Maths Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 22

Differential Equations

Order, degree and formation

order=highest derivative; degree=its power, once the equation is polynomial in derivatives

FORMATION

$$n \text{ arbitrary constants} \Rightarrow \text{differentiate } n \text{ times and eliminate them (order } n)$$

Variable separable and homogeneous

SEPARABLE

$$f(y)\,dy = g(x)\,dx \;\Rightarrow\; \int f(y)\,dy = \int g(x)\,dx + C$$

HOMOGENEOUS

$$\frac{dy}{dx} = F\left(\frac{y}{x}\right): \quad y = vx, \quad \frac{dy}{dx} = v + x\frac{dv}{dx}$$

Linear differential equations

$$\frac{dy}{dx} + P(x)\,y = Q(x): \quad \text{IF} = e^{\int P\,dx}, \qquad y\cdot\text{IF} = \int Q\cdot\text{IF}\,dx + C$$

BERNOULLI

$$\frac{dy}{dx} + Py = Qy^n: \ \text{put } z = y^{1-n}$$

EXACT FORMS

$$x\,dy + y\,dx = d(xy), \qquad \frac{x\,dy - y\,dx}{x^2} = d\left(\frac{y}{x}\right), \qquad \frac{x\,dy - y\,dx}{x^2 + y^2} = d\left(\tan^{-1}\frac{y}{x}\right)$$

Applications

GROWTH AND DECAY

$$\frac{dN}{dt} = kN \;\Rightarrow\; N = N_0 e^{kt}$$

NEWTON'S LAW OF COOLING

$$\frac{dT}{dt} = -k(T - T_s)$$

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