1) What is ordinary differential Equation?

2) What is order of ordinary Differential Equation?

3) Linear / Non-linear O.D.E.

4) Homogeneous / Non-homogeneous O.D.E.

5) Examples related to Nomenclature of O.D.E.

6) Find out the order of the following O.D.E. and also check them for linearity and homogeneity.

(i) \( y'' - 5xy' = e^x + 1 \)

(ii) \( ty'' + t^2 y' - (e^{int}) y = t^2 - t + 1 \)

(iii) \( s^2 \frac{d^2t}{ds^2} + st \frac{dt}{ds} = s \)
(v) \[ 5 \left( \frac{d^4 b}{dp^4} \right)^5 + 7 \left( \frac{d b}{dp} \right)^{10} + 7 - b^5 = p \]

(v) \[ \frac{d^2 y}{dx^2} + 5 \left( \frac{dy}{dx} \right)^3 - 4y = e^x \]

(vi) \[ y'' - 2y' + y = 0. \]
(i) Order: 3
Linearity: Linear
Homogeneous: Non-homogeneous
\[ a_0 = 1, \quad a_1 = 0, \quad a_2 = 5, \quad a_3 = 0. \]

(ii) Order: 2
Linearity: Non-linear
Homogeneous: Non-homogeneous
\[ a_0 = t, \quad a_1 = t^2, \quad a_2 = \frac{(\sin t)}{t}. \]

(iii) Order: 2
Linearity: Non-linear
Homogeneous: Non-homogeneous
\[ a_0 = s^2, \quad a_1 = 3t, \quad a_2 = 0. \]

(iv) Order: 4
Linearity: Non-linear
Homogeneous: Non-homogeneous
\[ a_0 = 5 \left( \frac{d^4 b}{dx^4} \right)^4, \quad a_1 = p, \quad a_2 = 0, \quad a_3 = 7b \left( \frac{d^3 b}{dx^3} \right)^3, \quad a_4 = b^6 - b^4. \]
(iv) Order: 2
Linear: Non-linear
Homogeneous: Non-homogeneous

\[ a_0 = 1 \]
\[ a_1 = 5 \left( \frac{\text{dy}}{dx} \right)^2 \]
\[ a_2 = -4 \]

(vi) Order: 2
Linear: Linear
Homogeneous: Homogeneous

\[ a_0 = 1 \]
\[ a_1 = -2 \]
\[ a_2 = 1 \]