



Solution of homogenous second order differential equations



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Solution of homogenous second order differential equations

The homogenous differential equations are in the following form:

$$ay'' + by' + cy = 0$$

So, to solve the above equation depend on the following auxillary :

$$am^2 + bm + c = 0$$

then m_1 and m_2 are the roots of the above equation.

1. If m_1 and m_2 are real **are not equal**

$$m_1 \neq m_2$$

then the general solution is as follows:

$$y = Ae^{m_1x} + Be^{m_2x}$$

Example:1

Find the general solution of the following second order differential equation:

$$y'' - 7y' + 12y = 0$$

2. If $m_1 = m_2$ and real numbers then the solution is as follows

$$y = e^{mx} (A + Bx)$$

Example:2

$$y'' + 6y' + 9y = 0$$

3. If the roots are complex ($m = a + ib$) then the solution is as follows:

$$y = e^{ax} (A \cos bx + B \sin bx)$$

Example:3

$$y'' - 2y' + 10y = 0$$

4. If the differential equation have the following form:

$y'' + n^2y = 0$, where n is constant and $m = \pm ib$ then the general solution is as follows:

$$y = A \cos bx + B \sin bx$$

Example:4

$$y'' + 16y = 0$$

5. If the differential equation have the following form:

$y'' - n^2y = 0$, where n is constant and $m = \pm a$ then the general solution is as follows:

$$y = A \cosh ax + B \sinh ax$$

Example 5:

$$y'' - 4y = 0$$