MÉTODO DEL FACTOR INTEGRANTE.

ECUACIONES, NO-LINEALES, NO-EXACTAS

$$x^2y^2 + x^3y + x^4y^5 = C_1 \quad SG$$

$$\frac{\partial F}{\partial x} + \frac{\partial F}{\partial y}\cdot\frac{dy}{dx} = 0$$

$$2xy^2 + 3x^2y + 4x^3y^5 + \left(2x^2y + x^3 + 5x^4y^4\right)\frac{dy}{dx} = 0$$

$$\underbrace{2xy^2 + 3x^2y + 4x^3y^5}_{M(x,y)} + \Big(\underbrace{2x^2y + x^3 + 5x^4y^4}_{N(x,y)}\Big)\frac{dy}{dx} = 0$$

EXACTA.

$$\frac{\partial M}{\partial y} = 4xy + 3x^2 + 20x^3y^4$$

$$\frac{\partial N}{\partial x} = 4xy + 3x^2 + 20x^3y^4$$

$$x\left(2y^2 + 3xy + 4x^2y^5\right) + x\left(2xy + x^2 + 5x^3y^4\right)\frac{dy}{dx} = 0$$

$$\left(2y^2 + 3xy + 4x^2y^5\right) + \left(2xy + x^2 + 5x^3y^4\right)\frac{dy}{dx} = 0$$

$$\left(2y^2+3xy+4x^2y^5\right)+\left(2xy+x^2+5x^3y^4\right)\frac{dy}{dx}=0$$

$MM(x,y)$ $NN(x,y)$

NO-EXACTA

$$\frac{\partial MM}{\partial y}=4y+3x+20x^2y^4$$

$$\frac{\partial NN}{\partial x}=2y+2x+15x^2y^4$$

EDO(1)NL.NE.

$$M(x,y) + N(x,y)\frac{dy}{dx} = 0$$

$\mu(x,y)$ es una función conocida como Factor Integrante cuando

$$\mu(x,y)M(x,y) + \mu(x,y)N(x,y)\frac{dy}{dx} = 0$$

EXACTA.

$$\mu M + \mu N \frac{dy}{dx} = 0 \quad \text{EXACTA.}$$

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

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

$$\mu(x,y)$$

$\underline{\text{ED en DP } (L)}$

Hipótesis$_1$ $\mu \Rightarrow \mu(x)$ Hipótesis$_2 \Rightarrow \mu \Rightarrow \mu(y)$

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

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

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

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

$f(x)$

$$\left(2y^2+3xy+4x^2y^5\right)+\left(2xy+x^2+5x^3y^4\right)\frac{dy}{dx}=0$$

$$M \qquad\qquad N$$

$$\frac{\partial M}{\partial y}=4y+3x+20x^2y^4 \qquad \frac{\partial N}{\partial x}=2y+2x+15x^2y^4$$

$$f(x) \rightarrow \left(\frac{\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}}{N}\right)=\frac{\left(4y+3x+20x^2y^4\right)-\left(2y+2x+15x^2y^4\right)}{2xy+x^2+5x^3y^4}$$

$$=\frac{2y+x+5x^2y^4}{x\left(2y+x+5x^2y^4\right)}$$

$$f(x)=\frac{1}{x}$$

$$\frac{d\mu}{\mu} = \left(\frac{1}{x}\right) dx$$

$$\int \frac{d\mu}{\mu} = \int \frac{dx}{x}$$

$$\ln \mu = \ln x$$

$$\boxed{\mu(x) = x}$$

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

$$\mu \Rightarrow \mu(y)$$

$$\frac{d\mu}{dy} M + \mu(y) \frac{\partial M}{\partial y} = \mu(y) \frac{\partial N}{\partial x}$$

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

$$\frac{d\mu}{\mu} = \underbrace{\left(\frac{\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}}{M} \right)}_{g(y)} dy$$

$$\frac{dy}{dx} + p(x)y = 0$$

$$\frac{dy}{y} + p(x)\,dx = 0$$

$$y = c_1 e^{-\int p(x)\,dx}$$

$$\underbrace{p(x)y}_{M(x,y)} + \frac{dy}{dx} = 0 \qquad N(x,y) = 1$$

$$\frac{\partial M}{\partial y} = p(x) \qquad \frac{\partial N}{\partial x} = 0$$

$$f(x) \rightarrow \mu(x) \qquad \frac{d\mu}{\mu} = \left(\frac{p(x) - (0)}{1}\right) dx$$

$$\frac{d\mu}{\mu} = p(x)\, dx$$

$$\int \frac{d\mu}{\mu} = \int p(x)\, dx$$

$$L\mu = \int p(x)\, dx$$

$$\mu = e^{\int p(x)\, dx}$$

$$e^{\int p(x)dx} p(x) y + e^{\int p(x)dx} \frac{dy}{dx} = 0$$

$$MM \qquad NN$$

$$\frac{\partial MM}{\partial y} = e^{\int p(x)dx} p(x) \qquad \frac{\partial NN}{\partial x} = e^{\int p(x)dx} p(x)$$

$$d\left(e^{\int p(x)dx} y\right) = 0$$

$$\int d\left(e^{\int p(x)dx} y\right) = C_1$$

$$e^{\int p(x)dx} y = C_1$$

$$y = C_1 e^{-\int p(x)dx}$$