EDOL(2) cc H

$$\frac{d^2y}{dx^2} + a_1\frac{dy}{dx} + a_2 y = 0 \qquad \boxed{y = 0 \text{ trivial}}$$

$$y_p = e^{mx} \Rightarrow m^2 + a_1 m + a_2 = 0$$ Ecuación Característica

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CASO I.

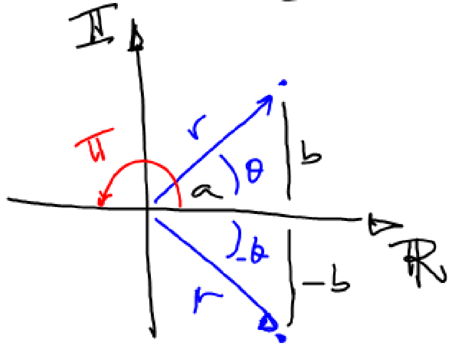
2 raíces $\begin{cases} m_1 \\ m_2 \end{cases}$ $m_1 \neq m_2 \in \mathbb{R}$ $\boxed{y_g = C_1 e^{m_1 x} + C_2 e^{m_2 x}}$

CASO II —— $m_1 = m_2 \in \mathbb{R}$

CASO III —— $m_1 \neq m_2 \,\mathbb{C}$ $\quad y_g = C_1 e^{(a+bi)x} + C_2 e^{(a-bi)x}$

$$\forall x \in \mathbb{R} \Rightarrow y \in \mathbb{R}$$

Euler $\quad e^{\pi i} + 1 = 0$



$$m_1 = a + bi \qquad i = \sqrt{-1}$$

$$m_2 = a - bi$$

$$re^{\theta i} = r\cos(\theta) + r\,\mathrm{sen}(\theta)\,i$$

$$re^{-\theta i} = r\cos(\theta) - r\,\mathrm{sen}(\theta)\,i$$

$$e^{\theta i} = \cos(\theta) + \mathrm{sen}(\theta)\,i$$

$$e^{-\theta i} = \cos(\theta) - \mathrm{sen}(\theta)\,i \quad \rightarrow \theta = \pi\,[rad]$$

$$e^{\pi i} = \cos(\pi) + \mathrm{sen}(\pi)\,i \qquad \cos(\pi) = -1$$

$$\mathrm{sen}(\pi) = 0$$

$$e^{\pi i} = -1 \quad \Rightarrow \boxed{e^{\pi i} + 1 = 0}$$

$$m^2 + a_1 m + a_2 = 0$$

$$m_1 \neq m_2 \in \mathbb{C} \qquad m_1 = a + bi \qquad a \in \mathbb{R}$$

$$m_2 = a - bi \qquad b \in \mathbb{R}^+$$

$$y_g = c_1 e^{(a+bi)x} + c_2 e^{(a-bi)x}$$

$$y_g = c_1 e^{ax} e^{bxi} + c_2 e^{ax} e^{-bxi}$$

$$y_g = e^{ax}\left(c_1 e^{bxi} + c_2 e^{-bxi}\right)$$

$$y_g = e^{ax}\left(c_1\left[\cos(bx) + \operatorname{sen}(bx)\, i\right] + c_2\left[\cos(bx) - \operatorname{sen}(bx)\, i\right]\right)$$

$$y_g = e^{ax}\left(\underbrace{[c_1 + c_2]}_{c_{10}}\cos(bx) + \underbrace{[c_1 i - c_2 i]}_{c_{20}}\operatorname{sen}(bx)\right)$$

$$y_g = c_{10} e^{ax}\cos(bx) + c_{20} e^{ax}\operatorname{sen}(bx) \qquad \forall x \in \mathbb{R}$$

$$y \in \mathbb{R}$$

$$m_1 = a + bi$$

$$m_2 = a - bi \qquad m_1 \neq m_2 \in \mathbb{C} \qquad \forall c_i \in \mathbb{R}$$

$$\frac{d^2y}{dx^2} + a_1\frac{dy}{dx} + a_2 y = 0 \qquad \text{EDO(2)LCC H.}$$

$$m^2 + a_1 m + a_2 = 0 \qquad \text{E.C.}$$

$$\left.\begin{matrix} m_1 \\ m_2 \end{matrix}\right\} \quad m_1 = m_2 \qquad y_g = c_1 e^{m_1 x} + c_2 \left(x e^{m x}\right)$$

$$(m - m_1)^2 = 0$$

$$\frac{d}{dm}$$

$$2(m - m_1) = 0$$

$$2m + a_1 = 0$$

$$m_1 \neq m_2$$

$$(m - m_1)(m - m_2) = 0$$

$$(m - m_2) + (m - m_1) = 0$$

$$m_1 = m_2$$

$$e^{mx} \xrightarrow{m=m_1} e^{m_1 x}$$

$$\frac{d}{dm}$$

$$xe^{mx} \xrightarrow{m=m_1} xe^{m_1 x}$$

$$\frac{d^2y}{dx^2} + a_1\frac{dy}{dx} + a_2 y = 0$$

$$\frac{d^2y}{dx^2} \Rightarrow m_1^2 x e^{m_1 x} + 2m_1 e^{m_1 x}$$

$$+$$

$$a_1\frac{dy}{dx} \Rightarrow a_1 m_1 x e^{m_1 x} + a_1 e^{m_1 x}$$

$$+$$

$$a_2 y \Rightarrow a_2 x e^{m_1 x}$$

$$=$$

$$0 = \left(\cancelto{0}{m_1^2 + a_1 m_1 + a_2}\right) x e^{m_1 x} + \left(\cancelto{0}{2m_1 + a_1}\right) e^{m_1 x}$$

$$y_p = xe^{m_1 x}$$

$$\frac{dy}{dx} = m_1 x e^{m_1 x} + e^{m_1 x}$$

$$\frac{d^2y}{dx^2} = m_1\left(m_1 x e^{m_1 x} + e^{m_1 x}\right) + m_1 e^{m_1 x}$$

$$\frac{d^2y}{dx^2} = m_1^2 x e^{m_1 x} + 2m_1 e^{m_1 x}$$

$$W = \begin{bmatrix} e^{m_1 x} & xe^{m_1 x} \\ m_1 e^{m_1 x} & m_1 x e^{m_1 x} + e^{m_1 x} \end{bmatrix}$$

$$|W| \neq 0.$$

$$\frac{d^2y}{dx^2} + a_1 \frac{dy}{dx} + a_2 y = 0$$

CASO II

$$m^2 + a_1 m + a_2 = 0 \qquad \left.\begin{matrix} m_1 \\ m_2 \end{matrix}\right\} \quad m_1 = m_2$$

$$y_g = C_1 e^{m_1 x} + C_2 x e^{m_1 x}$$

$$\frac{d^2y}{dx^2} = 0 \quad \text{EDO}(2)\text{LCCH}$$

$$\frac{d}{dx}\left(\frac{dy}{dx}\right) = 0 \qquad \frac{dy}{dx} = C_1 \qquad dy = C_1 dx$$

$$m^2 = 0 \qquad \begin{matrix} m_1 = 0 \\ m_2 = 0 \end{matrix} \quad \text{II} \qquad \int dy = C_1 \int dx$$

$$y_g = C_1 e^{m_1 x} + C_2 x e^{m_1 x} \qquad y + k_1 = C_1 (x + k_2)$$

$$y = C_1 x + (C_1 k_2 - k_1)$$

$$\boxed{y_g = C_1 + C_2 x} \qquad \boxed{y = C_1 x + C_2}$$