

$$\mathbb{R} \rightsquigarrow \mathbb{C} \Rightarrow i = \sqrt{-1} \quad \boxed{x^2 = a}$$

x

$$\boxed{x + iy}$$

$$\mathbb{C} \rightsquigarrow \mathbb{H} \Rightarrow j, j^2 = -1$$

$$\Rightarrow \boxed{ji = -ij}$$

$$z + jw = (x + iy) + j(x' + jy')$$

$$\stackrel{\text{H}}{=} x + iy + jx' + (ji)y'$$

22

$$x^2 + x = f(x)$$

$$f(0) = 0 + 0 = 0$$

$$f(1) = 1 + 1 = 0$$

$f(x) \neq 0 \rightarrow$ false!

$$a \in \mathbb{K}$$

$$e \cdot ? = a$$

$$e \cdot (e^{-1} \cdot a) = a$$

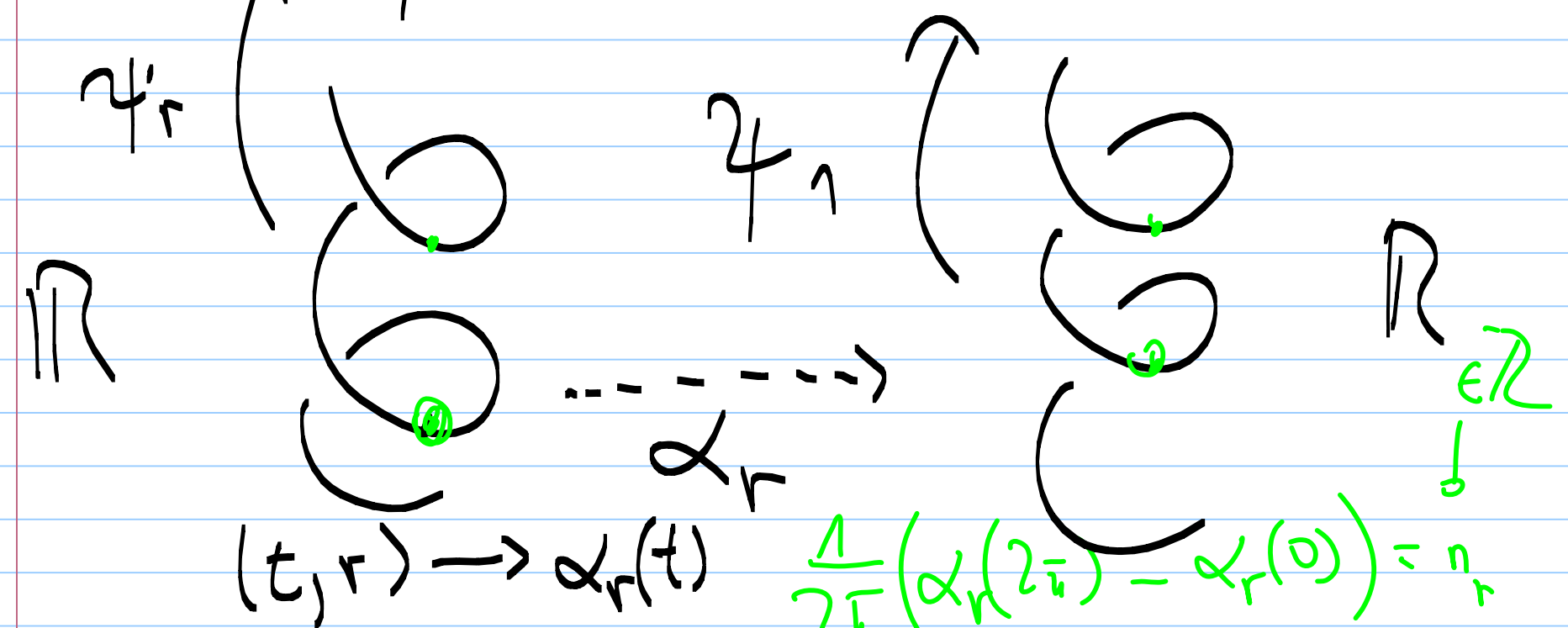
$$0 \neq f \in \mathbb{C}[z], \quad \underline{f(z) \neq 0 \quad \forall z \in \mathbb{C}}$$

$$\varphi: \mathbb{C} \rightarrow \mathbb{C}, \quad \varphi(z) = \frac{f(z)}{|f(z)|}$$

$$\varphi: \mathbb{C} \rightarrow K_1 = \{e^{it}, t \in \mathbb{R}\}$$

$$\varphi_r: \mathbb{R} \rightarrow K_r = \{r e^{it}, t \in \mathbb{R}\}, \quad \varphi_r^{\text{def}} = r \cdot e^{it}$$

$$K_r: \varphi \circ \varphi_r: \mathbb{R} \rightarrow K_1$$



$$(t, r) \rightarrow \alpha_r(t)$$

$$\frac{1}{2\pi} (\alpha_r(2\pi) - \alpha_r(0)) = n_r \in \mathbb{R}$$

$$f(z) = a_0 + a_1 z + \dots + a_d z^d \quad a_1 \neq 0$$

1) No nulli $|z| < \delta$ & some $|z| > R$ such

2) No nulli $|z| < \delta$ & some $|z| > R$

$$\begin{array}{l} 1) \Rightarrow \\ 2) \Rightarrow \end{array} \boxed{\begin{array}{l} n_r = 0 \\ n_r = d \end{array}}$$