Linear Homogeneous Equations of the 2nd order with constant coefficients

The general form

$$ay''(t) + by'(t) + cy(t) = 0, \qquad (1)$$

where a, b, c - constants.
To find the solution, solve the quadratic equation with unknown r:

$$ar^2 + br + c = 0. \qquad (2)$$

Sign of the discriminant $D = b^2 - 4ac$ of the equation (2)	Solutions r_1, r_2 of the quadratic equation (2)	Solution of the ODE (1)
$D > 0$	**two different real solutions** $r_1 \neq r_2,$ where $r_1 = \frac{-b+\sqrt{D}}{2a}$ and $r_2 = \frac{-b-\sqrt{D}}{2a}$	$y(t) = c_1 e^{r_1 t} + c_2 e^{r_2 t},$ where c_1, c_2 - constants
$D = 0$	**one repeated real solution** $r_1 = r_2 = r,$ where $r = \frac{-b}{2a}$	$y(t) = e^{rt} \cdot (c_1 + c_2 t) = c_1 e^{rt} + c_2 t e^{rt},$ where c_1, c_2 - constants
$D < 0$	**two complex conjugate roots** $r_{1,2} = \lambda \pm i\mu,$ where $\lambda = \frac{-b}{2a}$ and $\mu = \frac{\sqrt{-D}}{2a}$	$y(t) = e^{\lambda t} \cdot (c_1 \cos(\mu t) + c_2 \sin(\mu t)) = c_1 e^{\lambda t} \cos(\mu t) + c_2 e^{\lambda t} \sin(\mu t),$ where c_1, c_2 - constants