Concepts and Formulas

Linear Differential Equations:

Definition:

A first order differential equation of the form

$$\boxed{\frac{dy}{dx} + Py = Q}$$

where P and Q are functions of x only. Here no product of y and its derivative dy/dx occur and the dependent variable y and its derivative with respect to independent variable x occurs only in the first degree.

General Solution:

Various forms of general solution are

$$\boxed{y \cdot e^{\int P\,dx} = \int \left(Q.e^{\int P\,dx} \right) dx}$$

OR

$$\boxed{y = e^{-\int P\,dx} . \int \left(Q.e^{\int P\,dx} \right) dx + C}$$

OR

$$\boxed{y \times (I.F) = \int Q(I.F)dx + C}$$

where $e^{\int P dx}$ Integrating Factor(I.F)

Bernoulli Differential Equations:

Definition:

An ordinary differential equation is called a Bernoulli differential equation if it is of the form, with n being real number

$$\boxed{y' + P(x)y = Q(x)y^n,}$$

General Solution:

Trick is to first convert Bernoulli into Linear diff equation.

Replace $u = y^{1-n}$

We get:

$$\boxed{\frac{du}{dx} - (n-1)P(x)u = -(n-1)Q(x).}$$

Now general solution is same as linear diff equation.