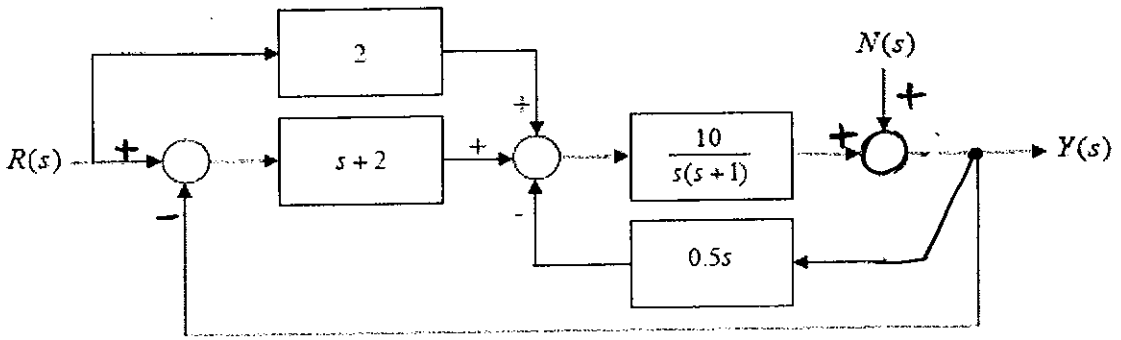
Quiz#2-ENSC383: Feedback Control Systems, Fall 2007

School of Engineering Science, Simon Fraser University

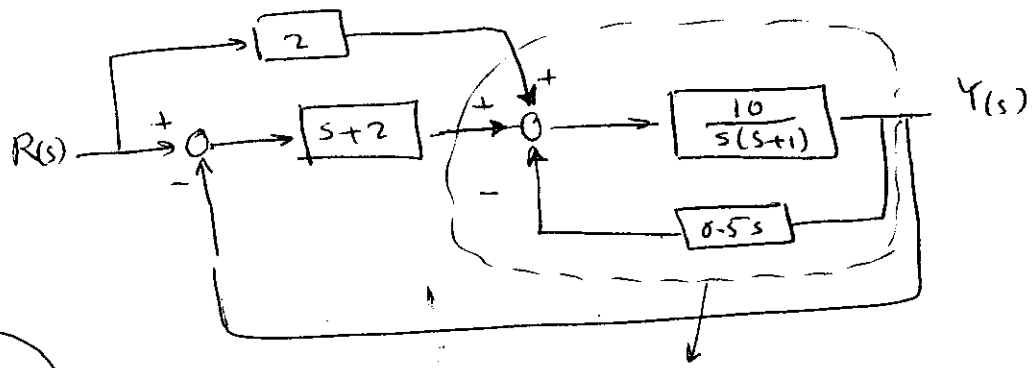
Name: _____

The block diagram of a feedback control system is shown in the following figure.

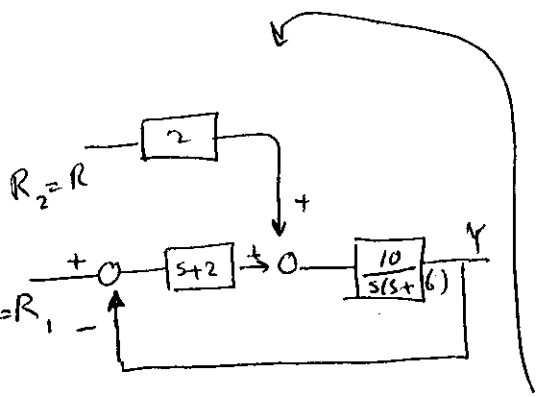


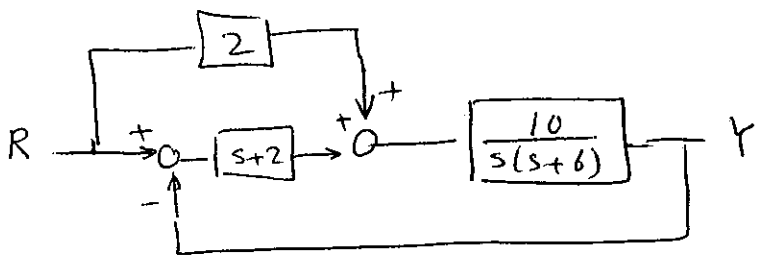
Find the following transfer functions: (a) $\left.\frac{Y(s)}{R(s)}\right|_{N(s)=0}$ (b) $\left.\frac{Y(s)}{N(s)}\right|_{R(s)=0}$

$N(s) = 0$



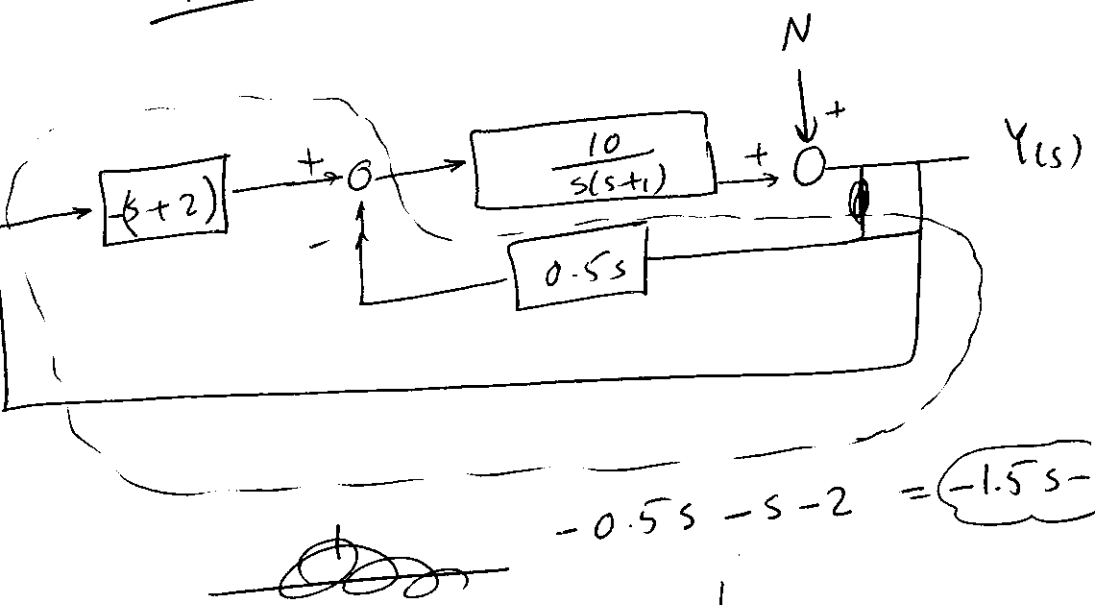
$$\frac{\frac{10}{s(s+1)}}{1+\frac{10\times 0.5}{s+1}} = \frac{10}{s^2+s+5} = \frac{10}{s(s+6)}$$



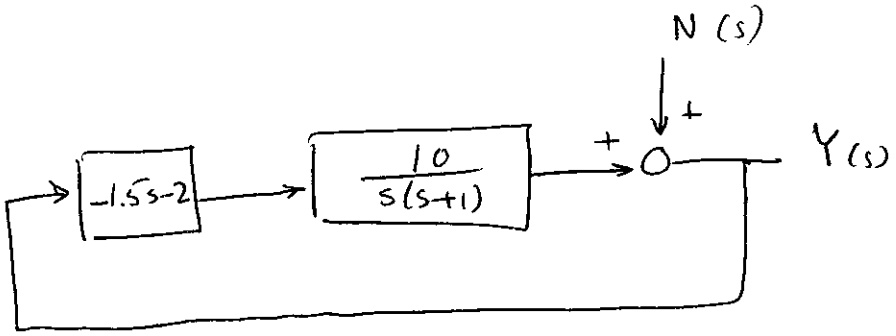


$$Y = \frac{\frac{10}{s(s+6)}(s+2)}{1+\frac{10(s+2)}{s(s+6)}} R_1 + \frac{2\times\frac{10}{s(s+6)}}{1+\frac{10(s+2)}{s(s+6)}} R_2 \Rightarrow \frac{Y}{R} = \frac{10(s+2)+20}{s^2+6s+10s+20} = \frac{10s+40}{s^2+16s+20}$$

$\frac{Y}{N} = ?$ when $R(s) = 0$



$-0.5s - s - 2 = -1.5s - 2$



$$\frac{Y}{N} = \frac{1}{1 + \frac{(1.5s+2)\,10}{s(s+1)}} = \frac{s(s+1)}{s^2 + s + 15s + 20}$$

$$= \frac{s(s+1)}{s^2 + 16s + 20}$$