Introduction

Linear Constant Coefficient Equations:

- dynamical systems;
- vibrating systems;
- linearized systems;
- part of the solution of multidimensional problems;
- ...

General form:

$$a_0 y + a_1 y' + a_2 y'' + a_3 y^{(3)} + \ldots + a_n y^{(n)} = q$$

where $a_0, a_1, \ldots, a_n$ are all constants but q can be any function of x.

Solution of the homogeneous equation:

Homogeneous equation:

$$a_0 y + a_1 y' + a_2 y'' + a_3 y^{(3)} + \ldots + a_n y^{(n)} = 0$$

Special solutions are $y = e^{\lambda x}$ provided that λ is a root of the characteristic polynomial:

$$a_0 + a_1 \lambda + a_2 \lambda^2 + a_3 \lambda^3 + \ldots + a_n \lambda^n = 0$$

If all roots $\lambda_1, \lambda_2, \ldots, \lambda_n$ are different, the *general* solution of the homogeneous equation is

$$y = C_1 e^{\lambda_1 x} + C_2 e^{\lambda_2 x} + \ldots + C_n e^{\lambda_n x}$$