Complete solution

$CS = CF + PI$

1] $\frac{1}{f(D)} x e^{ax} = \frac{1}{f(a)} e^{ax}$

i] $\frac{1}{f(D)} e^{ax} = \frac{1}{f(a)} e^{ax}$

$f(a) = 0$ then $\frac{1}{f(D)} e^{ax} = x \frac{1}{f'(a)} e^{ax}$

$f'(a) = 0$ then $\frac{1}{f(D)} e^{ax} = x^2 \frac{1}{f''(a)} e^{ax}$

2] $\frac{1}{f(D)} x^n = [f(D)]^{-1} x^n$

$[f(D)]^{-1} = 1 - D + D^2 - D^3 + D^4 - - - - - -$

3] $\frac{1}{f(D^2)} \sin ax = \frac{1}{f(-a^2)} \sin ax$

$\frac{1}{f(D^2)} \cos ax = \frac{1}{f(-a^2)} \cos ax$

$f(-a^2)=0$ then $\frac{1}{f(D^2)} \sin ax = x \frac{1}{f'(-a^2)} \sin ax$

$f'(-a^2)=0$ then $\frac{1}{f(D^2)} \sin ax = x^2 \frac{1}{f''(-a^2)} \sin ax$

4] $\frac{1}{f(D)} e^{ax} \phi(x) = e^{ax} \frac{1}{f(D+a)} \phi(x)$

$\frac{1}{f(D)} e^{ax} X = e^{ax} \frac{1}{f(D+a)} X$

5] $\frac{1}{D+a} \phi(x) = e^{-ax} \int e^{ax} \phi(x)\, dx$

$\frac{1}{f(D)} x^n (\cos ax + i \sin ax) = \frac{1}{f(D)} x^n e^{iax}$

$= e^{iax} \frac{1}{f(D+ia)} x^n$

$\frac{1}{f(D)} x^n \sin ax =$ imag part of $e^{iax} \frac{1}{f(D+ia)} x^n$

$\frac{1}{f(D)} x^n \cos ax =$ real part of $e^{iax} \frac{1}{f(D+ia)} x^n$