

Differential Equations

CBSE Class 12 Maths · Knowledge organiser

KEY DEFINITIONS

Order

The order of the highest derivative in a differential equation.

Degree

The power of the highest-order derivative, when the equation is a polynomial in the derivatives.

General solution

Has as many arbitrary constants as the order; a particular solution fixes them.

KEY FORMULAS

Order = highest derivative; degree = power of it (when polynomial in derivatives). General solution has as many constants as the order

Variables separable	$\int \frac{dy}{g(y)} = \int f(x) dx + C$
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Homogeneous $\frac{dy}{dx} = F\left(\frac{y}{x}\right)$	$y = vx, \quad \frac{dy}{dx} = v + x \frac{dv}{dx}$
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Linear $\frac{dy}{dx} + Py = Q$	I.F. = $e^{\int P dx}$, $y \cdot \text{I.F.} = \int Q \cdot \text{I.F.} dx + C$
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Linear $\frac{dx}{dy} + P_1x = Q_1$	I.F. = $e^{\int P_1 dy}$, $x \cdot \text{I.F.} = \int Q_1 \cdot \text{I.F.} dy + C$
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YOU SHOULD BE ABLE TO...

- Find the order and degree of a differential equation and solve simple variables-separable equations.
- Recognise and solve homogeneous and linear equations and find particular solutions from given conditions.
- Write complete long answers and case studies, including setting up a differential equation from a real situation.
- Handle equations that are linear in x, mixed-method problems and modelling questions that need interpretation.

WORKED EXAMPLE

$$\frac{dy}{dx} = xy: \ln |y| = \frac{x^2}{2} + c \Rightarrow y = Ce^{x^2/2}.$$

COMMON MISTAKES

- ✗ Stating the degree without first clearing a radical or fractional power.
- ✗ Forgetting to write the equation in standard form (coefficient of $\frac{dy}{dx}$ equal to 1) before finding P .
- ✗ Writing $e^{\int P dx}$ with a “+C” inside — the IF needs no constant.
- ✗ Adding the constant only after dividing: in $y \cdot \text{IF} = \int Q \cdot \text{IF} dx + C$, C must be divided by the IF too.