Suppose r is a root of the auxilary eqn

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

(*) $\Leftarrow$ $r = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Then $y = e^{rt}$ is a soln to

(**) $ay'' + by' + cy = 0$.

<u>Theorem</u>

(1) If $\Delta = b^2 - 4ac > 0$ then (*) has two distinct real roots r_1, r_2, $y_1 = e^{r_1 t}$, $y_2 = e^{r_2 t}$ are two linearly indept. solns to (**) & the general soln of (**) is

$$y = c_1 e^{r_1 t} + c_2 e^{r_2 t}, \text{ where}$$

c_1, c_2 are any constants.

(2) If $\Delta = b^2 - 4ac = 0$ then (*) has a double root

$$r = -b/2a,$$

$y_1 = e^{-\frac{b}{2a}t}$, $y_2 = t e^{-\frac{b}{2a}t}$ are two indept. solns of (**) & the general soln of (**) is

$$y = (c_1 + c_2 t) e^{-\frac{b}{2a}t},$$ where c_1, c_2 any constants.