- The order of the differential equation is the order of thederivative of the highest order occurring in the differential equation.
- The degree of a differential equation is the degree of the highest order differential coefficient appearing in it subject to the condition that it can be expressed as a polynomial equation in derivatives.
- A solution in which the number of constants is equal to the order of the equation is called the general solution of a differential equation.
- Particular solutions are derived from the general solution by assigning different values to the constants of general solution.
- An ordinary differential equation (ODE) of order n is an equation of the form $F(x, y, y', \ldots, y^{(n)}) = 0$, where y is a function of x and y' denotes the first derivative of y with respect to x.
- An ODE of order n is said to be linear if it is of the form $a_n(x)y^{(n)} + a_{n-1}(x)\, y^{(n-1)} + \ldots + a_1(x)\, y' + a_0(x)\, y = Q(x)$
- If both m_1 and m_2 are constants, the expressions $(D - m_1)(D - m_2)\, y$ and $(D - m_2)(D - m_1)\, y$ are equivalent i.e. the expression is independent of the order of operational factors.
- A differential equation of the form $dy/dx = f(ax+by+c)$ is solved by writing $ax + by + c = t$.
- A differential equation, $M\,dx + N\,dy = 0$, is homogeneous if replacement of x and y by λx and λy results in the original function multiplied by some power of λ, where the power of λ is called the degree of the original function.
- Homogeneous differential equations are solved by putting $y = vx$.
- Linear equation are of the form of $dy/dx + Py = Q$, where P and Q are functions of x alone, or constants.
- Linear equations are solved by substituting $y = uv$, where u and v are functions of x.
- The general method for finding the particular integral of any function is $1/(D-\alpha)x = e^{\alpha x}\int Xe^{-\alpha x}dx$

Various methods of finding the particular integrals:

1. When $X = e^{ax}$ in $f(D)\, y = X$, where a is a constant

Then $1/f(D)\, e^{ax} = 1/f(a)\, e^{ax}$, if $f(a) \neq 0$ and

$1/f(D)\, e^{ax} = x^r/f^r(a)\, e^{ax}$, if $f(a) = 0$, where $f(D) = (D-a)^r f(D)$

2. To find P.I. when X = cos ax or sin ax

f (D) y = X

If $f(-a^2) \neq 0$ then $1/f(D^2)$ sin ax = $1/f(-a^2)$ sin ax

If $f(-a^2) = 0$ then $(D^2 + a^2)$ is at least one factor of $f(D^2)$

3. To find the P.I.when $X = x^m$ where $m \in N$

$f(D)\, y = x^m$

$y = 1/f(D)\, x^m$

4. To find the value of $1/f(D)\, e^{ax} V$ where 'a' is a constant and V is a function of x

$1/f(D) .e^{ax} V = e^{ax}.1/f(D+a). V$

5. To find 1/f (D). xV where V is a function of x

$1/f(D).xV = [x- 1/f(D). f'(D)]\, 1/f(D)\, V$

Some Results on Tangents and Normals:

1. The equation of the tangent at P(x, y) to the curve y= f(x) is Y – y = dy/dx .(X-x)

2. The equation of the normal at point P(x, y) to the curve y = f(x) isY – y = [-1/(dy/dx)].(X – x)

3. The length of the tangent = CP =y $\sqrt{[1+(dx/dy)^2]}$

4. The length of the normal = PD = y $\sqrt{[1+(dy/dx)^2]}$

5. The length of the Cartesian sub tangent = CA = y dy/dx

6. The length of the Cartesian subnormal = AD = y dy/dx

7. The initial ordinate of the tangent = OB = y – x.dy/dx