

# Exercise

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1. Solve following BVP

$$DE \quad x \frac{dy}{dx} - y = x,$$

$$BC \quad y(-1) = 1$$

## Solution

$$\text{Let } y = vx$$

$$\frac{dy}{dx} = v + x \frac{dv}{dx}$$

substituting above in DE

$$x \left( v + x \frac{dv}{dx} \right) - vx = x$$

$$x \frac{dv}{dx} = 1$$

$$dv = \frac{dx}{x}$$

Thus

$$v = \ln(x) + C = \frac{y}{x}$$

$$y = x(\ln(x) + C)$$

Impose BC  $y(-1) = 1$

$$1 = (-1)[\ln(-1) + C]$$

Thus,  $C = -1 - \pi i$

Particular solution,  $y = x(\ln(x) - 1 - \pi i)$