MÉTODO DE COEFICIENTES INDETERMINADOS.

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

$$y'' + a_1 y' + a_2 y = 0$$ ALGEBRA.

$$\ddot{y} + a_1 \dot{y} + a_2 y = 0$$ F. Newton

ODEL

$$\boxed{D^2 y + a_1 D y + a_2 y = 0}$$ F. Operador Diferencial

$$D^2y + a_1 Dy + a_2 y = 0$$

$$(D^2 + a_1 D + a_2) y = 0$$

$$(D - m_1)(D - m_2) y = 0 \qquad m_1 \neq m_2 \in \mathbb{R}$$

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

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

$$D^2y + 5Dy + 6y = 0$$

$$(D^2 + 5D + 6)y = 0$$

$$(D+2)(D+3)y = 0$$

$$y_g = c_1e^{-2x} + c_2e^{-3x}$$

$$(D+2)(D+3)\left[c_1e^{-2x} + c_2e^{-3x}\right] = 0$$

$$(D+2)\left[-2c_1e^{-2x} - \cancel{3c_2e^{-3x}} + 3c_1e^{-2x} + \cancel{3c_2e^{-3x}}\right] = 0$$

$$(D+2)\left[c_1e^{-2x}\right] = 0$$

$$\cancel{-2c_1e^{-2x}} + \cancel{2c_1e^{-2x}} = 0$$

$$0 = 0$$

$$y = C$$

$$Dy = 0 \qquad D^{-1}[0] = C$$

$$D^{-1}(Dy) = y$$

$Q(x)$

$P(D)$	$f(x)$
$(D-m)$	e^{mx}
D	1
D^2	x
D^{n+1}	x^n
$(D-m)^2$	xe^{mx}
$(D-m)^{n+1}$	$x^n e^{mx}$
(D^2+b^2)	$\cos(bx)$, $\operatorname{sen}(bx$
$((D-a)^2+b^2)$	$e^{ax}\cos(bx)$, $e^{ax}\operatorname{sen}(bx)$
$((D-a)^2+b^2)^2$	$xe^{ax}\cos(bx)$, $xe^{ax}\operatorname{sen}(bx)$
$((D-a)^2+b^2)^{n+1}$	$x^n e^{ax}\operatorname{sen}(bx)$, $x^n e^{ax}\cos(bx)$

OPERADORES ANIQUILADORES

$m = \pm bi$

$$(D^2-2D+1)y=4xe^x$$

$$(D-1)^2y=4xe^x$$

$$y=c_1e^x+c_2xe^x$$

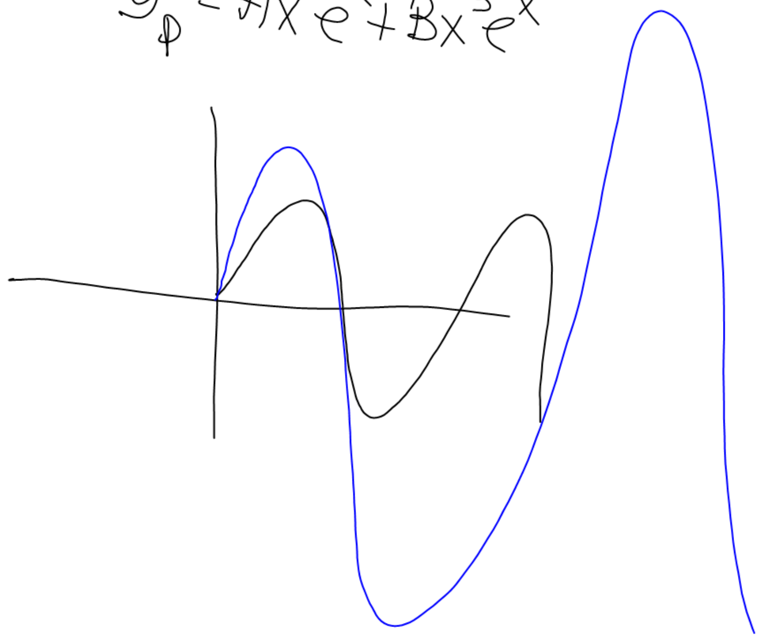
$$(D-1)^2\underbrace{(D-1)^2}_{A}y=0$$

EDOL(4)CCH $\rightarrow$ $(D-1)^4y=0$

$$y_H=c_1e^x+\underline{c_2xe^x+c_3x^2e^x}+c_4x^3e^x$$

$$y_{g/NH}=c_1e^x+c_2xe^x+Ax^2e^x+Bx^3e^x$$

$$y_p=Ax^2e^x+Bx^3e^x$$



$$(D^2 - 2D + 1)y = 4xe^x$$

$$y_p = Ax^2e^x + Bx^3e^x$$

$$y' = A(x^2e^x + 2xe^x) + B(x^3e^x + 3x^2e^x)$$

$$y' = 2Axe^x + (A+3B)x^2e^x + Bx^3e^x$$

$$y'' = 2A(xe^x + e^x) + (A+3B)(x^2e^x + 2xe^x) + B(x^3e^x + 3x^2e^x)$$

$$y'' = 2Ae^x + (4A+6B)xe^x + (A+6B)x^2e^x + Bx^3e^x$$

$$\left[2Ae^x + (4A+6B)xe^x + (A+6B)x^2e^x + Bx^3e^x\right] -$$

$$-2\left[2Axe^x + (A+3B)x^2e^x + Bx^3e^x\right] +$$

$$+\left[Ax^2e^x + Bx^3e^x\right] = 4xe^x$$

$$\left[\ 4\ \right]x^2e^x + \cancel{\left[0(B)\right]x^3e^x} + \left[6B\right]xe^x + \left[2Ae^x\right]$$

$$\boxed{B = \frac{2}{3}} \qquad A = 0$$

$$y_g = c_1e^x + c_2xe^x + \frac{2}{3}x^3e^x$$

EDOL (2) cc NH.

$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 8y = 5e^{3x} + 2x$$

$$(D^2 - 6D + 8)y = 5e^{3x} + 2x$$

$$(D-2)(D-4)y = 5e^{3x} + 2x$$

$$y_H = c_1e^{2x} + c_2e^{4x}$$

$$(D-2)(D-4)(D-3)_A y = 2x$$

$$(D-2)(D-4)(D-3)_A D^2_A y = 0$$

EDOL (5) cc H

$$y = c_1e^{2x} + c_2e^{4x} + c_3e^{3x} + c_4x + c_5$$

$$y_{g/NH} = \underbrace{c_1e^{2x} + c_2e^{4x}}_{y_{g/H}} + \underbrace{Ae^{3x} + Bx + D}_{y_{p/Q}}$$

$$(D^2-6D+8)y = 5e^{3x}+2x$$

$$y_p = Ae^{3x}+Bx+D \quad \text{— coef. indeter.}$$

$$y' = 3Ae^{3x}+B+(0)$$

$$y'' = 9Ae^{3x}+(0)$$

$$\left[9Ae^{3x}\right]-6\left[3Ae^{3x}+B\right]+8\left[Ae^{3x}+Bx+D\right] = 5e^{3x}+2x$$

$$\left[-A\right]e^{3x}+\left[8B\right]x+\left[-6B+8D\right] = 5e^{3x}+2x$$

$$-A=5 \qquad A=-5$$

$$8B=2 \qquad B=\frac{1}{4}$$

$$-6B+8D=0$$

$$8D=+6B$$

$$8D=\frac{3}{2} \qquad D=\frac{3}{16}$$

$$\boxed{y_{g/NH} = C_1e^{2x}+C_2e^{4x}-5e^{3x}+\frac{x}{4}+\frac{3}{16}}$$

$$M + N\frac{dy}{dx} = 0$$

$$\frac{\partial M}{\partial y} \neq \frac{\partial N}{\partial x} \quad \text{tiene FI.}$$

$$\mu M + \mu N \frac{dy}{dx} = 0$$

$$\frac{\partial \mu}{\partial y} M + \mu \frac{\partial M}{\partial y} = \frac{\partial \mu}{\partial x} N + \mu \frac{\partial N}{\partial x}$$

$\mu(x)$

$$\mu \frac{\partial M}{\partial y} = \frac{d\mu}{dx} N + \mu \frac{\partial N}{\partial x}$$

$$\int \frac{d\mu}{\mu} = \int \frac{\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)}{N} dx$$

$$\ln \mu = \int \left(F(x) \right) dx$$

$$\mu = e^{\int \left(\, \right) dx}$$