SOLUZIONE

a)
$$Y(s) = G(s)\frac{1}{s} = 4\frac{1-s}{(s+2)(s+1)}\frac{1}{s} = \frac{A}{s} + \frac{B}{s+2} + \frac{C}{s+1} =$$
$$= \frac{A(s^2+3s+2) + B(s^2+s) + C(s^2+s)}{s(s+2)(s+1)}$$

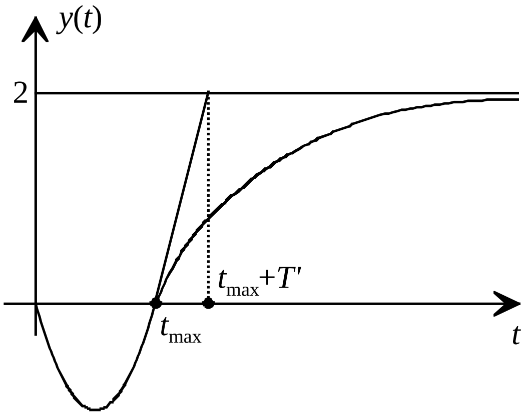
$$\begin{cases} A+B+C=0 \\ 3A+B+2C=-4 \\ 2A=4 \end{cases} \Rightarrow \begin{cases} A=2 \\ B=6 \\ C=-8 \end{cases}$$

$$Y(s) = \frac{2}{s} + \frac{6}{s+2} + \frac{-8}{s+1} \quad \Rightarrow \quad y(t) = \left(2 + 6e^{-2t} - 8e^{-t}\right)\mathrm{sca}(t)$$

b) $$\frac{dy(t)}{dt} = -12e^{-2t} + 8e^{-t}, \quad \frac{d^2y(t)}{dt^2} = 24e^{-2t} - 8e^{-t}$$

$$\frac{d^2y(t)}{dt^2} = 24e^{-2t} - 8e^{-t} = 0 \quad \Rightarrow \quad 24e^{-t} = 8 \quad \Rightarrow \quad e^{-t} = \frac{1}{3} \quad \Rightarrow \quad t_{\max} = \log 3$$

c) $$y(t_{\max}) = 2 + 6e^{-2\log 3} - 8e^{-\log 3} = 2 + 6e^{\log\frac{1}{9}} - 8e^{\log\frac{1}{3}} = 2 + \frac{6}{9} - \frac{8}{3} = 0 \quad \Rightarrow \quad \tau = t_{\max}$$



$$T = t_{\max} + T'$$

$$2 = T'\,\dot{y}(t_{\max}) \quad \Rightarrow \quad T' = \frac{2}{\dot{y}(t_{\max})}$$

$$\dot{y}(t_{\max}) = -12e^{-2\log 3} + 8e^{-\log 3} = \frac{4}{3} \quad \Rightarrow \quad T' = 2\frac{3}{4} = \frac{3}{2} \quad \Rightarrow \quad T = \log 3 + \frac{3}{2}$$