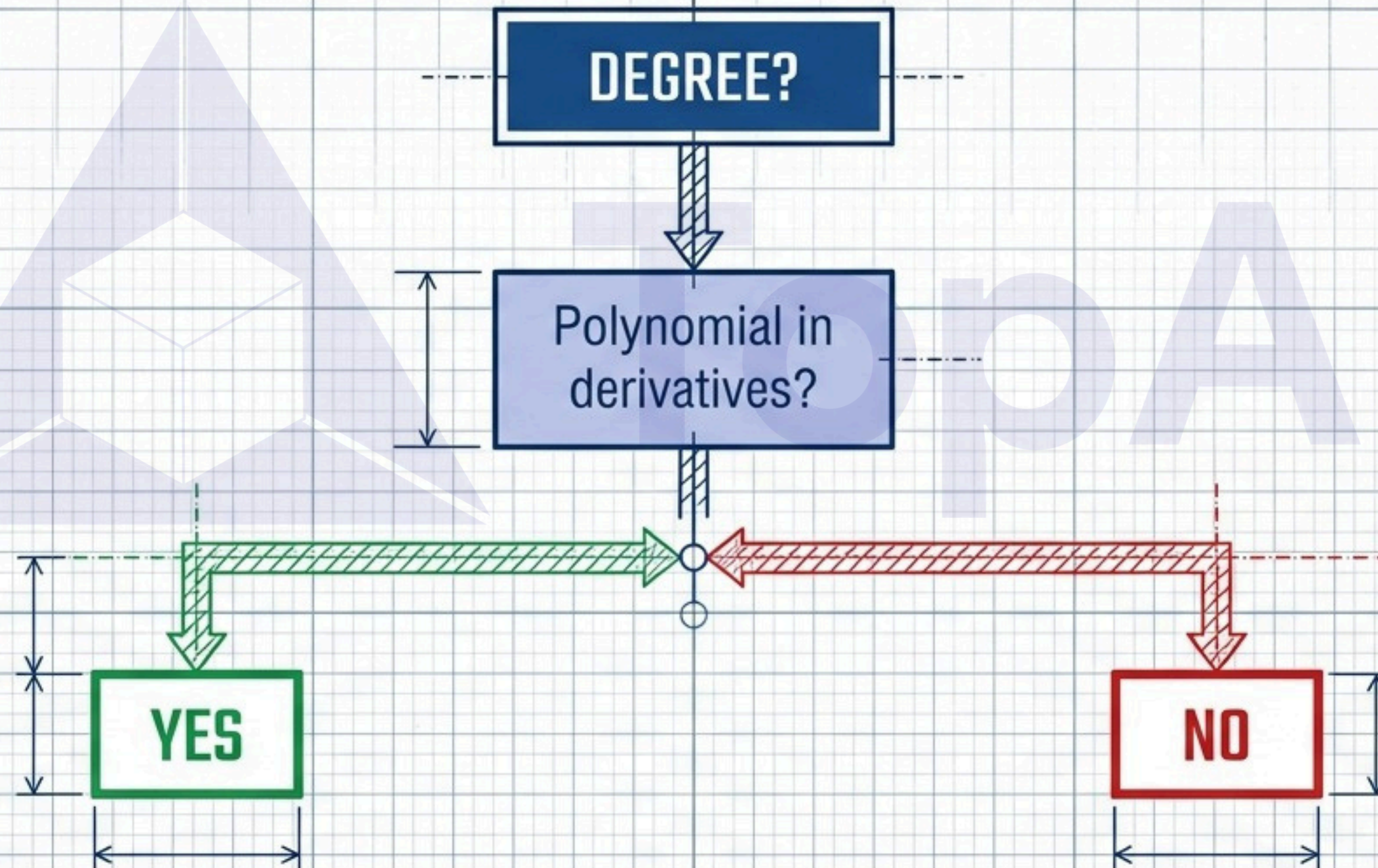


Degree of a Differential Equation

First ask: Is degree even defined?



Degree Needs One Condition

The differential equation must be polynomial in its derivatives.

DIAGNOSTIC COMPARISON: DERIVATIVE FORMALISM CHECK

PASS

FAIL

The Valid Condition

The Invalid Condition

Exponent = 2 ✓

Poly. Structure OK ✓

Exponent = 2 ✓

Exponent = 1 ✓

$$a(y'')^2 + b(y') + c = 0$$

$\frac{dy}{dx}$

✓ Polynomial in derivatives

Degree may be defined

Transcendental Function TRAP

VIOLATION DETECTED

Non-Algebraic

Undefined Exponent

$$\sin(y') + y = 0$$
$$e^{y'} = x$$

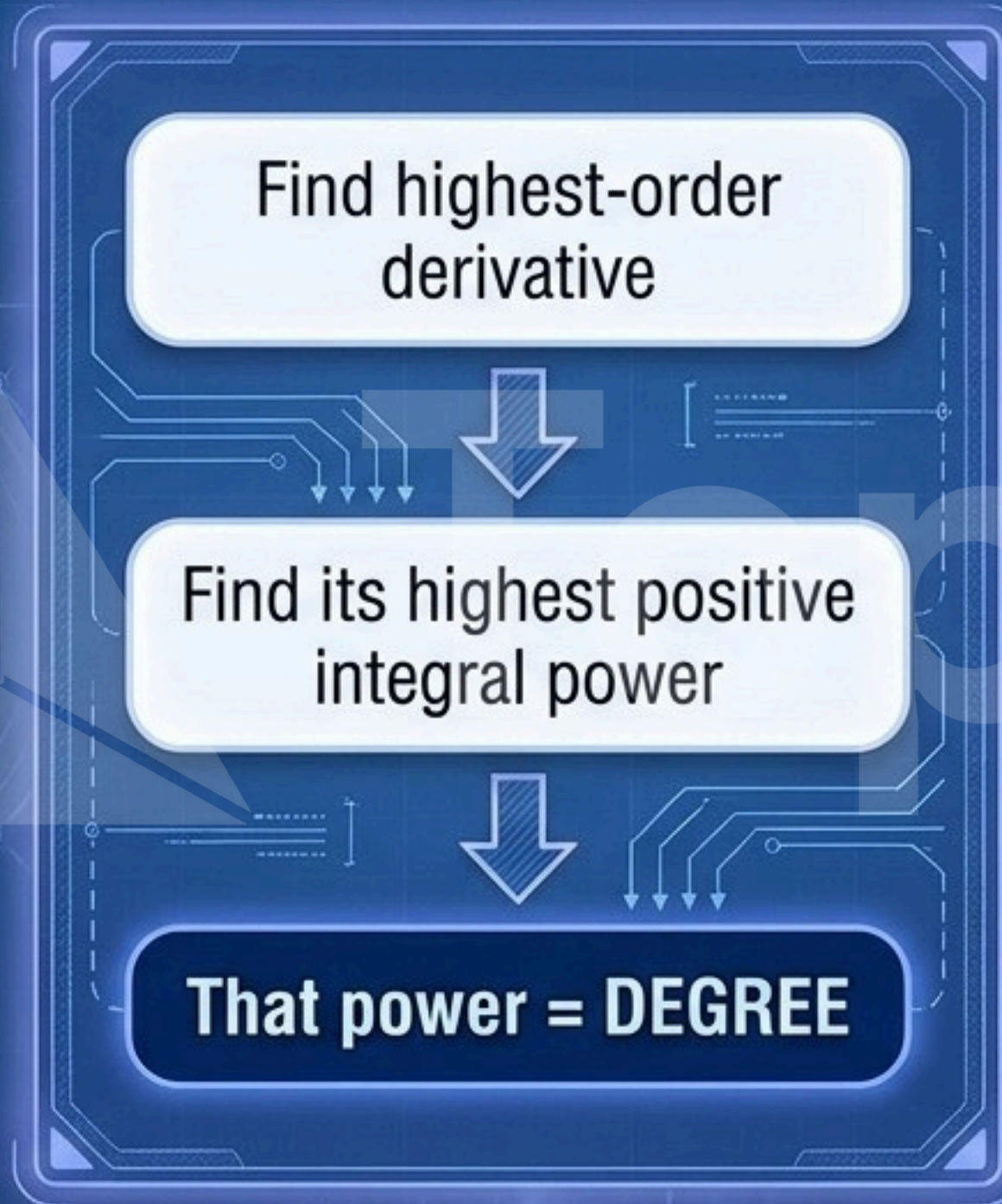
$\frac{dy}{dx}$

✗ Non-polynomial in derivatives

Degree not defined

Once Polynomiality Is Confirmed...

Once Polynomiality Is Confirmed...





You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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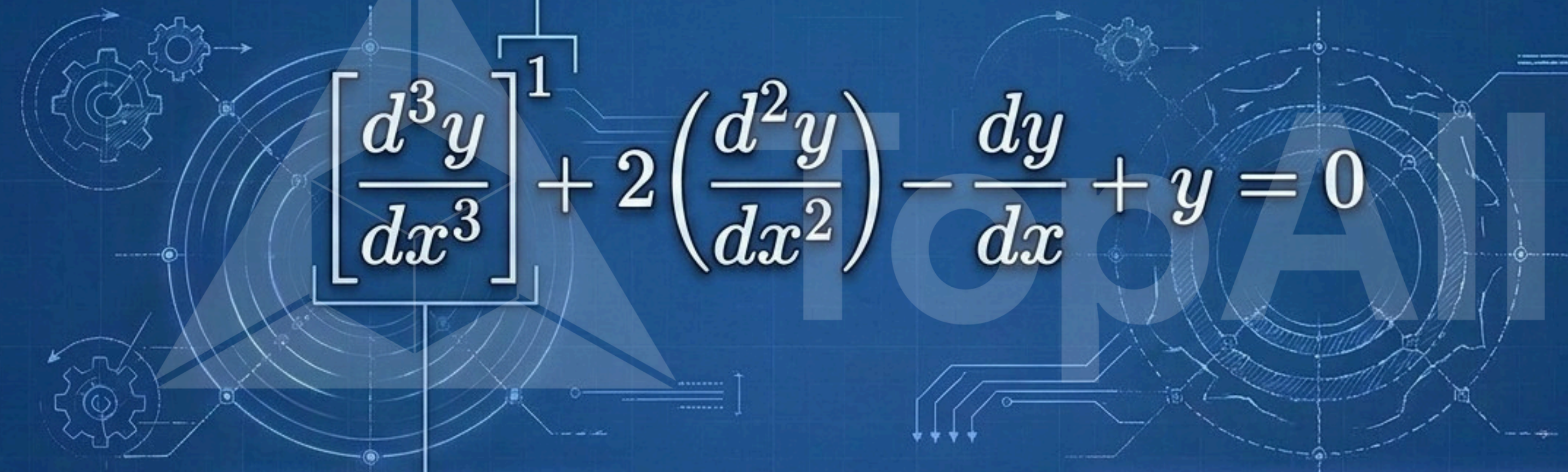
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Example: Degree One

Power = 1


$$\left[\frac{d^3 y}{dx^3} \right]^1 + 2 \left(\frac{d^2 y}{dx^2} \right) - \frac{dy}{dx} + y = 0$$

Highest derivative

Therefore: **DEGREE = 1**

Example: Degree Two

Power = 2

$$\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 + y = 0$$

✗ Ignore

Highest-order derivative

Therefore: **DEGREE = 2**

The Most Important Trap

$$\frac{dy}{dx} + \sin\left(\frac{dy}{dx}\right) = 0$$

Not polynomial in derivative

DEGREE NOT DEFINED

Never Mix These Two

ORDER

Highest-order derivative present.

Always defined.

DEGREE

Power of highest-order derivative.

Only after polynomiality is confirmed.

1. Find order

2. Check polynomiality

3. Find degree

Polynomial check first. Power second.



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