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1. $J[y] = \int_0^1 \left(\frac{(y')^2}{6} + xy \right) dx$ $\boxed{y \Leftrightarrow f}$

$F \Rightarrow \frac{(f')^2}{6} + xf$

Euler ξ^n :- $\frac{\partial F}{\partial f} - \frac{d}{dx}\left(\frac{\partial F}{\partial f'}\right) = 0$ Substituting Back

x $\qquad \frac{d}{dx}\left(\frac{2(f')}{6}\right) \Rightarrow \frac{1}{3} f''$

$x - \frac{1}{3} y'' = 0$

$\Rightarrow y'' \Rightarrow 3x \Rightarrow y' = \frac{3x^2}{2} + C_1 \Rightarrow y = \frac{x^3}{2} + C_1 x + C_2$

Sub $y(0) = 0$ & $y(1) = 1$; $\boxed{y = \frac{x}{2}(x^2+1)}$

$y' \Rightarrow \frac{3x^2}{2} + \frac{1}{2}$

$J[y]\Big|_{y_{opt}} \Rightarrow \int_0^1 \left(\frac{\frac{1}{4} \times (3x^2+1)^2}{6} + \frac{x^2}{2}(x^2+1) \right) dx$

$\Rightarrow \int_0^1 \left(\frac{(3x^2+1)^2}{24} + \frac{(x^4+x^2)}{2} \right) dx \Rightarrow \underline{\underline{7/15}}$

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Taking a random new 'y' satisfying the Boundary Condⁿ

w.r.t., $y \Rightarrow \frac{x}{3}(x^2+2)$

$y(0)=0$, $y(1)=1$

$y' \Rightarrow x^2 + \frac{2}{3}$

$$J[y]\Big|_{y_{new}} \Rightarrow \int_0^1 \left(\frac{(x^2+2/3)^2}{6} + \left(\frac{x^4+2x^2}{3}\right)\right) dx$$

$$\Rightarrow \frac{127}{270} \Rightarrow \frac{7.0555}{15}$$

$$J[y]\Big|_{opt} < J[y]\Big|_{new}$$

$\boxed{\text{We have recieved a Minimum}}$