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$$t^2 \cdot \frac{dx}{dt} + 3t\,x = t^4 \ln t + 1 \quad , \quad x(1) = 0$$

$$\frac{dx}{dt} + \frac{3}{t}\,x = t^2 \ln t + \frac{1}{t}$$

$$\lambda = e^{\int \frac{3}{t}dt} \Rightarrow \lambda = t^3 \Rightarrow t^3 . x = \int t^3 \left(t^2 \ln t + \frac{1}{t}\right) dt + c$$

$$t^3 x = \int (t^5 \ln t + t^2) dt + c \Rightarrow t^3 x = \frac{t^6 \ln t}{6} - \frac{t^6}{36} + \frac{t^3}{3} + c$$

$$x = \frac{t^3 \ln(t)}{6} - \frac{t^3}{36} + \frac{1}{3} + c \quad , \quad 0 = \frac{1 \ln(1)}{6} - \frac{1}{36} + \frac{1}{3} + c$$

$$-c = \frac{1}{3} - \frac{1}{36} \Rightarrow -c = \frac{12}{36} - \frac{1}{36} \Rightarrow c = -\frac{11}{36}$$

$$x = \frac{t^3 \ln(t)}{6} - \frac{t^3}{36} + \frac{1}{36}$$

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$$y' \underbrace{-2x}_{P(x)} y = \underbrace{x}_{Q(x)}$$

$$\lambda = e^{\int -2x\,dx} \Rightarrow \lambda = e^{-x^2} = \frac{1}{e^{x^2}} \Rightarrow \frac{1}{e^{x^2}} \cdot y = \int \frac{x}{e^{x^2}} dx + c$$

$$\frac{y}{e^{x^2}} = -\frac{e^{-x^2}}{2} + c \Rightarrow y = -\frac{e^{(-x^2+1)}}{2} + c$$

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$$y' + \frac{2}{x}y = -x^9 \cdot y^5$$

$n=5$

$$y^{-5}y' + \frac{2}{x}y^{-4} = -x^9$$

$$z = y^{-4} \Rightarrow z' = -4y^{-5}y' \Rightarrow y^{-5}y' = \frac{z'}{-4}$$

$$\frac{z'}{-4} + \frac{2}{x} \cdot z = -x^9 \Rightarrow z' \underbrace{- \frac{8}{x}}_{p(x)} \cdot z = \underbrace{4x^9}_{q(x)}$$

$$\lambda = e^{\int -\frac{8}{x}dx} = e^{-8\ln x} = x^{-8} \Rightarrow x^{-8} \cdot z = \int x^{-8} \cdot 4x^9 \cdot dx + c$$

$$x^{-8} \cdot z = 2x^2 + c \Rightarrow z = 2x^{10} + cx^8$$

$$y^{-4} = 2x^{10} + cx^8$$

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$$y' + y = y^{-2}$$

$$\frac{dy}{dx} + y = y^{-2} \Rightarrow dy + ydx = y^{-2} \cdot dx \Rightarrow dy = y^{-2} \cdot dx - ydx$$

$$dy = dx(y^{-2} - y) \Rightarrow dx = \frac{dy}{y^{-2} - y} \Rightarrow \int dx = \int \frac{dy}{y^{-2} - y}$$

$$x = -\frac{\ln(y^3 - 1)}{3} + c$$