

## Differential Equations - Class XII

### Past Year JEE Questions

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#### Questions

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##### Question: 01

Let  $y = y(x)$  be the solution of the differential equation,

$\frac{dy}{dx} + y \tan x = 2x + x^2 \tan x$ ,  $x \in (-\frac{\pi}{2}, \frac{\pi}{2})$ , such that  $y(0) = 1$ . Then :

A.  $y(\frac{\pi}{4}) - y(-\frac{\pi}{4}) = \sqrt{2}$

B.  $y'(\frac{\pi}{4}) - y'(-\frac{\pi}{4}) = \pi - \sqrt{2}$

C.  $y(\frac{\pi}{4}) + y(-\frac{\pi}{4}) = \frac{\pi^2}{2} + 2$

D.  $y'(\frac{\pi}{4}) + y'(-\frac{\pi}{4}) = -\sqrt{2}$

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#### Solutions

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##### Solution: 01

##### Explanation

$$\frac{dy}{dx} + y(\tan x) = 2x + x^2 \tan x$$

$$\text{I.F.} = e^{\int \tan x dx} = e^{\ln \sec x} = \sec x$$

$$y \cdot \sec x = \int (2x + x^2 \tan x) \sec x dx$$

$$\Rightarrow y \sec x = x^2 \sec x + \lambda$$

$$\Rightarrow y(0) = 0 + \lambda = 1 \Rightarrow \lambda = 1$$

$$\Rightarrow y = x^2 + \cos x$$

$$\Rightarrow y' = 2x - \sin x$$

$$\Rightarrow y'(\frac{\pi}{4}) = \frac{\pi}{2} - \frac{1}{\sqrt{2}}$$

$$\Rightarrow y'(-\frac{\pi}{4}) = -\frac{\pi}{2} + \frac{1}{\sqrt{2}}$$

$$\therefore y'(\frac{\pi}{4}) - y'(-\frac{\pi}{4}) = \pi - \sqrt{2}$$