5. Higher-Order Nonlinear Ordinary Differential Equations

1. $y'''_{xxx} = Ax^{\alpha}y^{\beta}$. *Emden–Fowler equation of the third-order.*

2. $y'''_{xxx} = ay^{-5/2} + by^{-7/2}$.

3. $y'''_{xxx} = f(y)$.

4. $yy'''_{xxx} = f(x)$.

5. $y''''_{xxxx} = Ay^{-5/3}$.

6. $y''''_{xxxx} = f(y)$.

7. $F\left(x, y'_x, y''_{xx}, \ldots, y^{(n)}_x\right) = 0$. *The equation does not depend on y explicitly.*

8. $F\left(y, y'_x, y''_{xx}, \ldots, y^{(n)}_x\right) = 0$. *Autonomous equation.*

9. $F\left(x, xy'_x - my, y^{(m+1)}_x, y^{(m+2)}_x, \ldots, y^{(n)}_x\right) = 0, \qquad m = 1, 2, \ldots, n-1.$

10. $F\left(x^k y^m, \dfrac{xy'_x}{y}, \dfrac{x^2 y''_{xx}}{y}, \ldots, \dfrac{x^n y^{(n)}_x}{y}\right) = 0$. *Generalized homogeneous equation.*

11. $F\left(e^{\alpha x}y^m, \dfrac{y'_x}{y}, \dfrac{y''_{xx}}{y}, \ldots, \dfrac{y^{(n)}_x}{y}\right) = 0.$

12. $F\left(x^m e^{\alpha y}, xy'_x, x^2 y''_{xx}, \ldots, x^n y^{(n)}_x\right) = 0.$

