Simple root: $x = r$

$$y = Ce^{rx}$$

Repeated root: $x = r \, (\text{mult } n)$

$$y = C_0 e^{rx} + C_1 x e^{rx} + \cdots + C_{n-1} x^{n-1} e^{rx}$$

Complex roots: $x = \alpha \pm \beta i$

$$y = C_1 e^{\alpha x} \sin(\beta x) + C_2 e^{\alpha x} \cos(\beta x)$$

Repeated complex roots: $x = \alpha \pm \beta i \, (\text{mult } n)$

$$\begin{aligned} y = {} & e^{\alpha x} \left(C_{0,1} \sin(\beta x) + C_{0,2} \cos(\beta x) \right) \\ & + x e^{\alpha x} \left(C_{1,1} \sin(\beta x) + C_{1,2} \cos(\beta x) \right) \\ & + \cdots + x^{n-1} e^{\alpha x} \left(C_{n-1,1} \sin(\beta x) + C_{n-1,2} \cos(\beta x) \right) \end{aligned}$$

To annihilate:	Use:
$y = x^n$	$A = D^{n+1}$
$y = e^{rx}$	$A = D - r$
$y = x^n e^{rx}$	$A = (D - r)^{n+1}$
$y = \sin(\beta x)$	$A = D^2 + \beta^2$
$y = x^n \sin(\beta x)$	$A = (D^2 + \beta^2)^{n+1}$
$y = x^n e^{\alpha x} \sin(\beta x)$	$A = \left((D - \alpha)^2 + \beta^2 \right)^{n+1}$