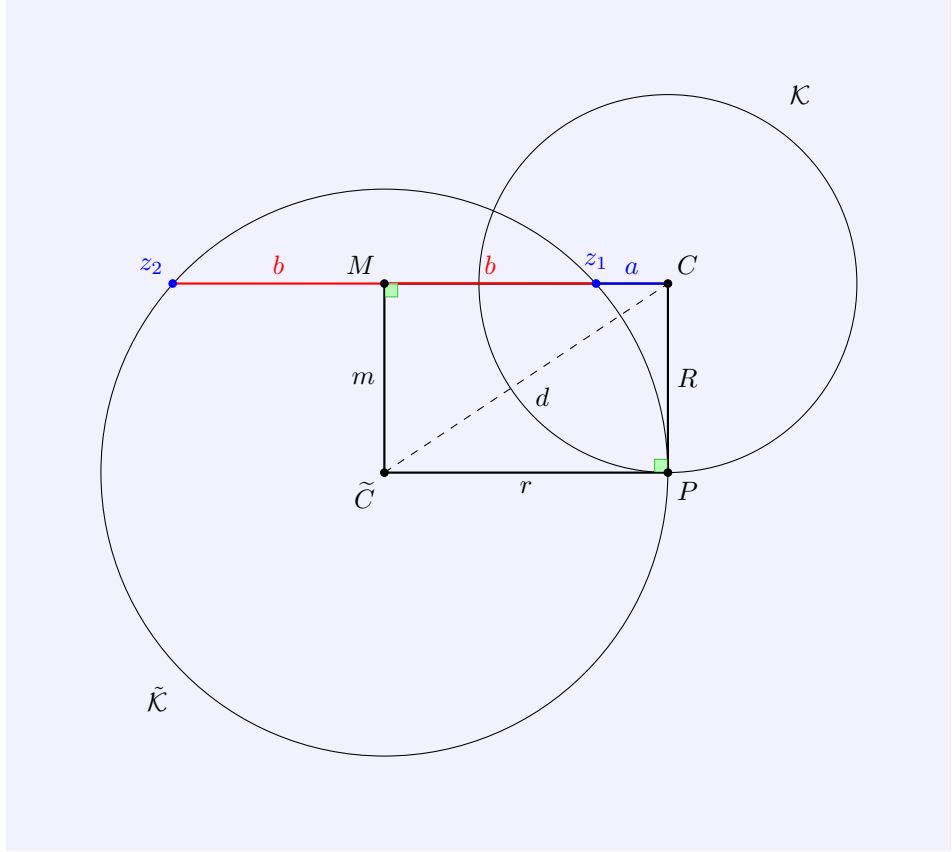


Figure 3: The points z_1 and z_2 are symmetrical with respect to the circle $\mathcal{K} = S(C, R)$.

3.5.1 Exponential function periodicity

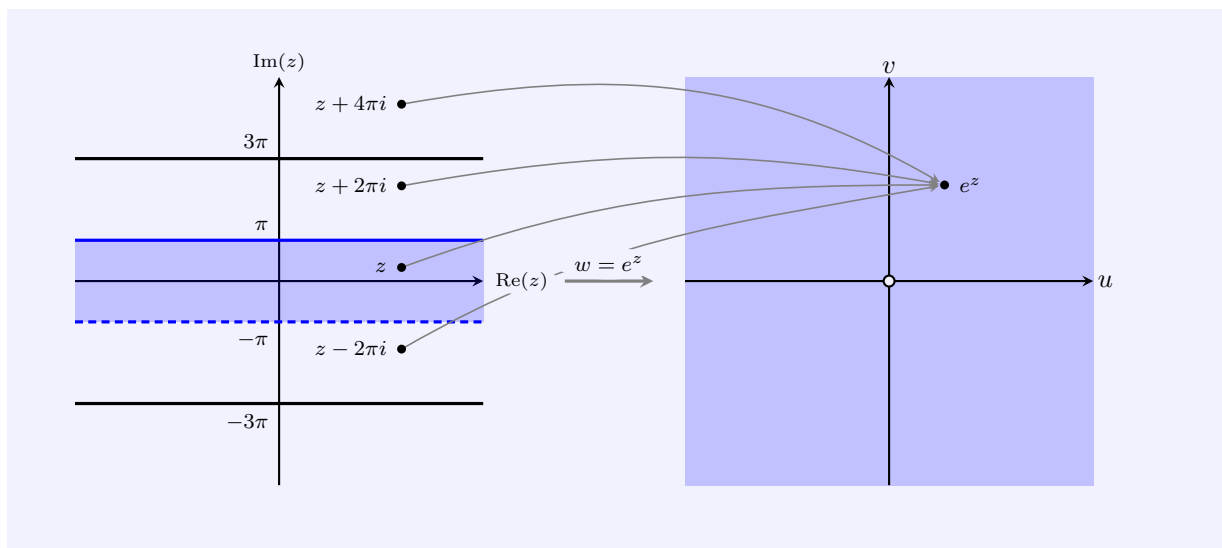


Figure 4:

3.5.2 Exponential function image vertical lines

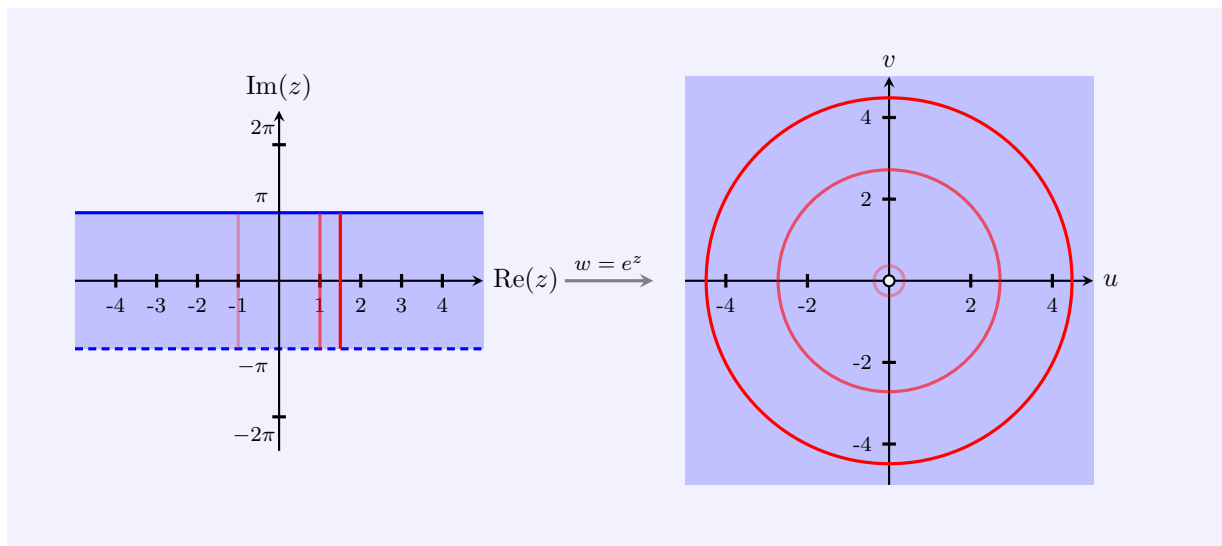


Figure 5:

3.5.3 Exponential function image horizontal lines

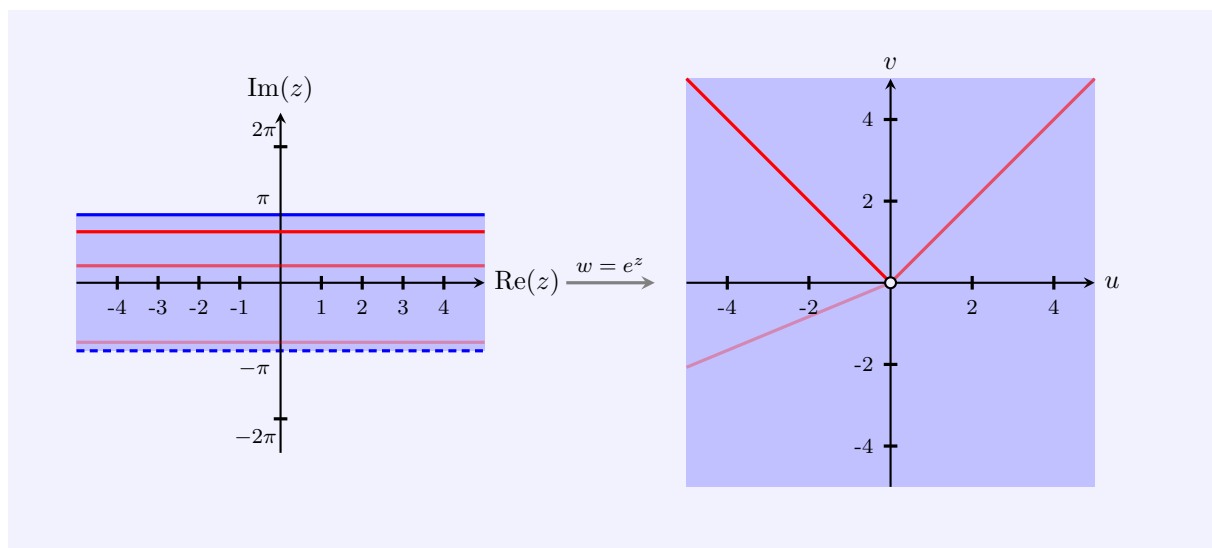


Figure 6:

3.8.4 Exercise

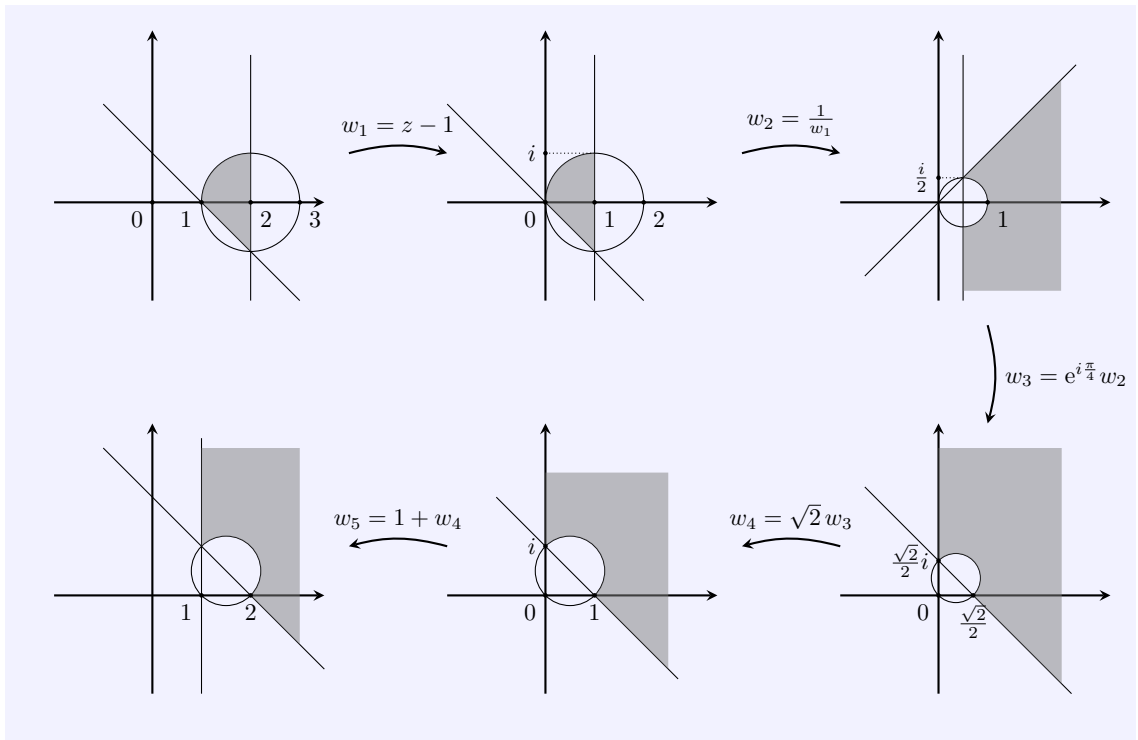


Figure 7: Image of domain $\mathcal{D} = \{z \in \mathbb{C} | \operatorname{Re}(z) + \operatorname{Im}(z) \geq 1, |z - 2| \leq 1, \operatorname{Re}(z) \leq 2\}$ through the function $f(z) = \frac{z+i}{z-i}$.

5.1.1

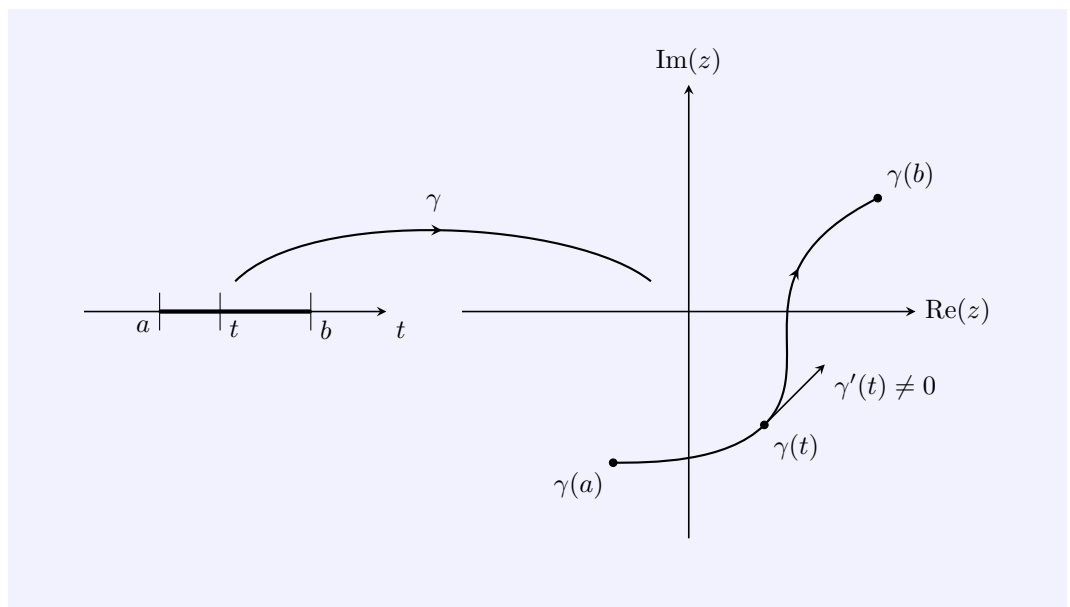


Figure 8:

5.2.3

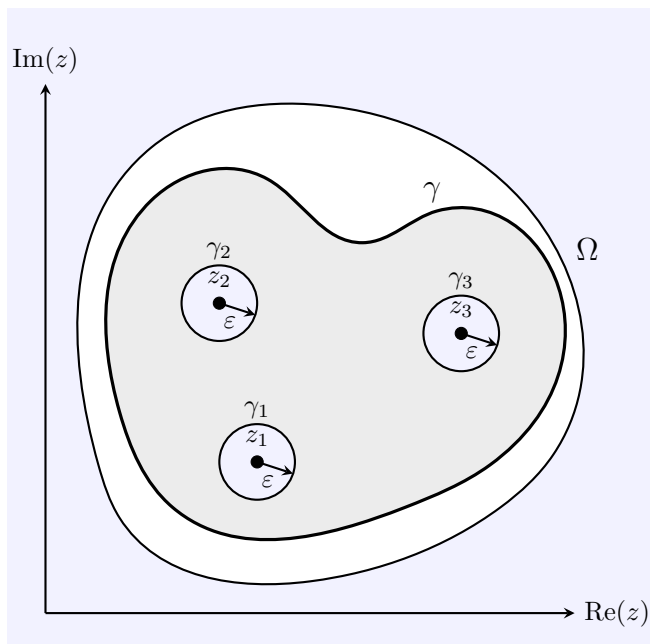


Figure 9:

5.3 Cauchy integral formulas and consequences

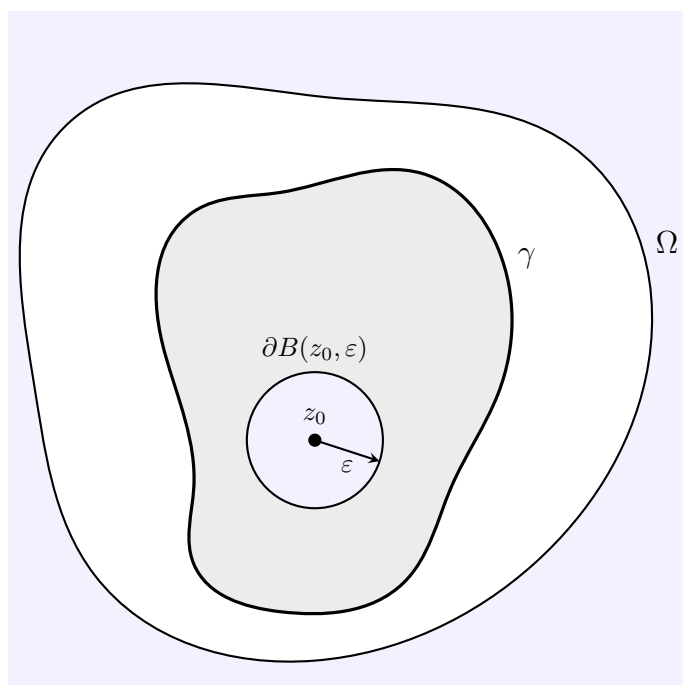


Figure 10:

5.4.4

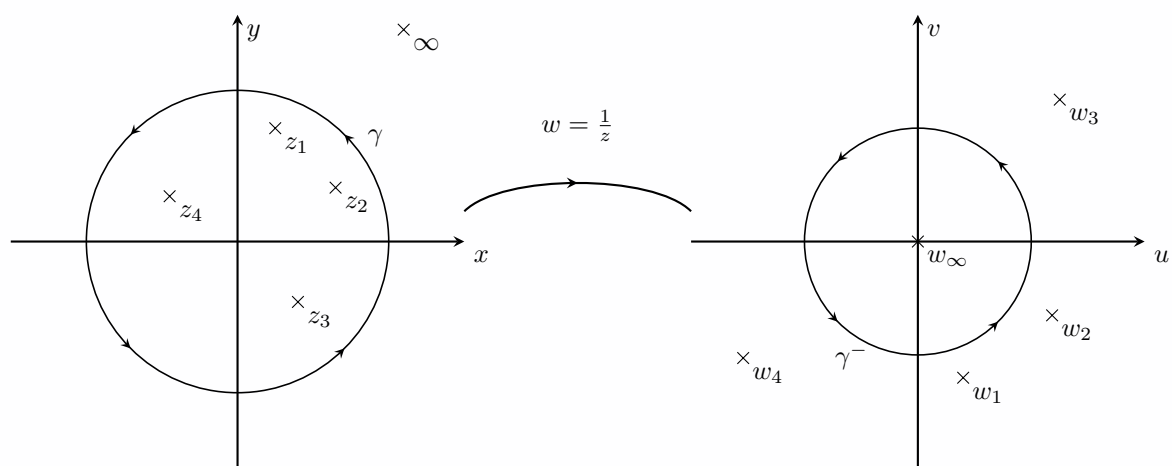


Figure 11:

5.5.2 Uniqueness of holomorphic functions

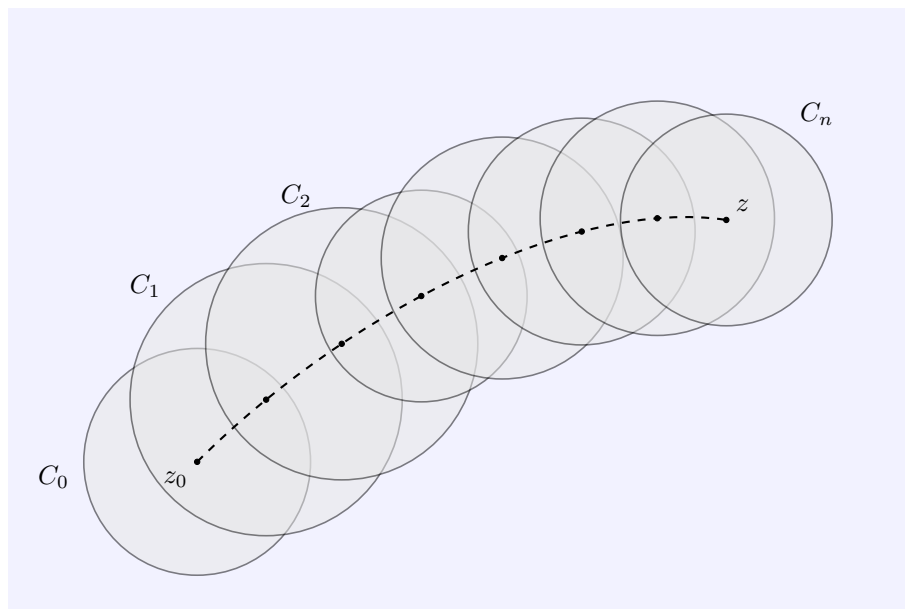


Figure 12: Let f be holomorphic in the space $\Omega \subseteq \mathbb{C}$. If $z_0 \in \Omega$ is an accumulation point of zeros of f , then $f \equiv 0$ over the entire space Ω .

5.6.2

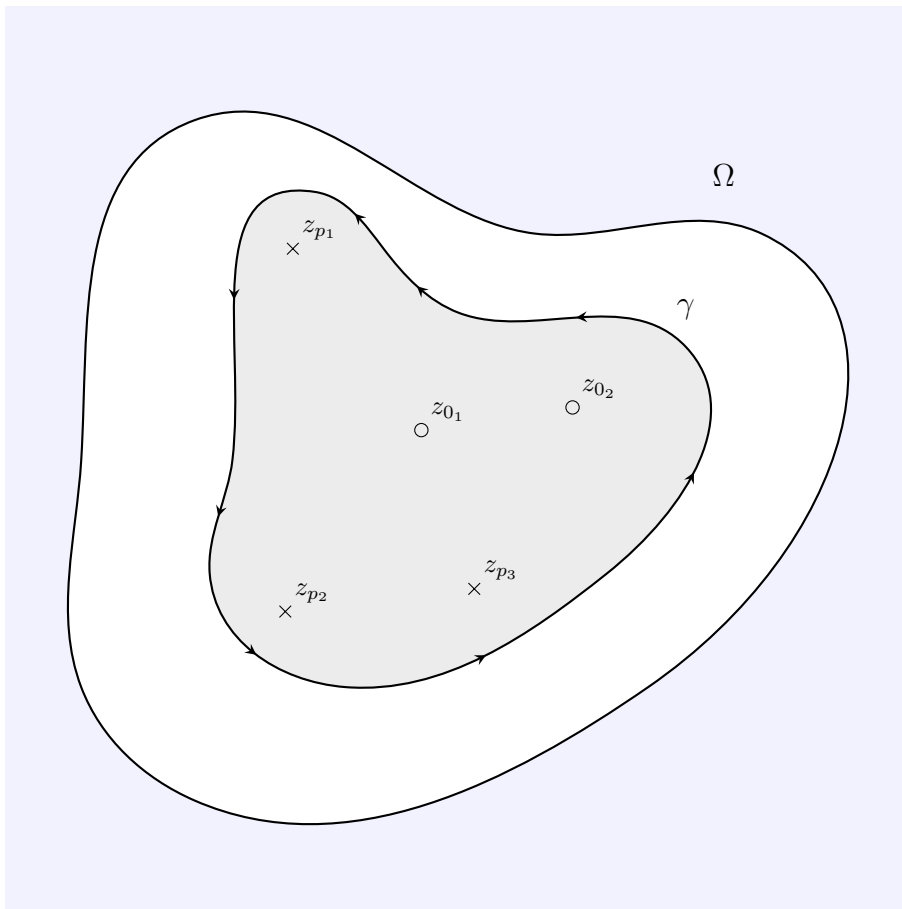


Figure 13:

5.6.3 Argument Principle

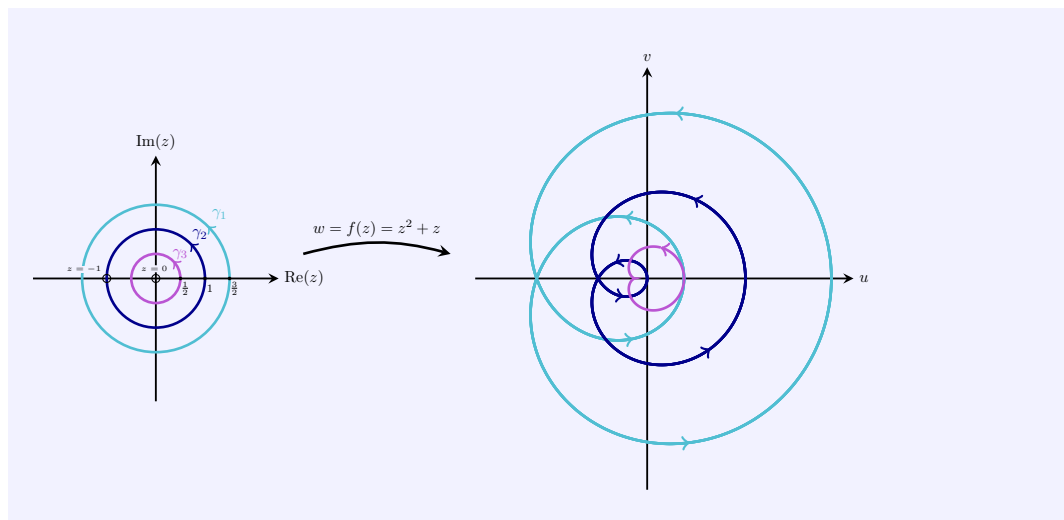


Figure 14: Illustration of the argument principle for $f(z) = z^2 + z$. The images of the circles $\gamma_1, \gamma_2, \gamma_3$ under f show how many times each curve winds around the origin, corresponding to the number of zeros of f inside each circle.

5.6.3 Rouches theorem

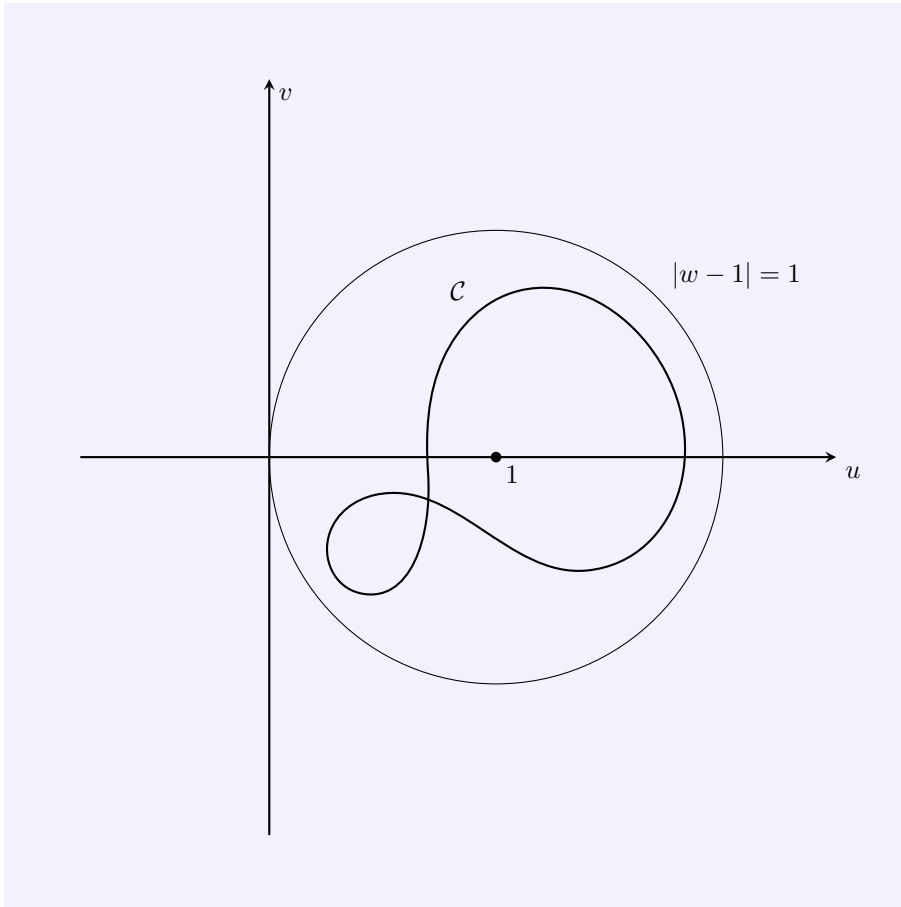


Figure 15: