

Solving First-Order Ordinary Differential Equations Exactly Next Independent Solution



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- Click on Prerequisites to Numerical Methods for Solving Ordinary Differential Equations



Problem Statement

Solve the ordinary differential equation exactly

$$2 \frac{dy}{dx} + 3y = e^{-1.5x}, \underline{\underline{y(0) = 5}}$$

$$y = y_H + y_P$$

$$y_H: 2m^1 + 3m^0 = 0$$

$$2m + 3 = 0$$

$$m = -1.5$$

$$y_H = K e^{mx}$$

$$\boxed{y_H = K e^{-1.5x}}$$



$$2 \frac{dy}{dx} + 3y = \underline{\underline{e^{-1.5x}}}$$

$$y_H = \underline{K e^{-1.5x}}, \quad y_P = \underline{A x e^{-1.5x}}$$

$$2 \frac{dy_P}{dx} + 3 y_P = e^{-1.5x}$$

$$2 \frac{d}{dx} (\underline{A x e^{-1.5x}}) + 3 A x e^{-1.5x} = e^{-1.5x}$$

$$2 (A e^{-1.5x} - 1.5 A x e^{-1.5x}) + 3 A x e^{-1.5x} = e^{-1.5x}$$

$$\cancel{2 A e^{-1.5x}} - \cancel{3 A x e^{-1.5x}} + \cancel{3 A x e^{-1.5x}} = e^{-1.5x}$$

$$2 A e^{-1.5x} = e^{-1.5x}$$

$$2A = 1$$

$$A = \frac{1}{2}$$

$$y_P = A x e^{-1.5x} = \frac{1}{2} A x e^{-1.5x} = 0.5 A x e^{-1.5x}$$



$$y_H = Ke^{-1.5x}$$

$$y_p = 0.5x e^{-1.5x}$$

$$y = \underline{\underline{K}}e^{-1.5x} + 0.5x e^{-1.5x}$$

$$y(0) = 5$$

$$5 = Ke^{-1.5(0)} + \underline{0.5(0)e^{-1.5(0)}}$$

$$5 = K + 0 = K$$

$$y = 5e^{-1.5x} + 0.5x e^{-1.5x}$$

END



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Acknowledgement

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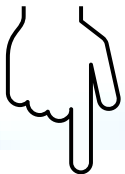
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