40 AC. en Roma

último día del año (28 febrero) + 1 cada 4 años

$365 \frac{1}{4}$ 365.248 ....

1587 DC. en Roma. Gregorio.

todos los años que se dividan en 4
serán bisiestos menos

los años que se dividan entre 400

CASO II.- raíces de la ecuación característica reales e iguales.

$$\frac{d^2y}{dx^2} + a_1 \frac{dy}{dx} + a_2 y = 0 \quad \text{EDO(2)LccH}$$

$$m^2 + a_1 m + a_2 = 0 \Rightarrow (m - m_1)^2 = 0$$

$$y_1^{(P)} = e^{m_1 x} \qquad y_2^{(P)} = e^{m_2 x} \qquad m_1 = m_2 \in \mathbb{R}$$

$$y^{(g)} = c_1 e^{m_1 x} + \cancel{c_2 e^{m_2 x}}$$

$$y = c_1 e^{m_1 x} + \cancel{c_2 e^{m_2 x}} \qquad m_1 = m_2$$

$$W = \begin{vmatrix} e^{m_1 x} & e^{m_2 x} \\ m_1 e^{m_1 x} & m_2 e^{m_2 x} \end{vmatrix} \neq 0$$

$$m_2 e^{m_2 x} e^{m_1 x} - m_1 e^{m_1 x} e^{m_2 x} \neq 0 \qquad e^{m_1 x} \neq 0 \quad e^{m_2 x} \neq 0$$

$$(m_2 - m_1) e^{m_1 x} e^{m_2 x} \neq 0 \qquad m_2 - m_1 \neq 0 \qquad m_2 \neq m_1$$

$$m_1^2 + a_1 m_1 + a_2 \equiv 0$$

$$m^2 + a_1 m + a_2 = 0 \iff (m - m_1)^2 = 0$$

sólo cuando $m_1 = m_2$

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

$$2m + a_1 = 0 \qquad\qquad 2(m - m_1) = 0$$

sust. $m = m_1$

$$\boxed{2m_1 + a_1 \equiv 0} \qquad\qquad 2(m_1 - m_1) \equiv 0$$

$$(m - m_1)\cdot(m - m_2) = 0 \qquad m_1 \neq m_2$$

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

raiz

$$\frac{d}{dm}\left\{\begin{array}{l} e^{mx} \xrightarrow{m=m_1} e^{m_1 x} \\ xe^{mx} \xrightarrow{m=m_1} xe^{m_1 x} \end{array}\right.$$

$$y_{\text{II}}^{(g)} = C_1 e^{m_1 x} + C_2 x e^{m_1 x}$$

$$\frac{d^2y}{dx^2} + a_1\frac{dy}{dx} + a_2 y = 0 \qquad y_P = xe^{m_1 x}$$

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

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

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

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

$$(0)\, x e^{m_1 x} + (0)\, e^{m_1 x} = 0 \Rightarrow \underline{0 \equiv 0}$$

$$\boxed{\frac{d^2y}{dt^2} = 0}$$ EDO(2)L cc H.

$$\frac{d}{dt}\left(\frac{dy}{dt}\right) = 0 \qquad \frac{dy}{dt} = C_2 \qquad dy = C_2\,dt$$

$$\int dy = C_2 \int dt \qquad y + k_1 = C_2(t + k_2)$$

$$y = C_2 t + (C_2 k_2 - k_1) \qquad \boxed{y = C_2 t + C_1}$$

$$\frac{d^2y}{dt^2} = 0 \qquad m^2 = 0 \qquad m_1 = m_2 \Rightarrow 0.$$

CASO II

$$y^{g} = c_1 e^{m_1 t} + c_2 t e^{m_1 t}$$

$$\boxed{y^{g} = c_1 + c_2 t}$$

EDO(2)LccH

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

$$\boxed{m^2 + a_1 m + a_2 = 0}$$

$$\downarrow$$

$$m_1 \quad m_2$$

I.) $m_1 \neq m_2 \in \mathbb{R}$

$$y_g = C_1 e^{m_1 t} + C_2 e^{m_2 t}$$

II) $m_1 = m_2 \in \mathbb{R}$

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

III) $m_1, m_2 \in \mathbb{C}$ $\quad m_{1,2} = a \pm bi$ $\quad a \in \mathbb{R}$, $b \in \mathbb{R}^+$

$$y_g = C_1 e^{at}\cos(bt) + C_2 e^{at}\operatorname{sen}(bt)$$

III)bis $m_{1,2} = \pm bi$

$$y_g = C_1 \cos(bt) + C_2 \operatorname{sen}(bt)$$

$$y_g = \overbrace{C_1 e^{2x}}^{\mathrm{I}} + \overbrace{C_2 e^{x} + C_3 x e^{x}}^{\mathrm{II}} + \overbrace{C_4 e^{x}\cos(x) + C_5 e^{x}\operatorname{sen}(x)}^{\mathrm{III}}$$

$$(m-2)(m-1)^2(m-(1-i))(m-(1+i)) = 0$$

$$(m-2)(m^2-2m+1)((m-1)^2-i^2) = 0$$

$$(m^3-4m^2+5m-2)(m^2-2m+2) = 0$$

$$m^5-6m^4+15m^3-18m^2+14m-4 = 0$$

$$\frac{d^5y}{dx^5} - 6\frac{d^4y}{dx^4} + 15\frac{d^3y}{dx^3} - 20\frac{d^2y}{dx^2} + 14\frac{dy}{dx} - 4y = 0$$

$$y = C_1 \cos(2x) + C_2 \operatorname{sen}(2x) + C_3 x \cos(2x) + C_4 x \operatorname{sen}(2x)$$

$$(m-2i)^2 (m+2i)^2 = 0$$

$$(m^2 - 4mi - 4)(m^2 + 4mi - 4) = 0$$

$$((m^2-4) - 4mi)((m^2-4) + 4mi) = 0$$

$$(m^2-4)^2 - (4mi)^2 = 0 \qquad \frac{d^4y}{dx^4} + 8\frac{d^2y}{dx^2} + 16y = 0$$

$$m^4 - 8m^2 + 16 + 16m^2 = 0$$

$$m^4 + 8m^2 + 16 = 0$$