

30.10.2025

## Linear Equation

Form:  $\boxed{\frac{dy}{dx} + Py = Q}$

Here,  $P$  and  $Q$  are either function of  $x$  only or constants.

Its Integrating factor (I.F) =  $e^{\int P dx}$

Solution is given by

$$\boxed{y \times \text{I.F} = \int Q \times \text{I.F} dx}$$

$$\text{ie. } y \times e^{\int P dx} = \int Q \times e^{\int P dx} dx$$

$\boxed{Q}$

$$\frac{dy}{dx} + y \cot x = e^{\cos x}$$

Here,  $P = \cot x$ ,  $Q = e^{\cos x}$

$$\text{I.F} = e^{\int P dx} = e^{\int \cot x dx} = e^{\log \sin x} = \sin x.$$

$\therefore$  Soln. is given by

$$y \times \text{I.F} = \int Q \times \text{I.F} dx$$

$$\Rightarrow y \times \sin x = \int \sin x \times e^{\cos x} dx$$

$$\text{But } \int \sin x e^{\cos x} dx = -e^{\cos x}$$

$$\Rightarrow y \sin x = -e^{\cos x} + C$$