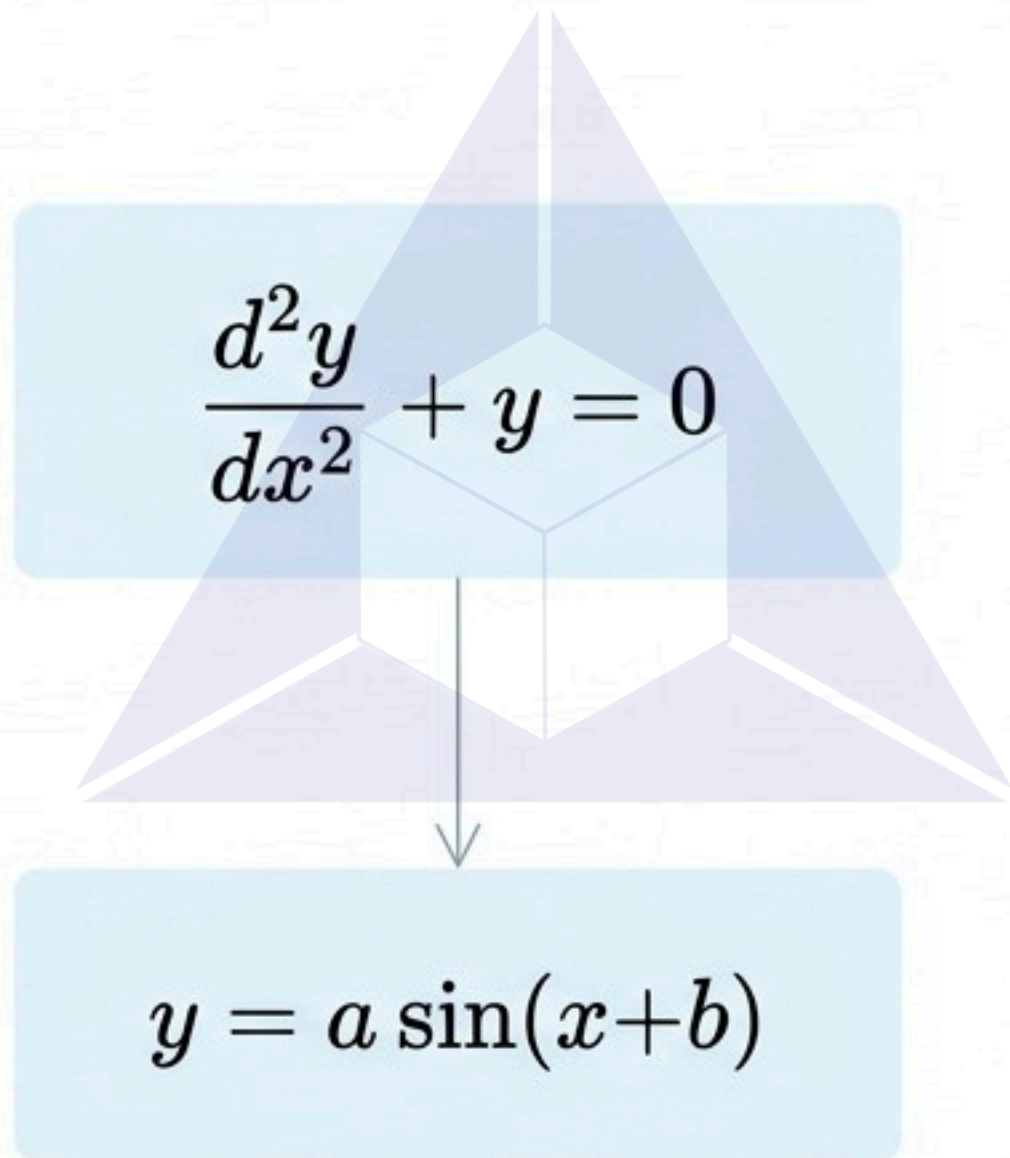


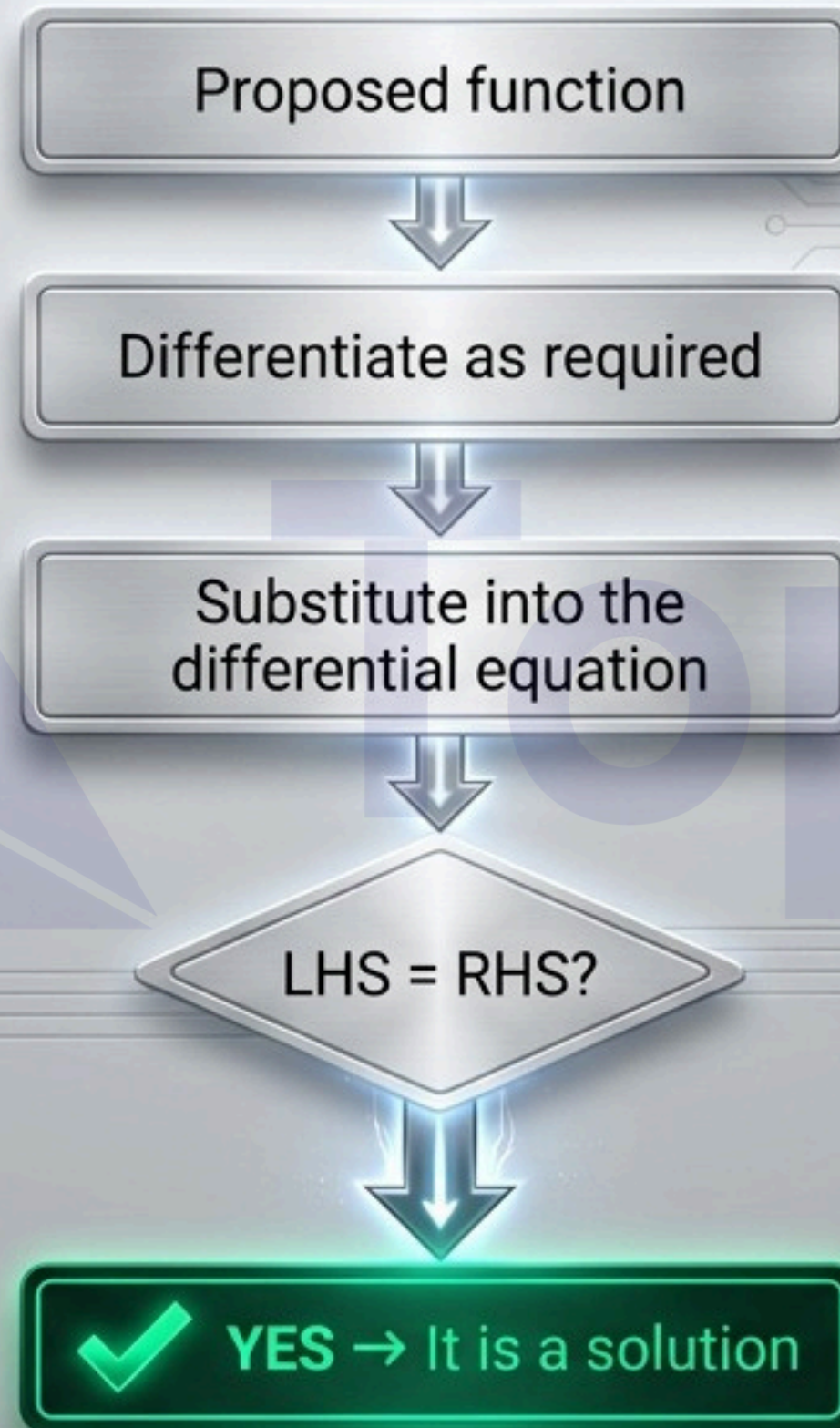
Solutions of a Differential Equation

The answer is a function — not just a number


$$\frac{d^2y}{dx^2} + y = 0$$

$$y = a \sin(x+b)$$

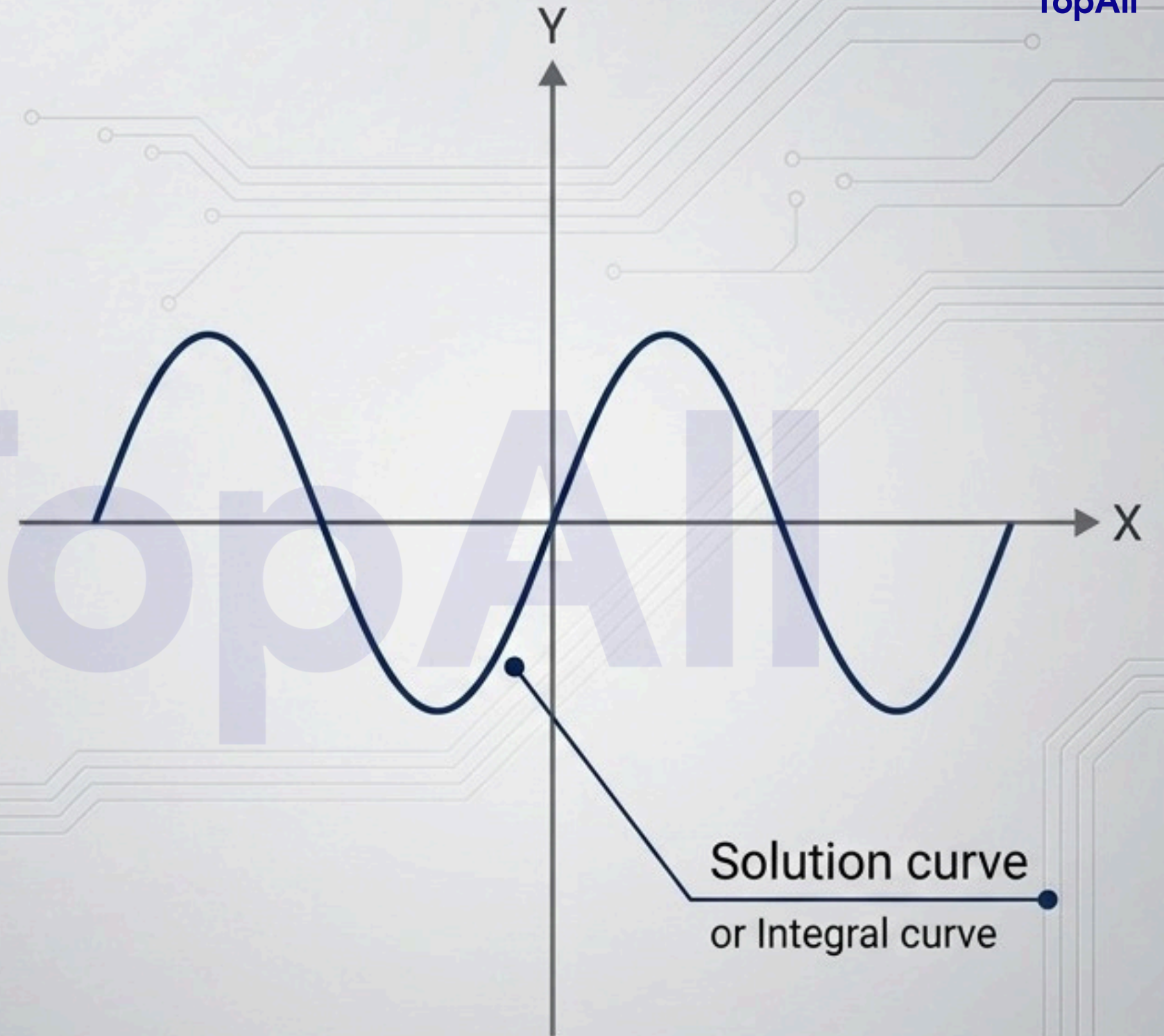
A Solution Must Satisfy the Equation



Every Solution Is Also a Curve

$$y = \varphi(x)$$

Solution function





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$$E=mc^2$$



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Key Highlights

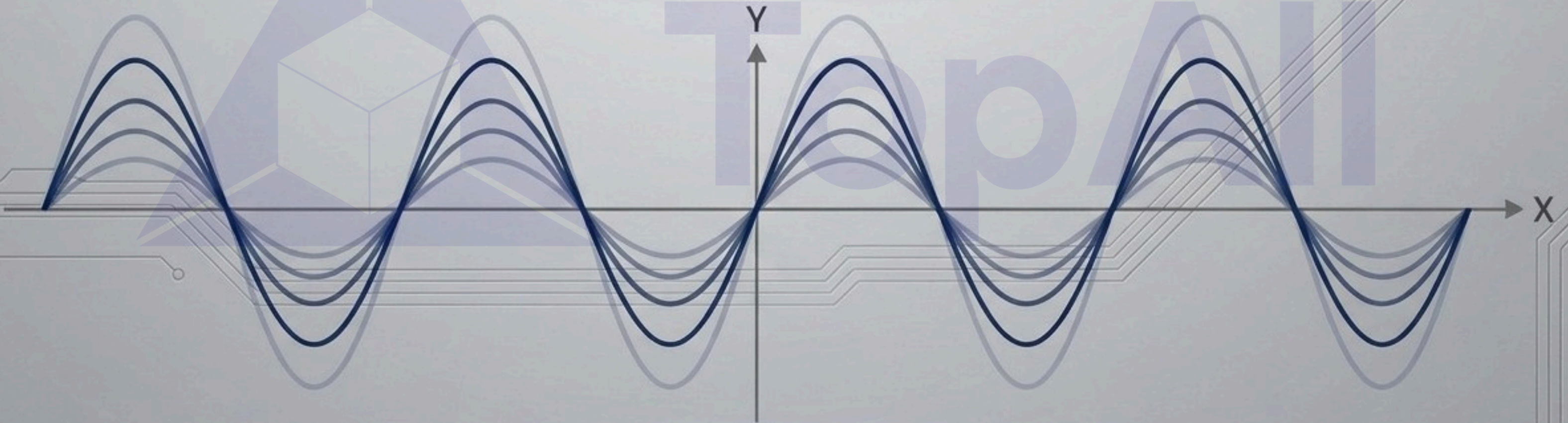
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A Family of Solutions

$$y = a \sin(x + b)$$

Arbitrary constants



A solution containing arbitrary constants is a general solution.

Choose One Member of the Family

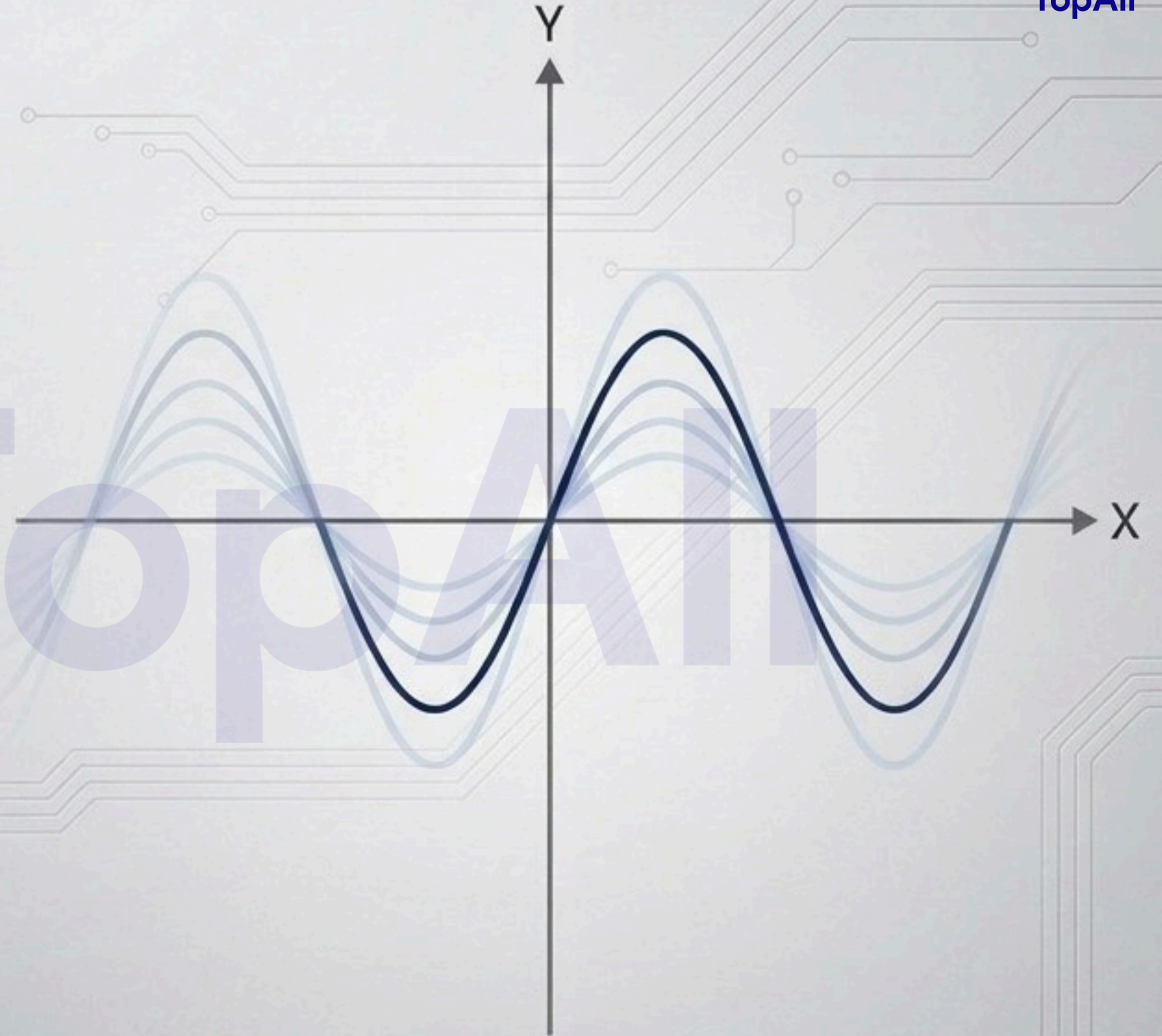
$$y = a \sin(x+b)$$

$$a = 2, b = \frac{\pi}{4}$$

PARTICULAR SOLUTION

$$y = 2 \sin\left(x + \frac{\pi}{4}\right)$$

No arbitrary
constants remain.



How to Verify a Proposed Solution

Given differential equation: $y'' + y' - 6y = 0$ | Proposed solution: $y = e^{-3x}$

1 Find derivatives

$$y' = -3e^{-3x}$$
$$y'' = 9e^{-3x}$$

2 Substitute y , y' and y'' into the given differential equation

$$(9e^{-3x}) + (-3e^{-3x}) - 6(e^{-3x}) = 0$$

3 Resolve

$$9e^{-3x} - 9e^{-3x} = 0$$

LHS = RHS. Therefore: the function is a solution.

General vs Particular

GENERAL SOLUTION	PARTICULAR SOLUTION
● Contains arbitrary constants ▲ Contains arbitrary constant ● Represents a family of curves	● Specific values assigned ▲ No arbitrary constants ● Represents one member of the family

General = family | Particular = one selected solution



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