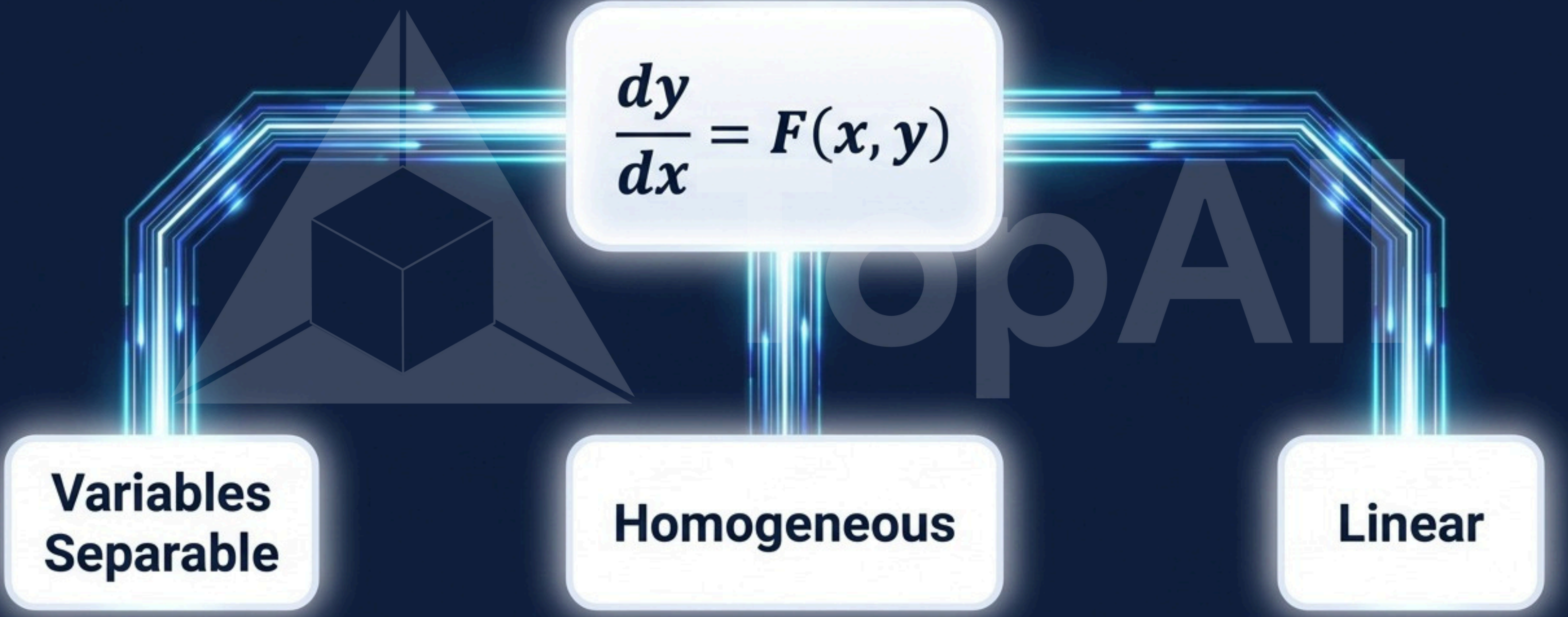


How Do We Solve First Order, First Degree DEs?

The structure tells you the method.


$$\frac{dy}{dx} = F(x, y)$$

**Variables
Separable**

Homogeneous

Linear

Know the Problem Type First

FIRST ORDER

Highest derivative present is the first derivative.

$$dy/dx$$

Higher orders like d^2y/dx^2 do not belong here.

FIRST DEGREE

Power of the highest derivative is 1.

Must be a polynomial equation in derivatives.

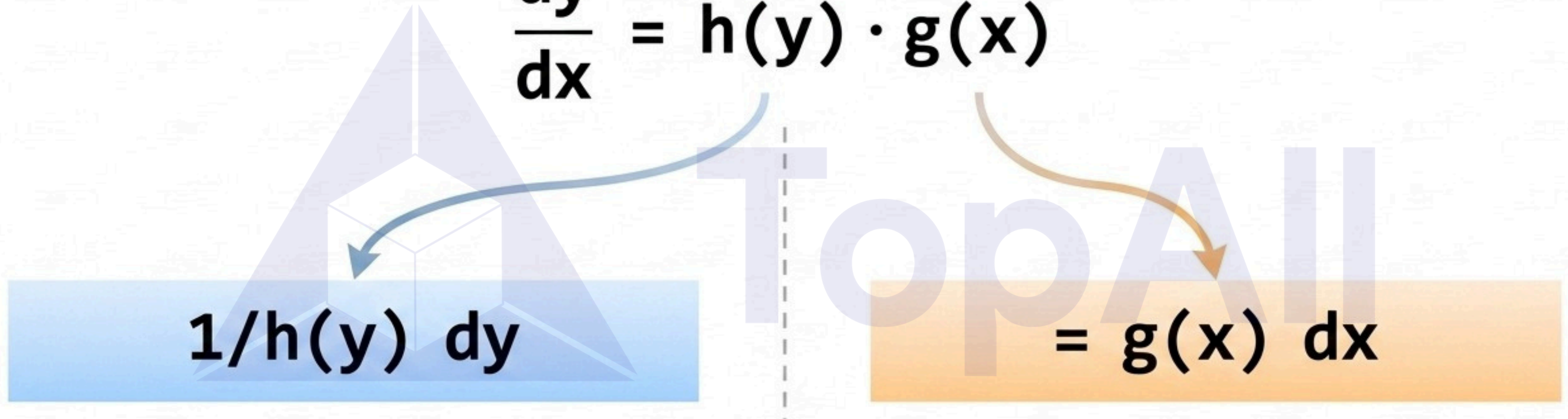
✓ $\left(\frac{dy}{dx}\right)^1 + y = e^x$

✗ $\sin\left(\frac{dy}{dx}\right) + y = 0$ ↖ Degree not defined!

Once the equation fits this class, choose the solving method.

Variables Separable

$$\frac{dy}{dx} = h(y) \cdot g(x)$$


$$1/h(y) dy$$

$$= g(x) dx$$

$$\int 1/h(y) dy = \int g(x) dx$$

Amber

Condition: $h(y) \neq 0$



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$$E=mc^2$$



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Homogeneous Differential Equation

Recognition

$$F(\lambda x, \lambda y) = \lambda^0 F(x, y)$$

$$\frac{dy}{dx} = g(y/x)$$

tag

$$y/x$$

Standard
Substitution

$$y = vx$$

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

Substitution reduces the homogeneous equation into a Variables Separable equation.

Linear Differential Equation

$$dy/dx + Py = Q$$

Amber

- P and Q must be constants or functions of x only.

Step 1: Standardise

Ensure coefficient of $\frac{dy}{dx}$ is exactly 1.

Step 2: Identify

Extract P (the multiplier of y).
Extract Q (the RHS function).

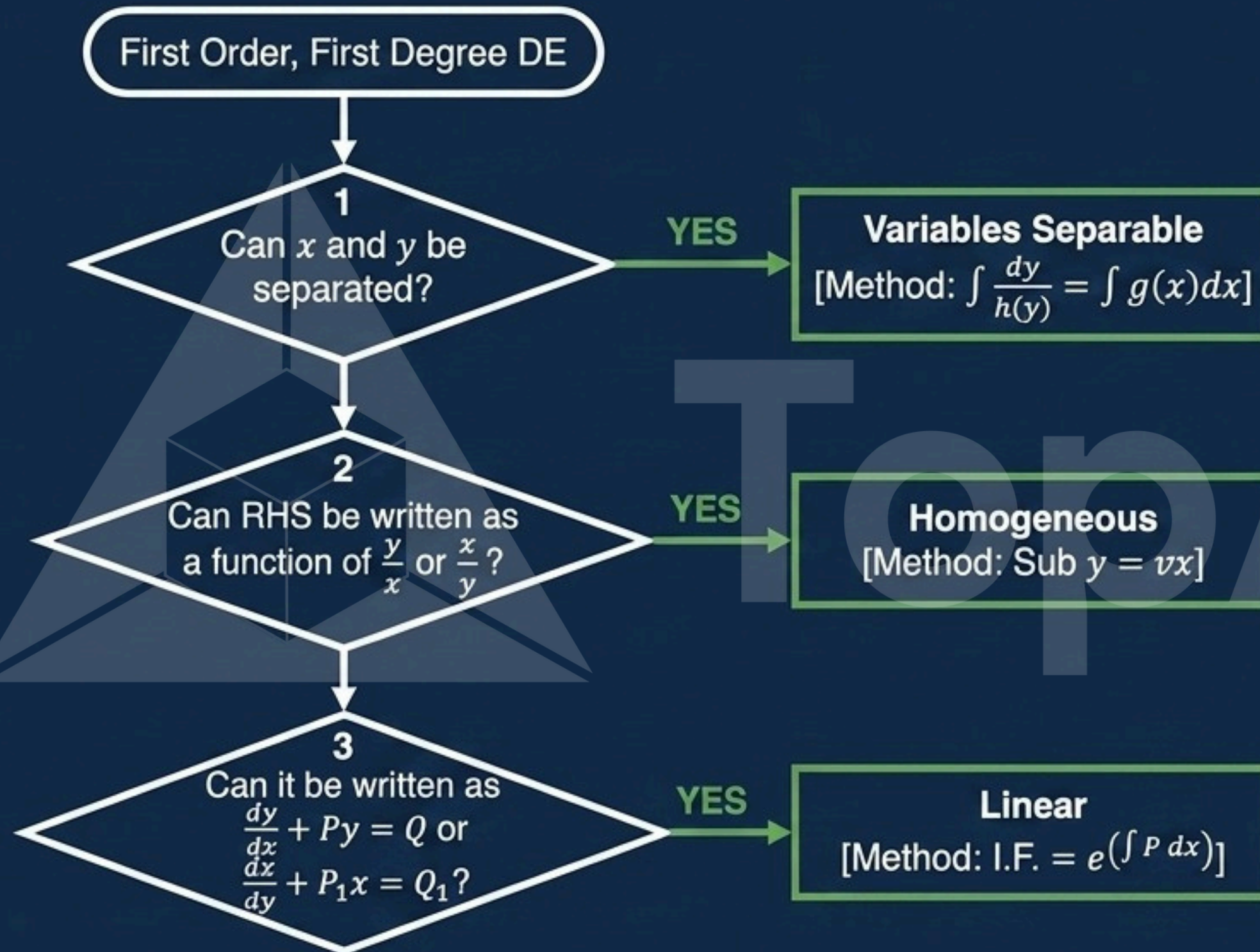
Step 3: Integrating Factor (I.F.)

Compute:

$$\text{I.F.} = e^{\int P dx}$$

Also applies to: $dx/dy + P_1x = Q_1$ (where P_1, Q_1 are functions of y)

Classify Before You Solve



TRAP: Always ensure polynomial degree conditions are met before applying any method. Watch out for terms like $\sin\left(\frac{dy}{dx}\right)$!

Rewrite → Recognise → Choose Method → Solve



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