P.4 a)

$\dot{y}_1 = y_2 + u(t)$ ①

$\dot{y}_2 = 2y_1 + y_2 - u(t)$ ②

Find $\frac{Y_1(s)}{U(s)}$ and put it in form $\frac{1}{s+a}$?

$\downarrow \mathcal{L}$

$sY_1(s) = Y_2(s) + U(s)$ ①

$sY_2(s) = 2Y_1(s) + Y_2(s) - U(s)$ ②

① $Y_2(s) = sY_1 - U$

① $\xrightarrow{\text{sub in}}$ ② $s(sY_1 - U) = 2Y_1 + (sY_1 - U) - U$

$\Rightarrow s^2Y_1 - sU = 2Y_1 + sY_1 - U - U$

$s^2Y_1 - sY_1 - 2Y_1 = sU - 2U$

$$G(s) \frac{Y_1(s)}{U(s)} = \frac{s-2}{s^2 - s - 2}$$

b) ~~I'm assuming this question is asking for the transfer function in expanded partial-fraction form.~~

$$G(s) = \frac{s-2}{(s+1)(s-2)} = \frac{A}{s+1} + \frac{B}{(s-2)}$$

$s - 2 = As - 2A + Bs + B$

$1 = A + B \Rightarrow B = 1 - A$

$-2 = -2A + B \Rightarrow -2 = -2A + 1 - A$

$-3 = -3A$

$A = 1$

$$G(s) = \frac{1}{s+1}$$

easier than I thought...