

IIT Delhi, Department of Mathematics
MAL335: Differential Equations

Minor-2

Max. Marks 25

Time: 1 hour

1. For $x > 0$, find all solutions of $x^2 y'' - xy' + y = x^2$ [6]
2. Determine the regular singular points and the corresponding indicial polynomials of [6]
- (a) $(1 - x^2)y'' - 2xy' + 2y = 0$,
(b) $(x^2 + x - 2)^2 y'' + 3(x + 2)y' + (x - 1)y = 0$,
(c) $xy'' + (1 - x)y' + y = 0$.
3. $3x^2 y'' + 5xy' + 3xy = 0$ has a solution $\phi(x) = x^{-\frac{2}{3}} [1 + \sum_{k=1}^{\infty} c_k x^k]$, ($x > 0$). [6]
Give the detailed computations of c_1, c_2, c_3 .
4. For $x > 0$, $x^2 y'' + 3xy' + (1 + x)y = 0$ has one solution $\phi_1(x) = \frac{1}{x} [1 + \sum_{k=1}^{\infty} \frac{(-1)^k}{(k)!} x^k]$. [7]
Give the detailed computations of the second solution ϕ_2 (valid near $x = 0$) such that ϕ_1, ϕ_2 are linearly independent.