Solution of homogenouse second order differential equations

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The homogenouse differential equations are in the following form:

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

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

$a\,m^2 + bm + c = 0$

then m1 and m2 are the roots of the above equation.

1. **If m1 and m2 are real are not equal**

   $m1 \neq m2$

   then the general solution is as follows:

   $y = Ae^{m1x} + Be^{m2x}$

Example:1

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

y" - 7y' + 12y=0

2. **If m1 = m2 and real numbers then the solution is asd follows**

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

Example:2

y" + 6 y' + 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 equatioon 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" + 16 y = 0

5. **If the differential equatioon have the following form:**

   y" - n^2y = 0 , where n is constant and m = ±a ` then the general solution is as follows:
   y = A cosh ax + B sinh ax

   Example 5:

   y" - 4y = 0