

Clasificación de las Ecuaciones

$$ED \left\{ \begin{array}{ll} \text{EDO ordinarias.} & y(x) \quad \frac{dy}{dx} \\ \text{ED en D Parciales} & z(x, y) \quad \frac{\partial z}{\partial x} \end{array} \right.$$

orden de una Ecuación Diferencial

El orden de ED estará dado por la derivada de mayor orden

$$\frac{d^4 y}{dx^4} - 4 \frac{d^2 y}{dx^2} + 4y = 0 \quad \text{orden} = 4$$

Solución general $y = C_1 y_1 + C_2 y_2 + C_3 y_3 + C_4 y_4$

$$\frac{\partial^2 z}{\partial x^2} - 6 \frac{\partial^3 z}{\partial x \partial y^2} = 0 \quad z(x, y)$$

orden = 3.

$$\boxed{\text{EDO}} \begin{cases} \text{Lineales} \\ \text{No-Lineales} \end{cases}$$

$$F\left(x, y, \frac{dy}{dx}, \dots, \frac{d^2 y}{dx^2}\right) = 0$$

pasos 1 $\rightarrow G\left(x, y, \frac{dy}{dx}, \dots\right) = Q(x)$

$$\frac{d^2 y}{dx^2} - x^2 \frac{dy}{dx} + h(x)y - e^{3x} + 4 = 0$$

$$\frac{d^2 y}{dx^2} - x^2 \frac{dy}{dx} + h(x)y = e^{3x} - 4$$

pasos 2

$G\left(x, y, \frac{dy}{dx}, \dots\right)$ es lineal en y
entonces $F(\quad) = 0$ es lineal

sustituyo

$$y \Rightarrow \lambda y \quad \lambda \in \mathbb{R}$$

$$G\left(x, \lambda y, \frac{d}{dx}(\lambda y), \frac{d^2}{dx^2}(\lambda y), \dots\right) = \lambda^n G\left(x, y, \frac{dy}{dx}, \dots\right)$$

$n \in \mathbb{N}$

EDO

$$a_0(x) \frac{d^2 y}{dx^2} + a_1(x) \frac{dy}{dx} + \dots + a_{n-1}(x) \frac{dy}{dx} + a_n(x) y = Q(x)$$

$$\frac{d^2 y}{dx^2} - x^2 \frac{dy}{dx} + L(x) y = e^{3x} - 4 \quad (L)$$

$$a_0(x) = 1 \quad a_1(x) = -x^2 \quad a_2(x) = L(x)$$

$$Q(x) = e^{3x} - 4$$

$$\frac{d^2 \theta}{dt^2} + \omega \sin(\theta) = 0 \quad \theta(t) \quad (NL)$$

$$\frac{d^2 y}{dx^2} + 5 \left(\frac{dy}{dx} \right) y = 0 \quad NL$$

$$\frac{dy}{dx} + y^3 = 0 \quad NL$$

$$\frac{dy}{dx} + 3y = \frac{1}{y} \quad NL$$

$$\left(\frac{dy}{dx} \right)^2 + e^y = 0$$

$$\frac{dy}{dx} + 3y - \frac{1}{y} = 0$$

$$\frac{d^2 y}{dx^2} + 9y = 0 \quad (L)$$

$$a_0(x) = 1 \quad a_1(x) = 0 \quad a_2(x) = 9 \quad Q(x) = 0$$

(L)

$$\frac{d^2 y}{dt^2} = -g \quad a_0(x) = 1 \quad a_1(x) = 0 \quad a_2(x) = 0$$

$$Q(x) = -g$$

Cap 1. \div $\text{EDo}(1) \text{ NL}$

Cap. 2 }
 Cap. 3 } = $\text{EDo}(n) \text{ L.}$
 Cap. 4 }

Cap. 5 } = EDenDP.

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

$$\frac{dy}{dx} = 2C_1 \cos(2x) - 2C_2 \operatorname{sen}(2x)$$

$$\frac{d^2y}{dx^2} = -4C_1 \operatorname{sen}(2x) - 4C_2 \cos(2x)$$

$$\frac{d^2y}{dx^2} = -4(C_1 \operatorname{sen}(2x) + C_2 \cos(2x))$$

$$\frac{d^2y}{dx^2} = -4y \Rightarrow \boxed{\frac{d^2y}{dx^2} + 4y = 0}$$

$$+ 2 C_1 \cos(2x) - 2 C_2 \sin(2x) = \frac{dy}{dx}$$

$$- 4 C_1 \sin(2x) - 4 C_2 \cos(2x) = \frac{d^2 y}{dx^2}$$

$$\begin{bmatrix} 2 \cos(2x) & -2 \sin(2x) \\ -4 \sin(2x) & -4 \cos(2x) \end{bmatrix} \begin{bmatrix} C_1 \\ C_2 \end{bmatrix} = \begin{bmatrix} \frac{dy}{dx} \\ \frac{d^2 y}{dx^2} \end{bmatrix}$$

$$C_1 = \frac{\begin{vmatrix} \frac{dy}{dx} & -2 \sin(2x) \\ \frac{d^2 y}{dx^2} & -4 \cos(2x) \end{vmatrix}}{\begin{vmatrix} 2 \cos(2x) & -2 \sin(2x) \\ -4 \sin(2x) & -4 \cos(2x) \end{vmatrix}}} = \frac{-4 \cos(2x) \frac{dy}{dx} + 2 \sin(2x) \frac{d^2 y}{dx^2}}{-8 \cos^2(2x) - 8 \sin^2(2x)}$$

$$C_1 = \frac{2}{-8} \left(\frac{-2 \cos(2x) \frac{dy}{dx} + \sin(2x) \frac{d^2 y}{dx^2}}{\cos^2(2x) + \sin^2(2x)} \right)$$

$$C_1 = -\frac{1}{4} \left(-2 \cos(2x) \frac{dy}{dx} + \sin(2x) \frac{d^2 y}{dx^2} \right)$$

$$C_1 = \frac{1}{2} \cos(2x) \frac{dy}{dx} - \frac{1}{4} \sin(2x) \frac{d^2 y}{dx^2}$$

$$C_2 = \frac{\begin{vmatrix} 2\cos(2x) & \frac{dy}{dx} \\ -4\sin(2x) & \frac{d^2y}{dx^2} \end{vmatrix}}{-8} \Rightarrow \frac{2\cos(2x)\frac{d^2y}{dx^2} + 4\sin(2x)\frac{dy}{dx}}{-8}$$

$$C_2 = -\frac{1}{4}\cos(2x)\frac{d^2y}{dx^2} - \frac{1}{2}\sin(2x)\frac{dy}{dx}$$

$$y = \left(\frac{1}{2}\cos(2x)\frac{dy}{dx} - \frac{1}{4}\sin(2x)\frac{d^2y}{dx^2} \right) \sin(2x) + \\ + \left(-\frac{1}{4}\cos(2x)\frac{d^2y}{dx^2} - \frac{1}{2}\sin(2x)\frac{dy}{dx} \right) \cos(2x)$$

$$y = \cancel{\frac{1}{2}\cos(2x)\sin(2x)\frac{dy}{dx}} - \frac{1}{4}\sin^2(2x)\frac{d^2y}{dx^2} + \\ + -\frac{1}{4}\cos^2(2x)\frac{d^2y}{dx^2} - \cancel{\frac{1}{2}\cos(2x)\sin(2x)\frac{dy}{dx}}$$

$$y = -\frac{1}{4}(\cos^2(2x) + \sin^2(2x))\frac{d^2y}{dx^2}$$

$$y = -\frac{1}{4}\frac{d^2y}{dx^2} \Rightarrow -4y = \frac{d^2y}{dx^2} \Rightarrow \boxed{\frac{d^2y}{dx^2} + 4y = 0}$$