Problema Arco y Flecha

$$M \frac{d^2 s}{dt^2} = -H s$$

$$[kg_m]\left[\frac{m}{s^2}\right] = \left[\frac{kg_f}{\cancel{m}}\right] \times [\cancel{m}]$$

$$\left[\frac{kg_f}{\cancel{\frac{m}{s^2}}}\right]\left[\cancel{\frac{m}{s^2}}\right] = [kg_f]$$

$$[kg_f] = [kg_f]$$

EDO(1) L CC H.

$$\frac{dy}{dx} + a_1 y = 0 \longrightarrow y = C_1 e^{-a_1 x}$$

EDO(1) L CV H.

$$\frac{dy}{dx} + p(x) y = 0 \longrightarrow y = C_1 e^{-\int p(x)dx}$$

$$y = C_1 e^{-a_1 x} \longrightarrow \frac{dy}{dx} + a_1 y = 0$$

$$y = \frac{C_1}{e^{a_1 x}}$$

$$y e^{a_1 x} = C_1$$

$$\frac{d}{dx}\left(y(x) \cdot e^{a_1 x}\right) = 0$$

$$y(x) \frac{d}{dx}\left(e^{a_1 x}\right) + e^{a_1 x} \frac{d}{dx} y(x) = 0$$

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

$$\underline{\underline{c\, e^{a_1 x}}}\left(\frac{dy}{dx} + a_1 y\right) = 0$$

FACTOR INTEGRANTE

$$\frac{dy}{dx} + a_1 y = \frac{0}{e^{a_1 x}}$$

$$\boxed{\frac{dy}{dx} + a_1 y = 0}$$

$$\frac{dy}{dx} + a_1 y = 0$$

$$e^{a_1 x}\left(\frac{dy}{dx} + a_1 y\right) = 0$$

$$e^{a_1 x}\frac{dy}{dx} + a_1 e^{a_1 x} y = 0$$

$$\frac{d}{dx}\left(y \cdot e^{a_1 x}\right) = 0$$

$$y \cdot e^{a_1 x} = c_1$$

SG $$y = c_1 e^{-a_1 x}$$

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

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

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

$$\Rightarrow \frac{d}{dx}\left(ye^{\int p(x)dx}\right) = 0$$

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

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

$$\frac{dy}{dx} + a_1 y = 0 \longrightarrow y = C_1 e^{-a_1 x}$$

EDO(1)L cc H

$$\frac{dy}{dx} + a_1 y = q(x)$$ EDO(1)L cc NH.

$$e^{a_1 x}\left(\frac{dy}{dx} + a_1 y\right) = e^{a_1 x} q(x)$$

$$\frac{d}{dx}\left(y e^{a_1 x}\right) = e^{a_1 x} q(x)$$

$$d\left(y e^{a_1 x}\right) = e^{a_1 x} q(x)\,dx$$

y', $\frac{dy}{dx}$, $\dot{y}$, $D_x y$

$u = e^{a_1 x} y$

$$\int d\left(y e^{a_1 x}\right) = \int e^{a_1 x} q(x)\,dx$$

$\int du$

u

$$y e^{a_1 x} + k_1 = \left[\int e^{a_1 x} q(x)\,dx\right] + k_2$$

$$y e^{a_1 x} = (k_2 - k_1) + \left[\int e^{a_1 x} q(x)\,dx\right]$$

SG NH cc

$$y = C_1 e^{-a_1 x} + e^{-a_1 x}\int e^{a_1 x} q(x)\,dx$$

$$\frac{dy}{dx} - 4y = x^2$$

$$y = C_1 e^{4x} + e^{4x}\int e^{-4x} x^2 dx.$$

$$\int x^2 e^{-4x} dx = \frac{x^2 e^{-4x}}{-4} - \int \frac{e^{-4x}}{-4}(2x) dx$$

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

$$u = x^2 \quad du = 2x\,dx$$

$$dv = e^{-4x} dx \quad v = \frac{e^{-4x}}{-4}$$

$$\int x^2 e^{-4x} dx = -\frac{1}{4} x^2 e^{-4x} + \frac{1}{2}\int x e^{-4x} dx$$

$$u = x \quad du = dx$$

$$dv = e^{-4x} dx \quad v = \frac{e^{-4x}}{-4}$$

$$= -\frac{1}{4} x^2 e^{-4x} + \frac{1}{2}\left[-\frac{1}{4} x e^{-4x} + \frac{1}{4}\int e^{-4x} dx\right]$$

$$\int x^2 e^{-4x} dx = -\frac{1}{4} x^2 e^{-4x} - \frac{1}{8} x e^{-4x} - \frac{1}{32} e^{-4x}$$

$$y = C_1 e^{4x} + e^{4x}\left(-\frac{1}{4} x^2 e^{-4x} - \frac{1}{8} x e^{-4x} - \frac{1}{32} e^{-4x}\right)$$

$$y = C_1 e^{4x} - \frac{1}{4} x^2 - \frac{1}{8} x - \frac{1}{32}$$

$$\frac{dy}{dx} + y = \cos(2x) \qquad q(x) = \cos(2x)$$

$$y = C_1 e^{-x} + e^{-x}\int e^{x}\cos(2x)\,dx$$

$$\int e^{x}\cos(2x)\,dx$$

$$u = \cos(2x) \quad du = -2\,\mathrm{sen}(2x)\,dx$$

$$dv = e^{x}dx \quad v = e^{x}$$

$$\int e^{x}\cos(2x)\,dx = e^{x}\cos(2x) + 2\int e^{x}\,\mathrm{sen}(2x)\,dx$$

$$u = \mathrm{sen}(2x) \quad du = 2\cos(2x)\,dx$$

$$dv = e^{x}dx \quad v = e^{x}$$

$$\int e^{x}\cos(2x)\,dx = e^{x}\cos(2x) + 2\left(e^{x}\,\mathrm{sen}(2x) - 2\int e^{x}\cos(2x)\,dx\right)$$

$$\int e^{x}\cos(2x)\,dx = e^{x}\cos(2x) + 2e^{x}\,\mathrm{sen}(2x) - 4\int e^{x}\cos(2x)\,dx$$

$$5\int e^{x}\cos(2x)\,dx = e^{x}\cos(2x) + 2e^{x}\,\mathrm{sen}(2x)$$

$$\int e^{x}\cos(2x)\,dx = \frac{1}{5}e^{x}\cos(2x) + \frac{2}{5}e^{x}\,\mathrm{sen}(2x)$$

$$\boxed{y = C_1 e^{-x} + \frac{1}{5}\cos(2x) + \frac{2}{5}\,\mathrm{sen}(2x)}$$

general

$$e^{a_1 x}$$

$$\frac{dy}{dx} + y = 0 \longrightarrow y = C_1 e^{-x}$$

$$y e^{x} = C_1$$

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

$$\frac{d}{dx}\left(y e^{x}\right) = C_1 + \int e^{x}\cos(2x)\,dx$$

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

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

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

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

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

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