Métodos de solución para
Ecuaciones Diferenciales Ordinarias
de Primer Orden No lineales
EDO(1)NL

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

Método de Variables Separables

Si se puede

$$P(x)\cdot Q(y) + R(x)\cdot S(y)\frac{dy}{dx} = 0$$

la EDO(1)NL

es de variables separables

$$SG \Rightarrow \frac{P(x)\cancel{Q(y)}}{R(x)\cancel{Q(y)}} + \frac{\cancel{R(x)}\cdot S(y)}{\cancel{R(x)}\cdot Q(y)}\cdot\frac{dy}{dx} = 0$$

$$\frac{P(x)}{R(x)} + \frac{S(y)}{Q(y)}\frac{dy}{dx} = 0$$

$$\frac{P(x)}{R(x)}dx + \frac{S(y)}{Q(y)}dy = 0$$

$$\underline{\underline{SG}} \quad \int\frac{P(x)}{R(x)}dx + \int\frac{S(y)}{Q(y)}dy = C_1$$

EDO(1) NL

$$(y^2+xy^2)\frac{dy}{dx}+x^2-yx^2=0$$

N M

$$x^2(1-y)+(1+x)y^2\frac{dy}{dx}=0$$

$P(x)=x^2$ $R(x)=1+x$

$Q(y)=1-y$ $S(y)=y^2$

$$SG \Rightarrow \int\frac{P(x)}{R(x)}dx+\int\frac{S(y)}{Q(y)}dy=C_1$$

$$\int\frac{x^2}{x+1}dx+\int\frac{y^2}{1-y}dy=C_1$$

$$\begin{array}{r|l} x^2 & x+1 \\ \hline -x^2-x & x-1 \\ \hline 0-x & \\ +x+1 & \\ \hline 0 \quad 1 & \end{array}$$

$$\int\left(x+1+\frac{1}{x+1}\right)dx$$

$$\int x\,dx+\int dx+\int\frac{dx}{x+1}$$

$$\frac{x^2}{2}+x+\ln(x+1)$$

$$\begin{array}{r|l} y^2 & 1-y \\ \hline -y^2+y & -y-1 \\ \hline 0 \quad y & \\ -y+1 & \\ \hline 0 \quad 1 & \end{array}$$

$$\int -y\,dy-\int dy+\int\frac{dy}{1-y}$$

$$-\frac{y^2}{2}-y-\ln(1-y)$$

$$SG \Rightarrow \frac{x^2}{2}+x+\ln(x+1)-\frac{y^2}{2}-y-\ln(1-y)=C_1$$

EDO(1)NL

2- Método de Coeficientes Homogéneos

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

&

$$M(\lambda x, \lambda y) = \lambda^m M(x,y)$$

$$N(\lambda x, \lambda y) = \lambda^n N(x,y)$$

$m = n$

Es de CH.

$$\underbrace{\sqrt{x^2-y^2}+y}_{M(x,y)} \underbrace{-x}_{N(x,y)}\frac{dy}{dx}=0$$

$$M(\lambda x,\lambda y)=\sqrt{\lambda^2x^2-\lambda^2y^2}+(\lambda y)$$
$$=\sqrt{\lambda^2(x^2-y^2)}+\lambda y$$
$$=\sqrt{\lambda^2}\sqrt{x^2-y^2}+\lambda y$$
$$=\lambda\sqrt{x^2-y^2}+\lambda y$$
$$=\lambda\left(\sqrt{x^2-y^2}+y\right) \qquad m=1$$

$$N(\lambda x,\lambda y)=-\lambda x$$
$$=\lambda(-x) \qquad n=1$$

$$m=n.$$

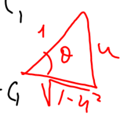
ECUACIÓN DE COEFICIENTES HOMOGÉNEOS.

$$u=\frac{y}{x} \rightarrow \underline{y=ux} \qquad \underline{\frac{dy}{dx}=u+x\frac{du}{dx}}$$

$$E_2 \Rightarrow \sqrt{x^2-u^2x^2}+ux-x\left(u+x\frac{du}{dx}\right)=0$$
$$\sqrt{x^2}\sqrt{1-u^2}+\cancel{ux}-\cancel{xu}-x^2\frac{du}{dx}=0$$
$$x\sqrt{1-u^2}-x^2\frac{du}{dx}=0$$

$$P=x$$
$$Q=\sqrt{1-u^2}$$
$$R=-x^2$$
$$S=1$$

$$\int\frac{x}{-x^2}dx+\int\frac{du}{\sqrt{1-u^2}}=C_1$$
$$-\int\frac{dx}{x}+\int\frac{du}{\sqrt{1-u^2}}=C_1$$
$$-\ln x+\int\frac{\cos(\theta)\,d\theta}{\cos(\theta)}=C_1$$



$$\frac{u}{1}=\operatorname{sen}(\theta)$$
$$\frac{du}{d\theta}=\cos(\theta)$$
$$\frac{\sqrt{1-u^2}}{1}=\cos(\theta)$$

$$-\ln x+\theta=C_1$$
$$-\ln x+\operatorname{ang\,sen}(u)=C_1$$

SG $$\boxed{-\ln x+\operatorname{ang\,sen}\left(\frac{y}{x}\right)=C_1}$$