$y'' - 3y' = 8e^{3x} + 4\sin x$

$\downarrow$

$m^2 - 3m = 0$

$m = 0, 3$

$y_1 = c_1 + c_2 e^{3x}$

$\curvearrowleft (D-3)\, e^{3x} = 0$

For y_p

$[D^2 - 2(0)D + (0^2+1)^2] \sin x$

$\curvearrowleft (D^2+1)\sin x$

$(D-3)(D^2+1)(D^2-3D)y = 0$

$3 \quad \pm i \quad 0, 3$

Ex 3 Solve $y'' + 3y' + 2y = 4x^2$

$\downarrow \quad m^2 + 3m + 2 = 0$

$m = -1, -2$

$y_c = c_1 e^{-x} + c_2 e^{-2x}$

For y_p $D^3(D^2 + 3D + 2)y = 0$

$\downarrow$

$0, 0, 0 \quad -1, -2$

$y = A + Bx + Cx^2 + Ee^{-x} + Fe^{-2x}$

D

$D^3 x^2 = 0$

U