Q4(a)

$y'' + y = e^x + x^2$

$y_1'' + y_1 = e^x$

$y_2'' + y_2 = x^2$

$y_1 = Ae^x$

$Ae^x = e^x \qquad A = \frac{1}{2}$

$y_1 = \frac{1}{2}e^x$

$y_2 = Ax^2 + Bx + C$

$2A + Ax^2 + Bx + C = x^2$

$A = 1 \quad B = 0 \quad C = -2$

$y_2 = x^2 - 2$

$y_p = y_1 + y_2 = \frac{1}{2}e^x + x^2 - 2$

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Q4(b)

$$y'' - y = e^x + x^2$$

$$y_1'' - y_1 = e^x$$

$$y_2'' - y_2 = x^2$$

$$y_1 = Ae^x$$

$$Ae^x - Ae^x = e^x \longrightarrow A = 1$$

$$y_1 = e^x$$

$$y_2 = Ax^2 + Bx + C$$

$$2A + Ax^2 + Bx + C = x^2$$

$$A = 1 \;, B = 0 \;, C = 2$$

$$y_2 = x^2 + 2$$

$$\boxed{y_p = e^x + x^2 + 2}$$