AR(1)

$$y_t = \mu + \phi_1 y_{t-1} + u_t$$
$$= \mu + \phi_1 L y_t + u_t$$

$$1 \cdot y_t - \underline{\phi_1 L} y_t = \mu + u_t$$
$$\underbrace{(1 - \phi_1 L)}_{\phi(L)} y_t = \mu + u_t$$
$$1 - \phi_1 \cdot z = 0$$
$$z = \frac{1}{\phi_1}$$

AR(2)

$\pi = 3.14\ldots$ $\quad i = \sqrt{-1}$

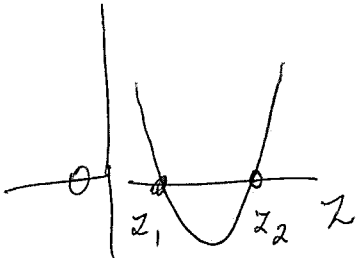
$$y_t = \mu + \phi_1 y_{t-1} + \phi_2 y_{t-2} + u_t$$
$$= \mu + \phi_1 L y_t + \phi_2 L^2 y_t + u_t$$

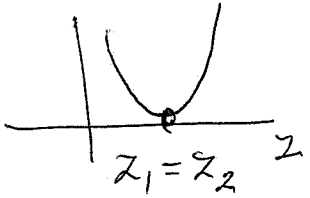
$$1 \cdot y_t - \underline{\phi_1 L} y_t - \underline{\phi_2 L^2} y_t = \mu + u_t$$
$$\underbrace{(1 - \phi_1 L - \phi_2 L^2)}_{\phi(L)} y_t = \mu + u_t$$
$$1 - \phi_1 z - \phi_2 z^2 = 0$$

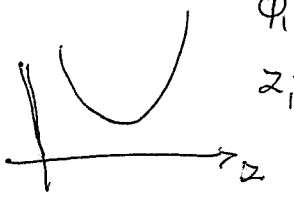
$y_t = y_{t-1} + u_t$

$\phi_1 = 1$

$z_1 = \frac{1}{\phi_1} = 1$ unit root







$$ax^2 + bx + c = 0$$
$$D = b^2 - 4ac$$
$$x_{1,2} = \frac{-b \pm \sqrt{D}}{2a}$$

$D < 0$ $\quad D = (-D) \cdot (-1)$

$D = -5$ $\quad D = 5 \cdot (-1)$

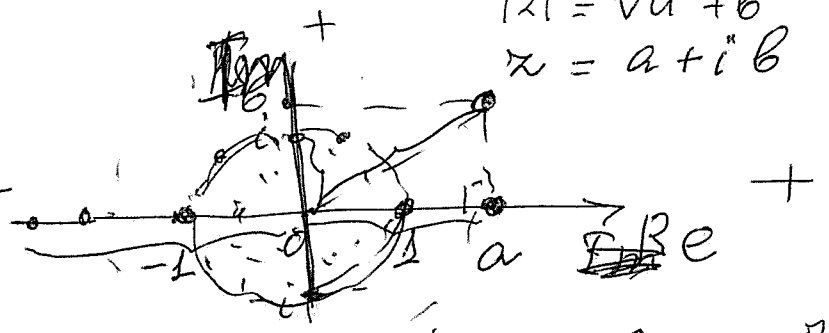
$$\sqrt{D} = \sqrt{5} \cdot \sqrt{-1}$$
$$= \sqrt{5} \cdot i$$

Σ $D < 0$ $\quad x_{1,2} = \dfrac{-b \pm \sqrt{-D} \cdot i}{2a}$

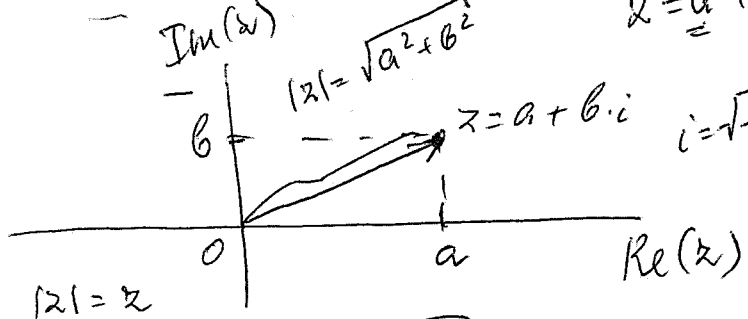
$i = \sqrt{-1}$

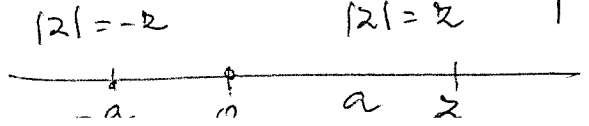
$|z| = \sqrt{a^2 + b^2}$

$z = a + i \cdot b$



$z = a + b \cdot i$





$\sqrt{(-a)^2} = a$