DIFFERENTIAL EQUATIONS (D.E.)

DERIVATIVE WALI EQN.

(I) DEFINITION

An equation that involves
→ Independent variable
→ Dependent variable
→ Derivatives of dependent variables

(II) ORDER of a D.E.

Order of the highest derivative involved in the D.E.
↳ Max. Power

(III) DEGREE of a D.E.

It is the highest power of the highest order derivative, after it has been expressed as a D.E. which is free from radicals, fractions and is a polynomial

1. No dy/dx in fractions or denominator
2. Derivative is only allowed for a Std. function

If it fails to follow ① or ② Degree is NOT DEFINED

(IV) FORMATION of a D.E. (Bole toh Differentiate)

No. of times we differentiate = No. of arbitrary constants in the equation

(V) SOLUTION OF a D.E. (TYPES)

GENERAL SOLN.
A solution which contains ARBITRARY CONSTANTS

PARTICULAR SOLN.
A soln. which is obtained by giving particular values to the arbitrary constants.
(Bole toh Integrate)

(VI) METHODS OF SOLVING

① **VARIABLE SEPARABLE FORM**
D.E. in which variables can be easily separated.
(Naam mein hi kaam hai!!)

$$\int f(x)\, dx = \int g(y)\, dy \quad \text{Integrate!}$$

② **HOMOGENOUS DE**
(All terms are same/uniform)
(Each & every term in the fns. f & g are of the same degree.)

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

Put $y = vx$
$$\Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$$

Put $x = vy$
$$\Rightarrow \frac{dx}{dy} = v + y\frac{dv}{dy}$$

TRICK TO IDENTIFY → METHOD OF SOLVING !!!

C : Convert D.E. into $\dfrac{dy}{dx} = \text{---}$

A : Ask — Homogeneous / Var. Sep. / LDE

F : Follow the method of solving

E : Exceptional case (needs Bernoulli or Substitution)
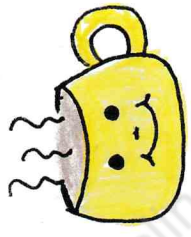
The CAFE Approach !!

⑤ **EXACT D.E.**

A D.E. which can be solved directly by differentiation. (without any muller, elimination, ___)

eg. $x\,dy + y\,dx = 0$
$d(xy) = 0$
$\Rightarrow xy = C$

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DIFFERENTIAL EQUATIONS (D.E.)

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kids to you !!

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③ **LINEAR DE** ✳ (LDE)

A) $\dfrac{dy}{dx} + Py = Q$

P, Q : Functions of x / constant

Soln is:
$y(IF) = \int Q(IF)\,dx$
$IF = e^{\int P\,dx}$

B) $\dfrac{dx}{dy} + Rx = S$ R, S : Functions of y / constant

Soln is:
$x(IF) = \int S(IF)\,dy$
$IF = e^{\int R\,dy}$

④ **BERNOULLI'S EQUATION**

$\dfrac{dy}{dx} + Py = Qy^n$

P, Q : Function of x / constant
$n \neq 0$ or 1

DIVIDE by y^n → CULPRIT

Follow ✳