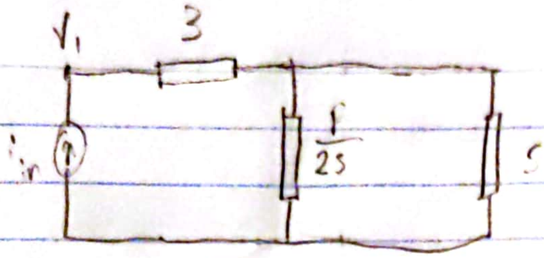
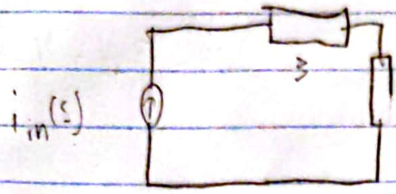
1.





$$\frac{(s)\left(\frac{1}{2s}\right)}{s+\frac{1}{2s}} = \frac{1}{\frac{2s^2+1}{2s}}$$

$$= \frac{2s}{2s^2+1}$$

$$\frac{\frac{2s}{2s^2+1}}{3+\frac{2s}{2s^2+1}} = \frac{(2s)\quad(1)}{(2s^2+1)\left(\frac{3(2s^2+1)+2s}{2s^2+1}\right)}$$

$$V_{out}(s) = \frac{2s}{6s^2+2s+3} V_{in}(s)$$

$$V_{out}(s) = \frac{2s}{6s^2+2s+3} I_{in}(s)$$

2. $R(s) = \frac{1}{s+1}$

$$Y(s) = \frac{8}{s^2+2s+5}\left(\frac{1}{s+1}\right)$$

$$= \frac{8}{(s+1)(s^2+2s+5)}$$

$$= \frac{A}{(s+1)} + \frac{Bs+C}{(s^2+2s+5)}$$

$$A = (s+1)F(s)\Big|_{s=-1} = \frac{8}{1^2-2+5} = 2$$

$$\frac{2}{s+1} + \frac{Bs+C}{s^2+2s+5} = \frac{8}{(s+1)(s^2+2s+5)}$$

$s=0$

$$2 + \frac{C}{5} = \frac{8}{5}$$

$s=1$ $\qquad C = -2$

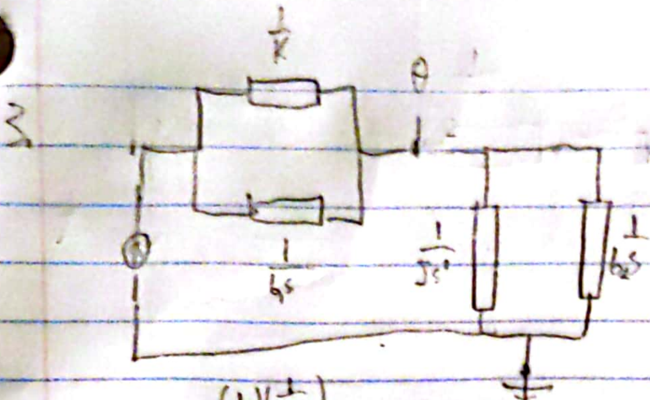
$$1 + \frac{B+C}{1^2+2+5} = \frac{8}{2(1+2+5)}$$

$$1 + \frac{B-2}{8} = \frac{1}{2}$$

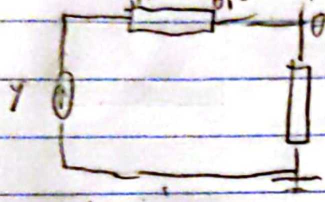
$B = -2$

$$Y(s) = \frac{2}{s+1} + \frac{-2s-2}{s^2+2s+5} = \frac{2}{s+1} - 2\frac{s-1}{(s+1)^2+4}$$

$$y(s) = 2e^{-t} - 2e^{-t}\cos(2t)$$



$$\frac{\left(\frac{1}{K}\right)\left(\frac{1}{b_1 s}\right)}{\frac{1}{K}+\frac{1}{b_1 s}} = \frac{1}{K+b_1 s} \cdot Y(s)$$

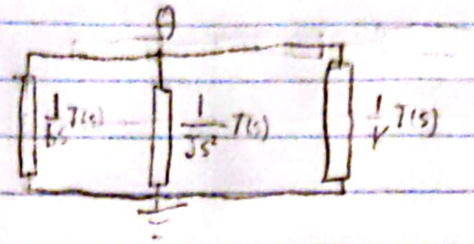


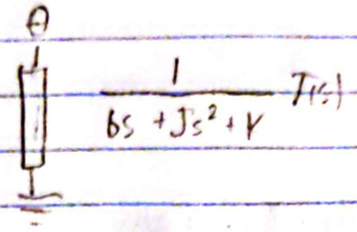
$$\frac{\left(\frac{1}{Js^2}\right)\left(\frac{1}{b_2 s}\right)}{\frac{1}{Js^2}+\frac{1}{b_2 s}} = \frac{1}{Js^2+b_2 s} T(s) = \theta(s)$$

$$Y(s) = \theta(s)(Js^2+b_2 s)$$

$$\frac{\theta(s)}{T(s)} = \frac{1}{Js^2+b_2 s}$$

4.





$$\theta(s) = \frac{T(s)}{bs + Js^2 + K}$$

$$\frac{\theta(s)}{T(s)} = \frac{1}{bs + Js^2 + K}$$

5.