ECUACIÓN DIFERENCIAL ORDINARIA LINEAL

HOMOGÉNEA
- COEF. CONSTANTES
- COEF. VARIABLES.

$$\boxed{\begin{array}{l} t_v = 9.25 \text{ s.} \\ h_m = 107 \text{ m} \\ d_m = 425 \text{ [m]} \end{array}}$$

$$y = c_1 x e^{2x} + c_2 x^2 e^{2x} \longleftarrow \quad c_3 e^{2x}$$

$$Ecuacion := \frac{d^2}{dx^2} y(x) - \left(4 + \frac{2}{x}\right)\left(\frac{d}{dx} y(x)\right) + \left(\frac{2}{x^2} + \frac{4}{x} + 4\right) y(x) = 0$$

$$\frac{d^2y}{dx^2} - \left(4 + \frac{2}{x}\right)\frac{dy}{dx} + \left(\frac{2}{x^2} + \frac{4}{x} + 4\right) y = 0$$

$$\frac{d^2y}{dx^2} + a_1(x)\frac{dy}{dx} + a_2(x)\, y = 0$$

EDO(2) L cv H.

EDO(3) L cc H

$$(m-2)^3 = 0 \qquad m^3 - 6m^2 + 12m - 8 = 0$$

$$\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 12\frac{dy}{dx} - 8y = 0$$

$$y = c_1 x e^{2x} + c_2 x^2 e^{2x} + c_3 e^{2x}.$$

EDO(1)L CV H.

$$a_0(x)\frac{dy}{dx} + a_1(x)y = 0$$

FORMA DE PRIMER ORDEN

$$\frac{dy}{dx} + \frac{a_1(x)}{a_0(x)}y = 0$$

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

$$a_0(x)\frac{dy}{dx} + a_1(x)y = Q(x)$$

$$\frac{dy}{dx} + \frac{a_1(x)}{a_0(x)}y = \frac{Q(x)}{a_0(x)}$$

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

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

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

$$dy=-p(x)y\,dx$$

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

$$\int\frac{dy}{y}=-\int p(x)dx$$

$$Ly+k_1=\left[-\int p(x)dx\right]+k_2$$

$$Ly=\left[-\int p(x)dx\right]+(k_2-k_1)$$

$$y=e^{(k_2-k_1)}\cdot e^{\left[-\int p(x)dx\right]}$$

$$y=C_1e^{-\int p(x)dx}$$

$$\frac{dy}{dx}-\frac{y}{x}=0 \qquad p(x)=-\frac{1}{x} \qquad \int p(x)dx=-\int\frac{dx}{x}$$

$$=-Lx$$

$$e^{-\int p(x)dx}=e^{-(-Lx)}\Rightarrow e^{Lx}$$

$$\boxed{\begin{array}{l} u=e^{Lx}\rightarrow Lu=Le^{Lx}\rightarrow Lu=Lx\,\cancel{Le}^{\,1} \\ Lu=Lx\rightarrow u=x \end{array}}$$

$$\frac{dy}{dx}-\frac{y}{x}=0 \qquad y=Ce^{Lx}\rightarrow\boxed{y=Cx}$$

$$\frac{dy}{dx}=C$$

$$[c]-\frac{(c\cancel{x})}{\cancel{x}}=0$$

$$c-C=0$$

$$\underline{0=0}$$

$$\frac{dy}{dx} + xy = 0 \qquad p(x) = x \qquad \int p(x)\,dx = \int x\,dx$$

$$= \frac{x^2}{2}$$

$$y = Ce^{-\frac{x^2}{2}}$$

$$\frac{dy}{dx} = Ce^{-\frac{x^2}{2}} \cdot (-x)$$

$$= -Cxe^{-\frac{x^2}{2}}$$

$$\left[-Cxe^{-\frac{x^2}{2}}\right] + x\left[Ce^{-\frac{x^2}{2}}\right] = 0$$

$$\left[-x + x\right]Ce^{-\frac{x^2}{2}} = 0$$

$$0 \equiv 0$$

$$\frac{dy}{dx} - \operatorname{sen}(2x)\, y = 0 \qquad p(x) = -\operatorname{sen}(2x)$$

$$\int p(x)\,dx = -\int \operatorname{sen}(2x)\,dx \rightarrow \frac{1}{2}\int -\operatorname{sen}(2x)\, 2dx$$

$$\int p(x)\,dx = \frac{1}{2}\cos(2x) \qquad \frac{dy}{dx} + p(x)\, y = 0$$

$$y_g = C_1 e^{-\frac{1}{2}\cos(2x)} \qquad y_g = C e^{-\int p(x)dx}$$

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

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

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

$$F(x,y) = C$$

$$\frac{d}{dx} F(x,y) = 0$$

regla de la cadena

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

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

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

FACTOR INTEGRANTE.

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

$$\frac{dy}{dx} + p(x)y = q(x) \qquad \text{EDO}(1)\,L\;CV\;NH.$$

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

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

$$d(v) = e^{\int p(x)dx} q(x)\,dx$$

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

$$v + k_1 = \left[\int e^{\int p(x)dx} q(x)\,dx\right] + k_2$$

$$v = (k_2 - k_1) + \left[\int e^{\int p(x)dx} q(x)\,dx\right]$$

$$y e^{\int p(x)dx} = C + \left[\int e^{\int p(x)dx} q(x)\,dx\right]$$

$$\boxed{y = C e^{-\int p(x)dx} + e^{-\int p(x)dx}\left[\int e^{\int p(x)dx} q(x)\,dx\right]}$$

$$y_{g/nh} = y_{g/h} + y_{p/q}$$

Regla de Oro

$$x\frac{dy}{dx}+y=x^2 Lx$$

$$\frac{dy}{dx}+\frac{y}{x}=\frac{x^2 Lx}{x}$$

$$p(x)=\frac{1}{x} \quad q(x)=x\,Lx$$

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

$$\int p(x)dx=\int\frac{dx}{x}\Rightarrow Lx$$

$$e^{\int p(x)dx}=e^{Lx}\Rightarrow x$$

$$\int(x)(x\,Lx)dx=\int x^2 Lx\,dx$$

$$\int u\,dv=uv-\int v\,du$$

$$\int x^2 Lx\,dx=\frac{x^3}{3}Lx-\int\frac{x^3}{3}\left(\frac{dx}{x}\right)$$

$$\boxed{\begin{array}{ll} u=Lx & du=\frac{dx}{x}\\ dv=x^2dx & v=\frac{x^3}{3}\end{array}}$$

$$\int x^2 Lx\,dx=\frac{x^3 Lx}{3}-\frac{1}{3}\int x^2dx$$

$$\int e^{\int p\,dx} q\,dx=\frac{x^3 Lx}{3}-\frac{x^3}{9}$$

$$e^{-\int p\,dx}=e^{-Lx}=e^{L\left(\frac{1}{x}\right)}\Rightarrow\frac{1}{x}$$

$$e^{-\int p\,dx}\int e^{\int p\,dx} q\,dx=\left(\frac{1}{x}\right)\left(\frac{x^3}{3}Lx-\frac{x^3}{9}\right)=x^2\left(\frac{Lx}{3}-\frac{1}{9}\right)$$

$$y=C\left(\frac{1}{x}\right)+x^2\left(\frac{Lx}{3}-\frac{1}{9}\right)$$