$$y'' - 3y' = 8 \cdot e^{3x} + 4\sin x \qquad\qquad \text{Ex 3 Solve } \quad y'' + 3y' + 2y = 4x^2$$

Left side:

$$\downarrow$$

$$m^2 - 3m = 0$$

$$m = 0, 3$$

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

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

for y_p

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

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

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

$$\downarrow \qquad \downarrow \qquad \downarrow$$

$$3 \qquad \pm i \qquad 0,3$$

Right side:

$$m^2 + 3m + 2 = 0$$

$$\downarrow$$

$$m = -1, -2$$

$$\boxed{D^3 X^2 = 0}$$

Un...

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

For y_p

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

$$\downarrow$$

$$0,0,0 \qquad -1, -2$$

$$Y = A + Bx + Cx^2 + \boxed{E e^{-x} + F e^{-2x}}$$

match
some excluded
i.c.