Problem 1: Apply the gain formula to the SFG shown below to find the transfer functions of $\frac{Y_2}{Y_1}$.

Forward Path:

$M_1 = G_1 G_2 G_3 G_4 G_5, \quad \Delta_1 = 1$

$M_2 = G_6 G_3 G_4 G_5, \quad \Delta_2 = 1$

Loop:

$L_{11} = -G_2 H_1$

$L_{21} = -G_5 H_2$

$L_{31} = -G_1 G_2 G_3 G_4 G_5 H_3$

$L_{41} = -G_6 G_3 G_4 G_5 H_3$

$L_{12} = G_2 G_5 H_1 H_2$

$\frac{Y_2}{Y_1} = \frac{G_4 G_2 G_3 G_4 G_5 + G_3 G_4 G_5 G_6}{1 + G_2 H_1 + G_5 H_2 + G_6 G_3 G_4 G_5 H_3 + G_6 G_3 G_4 G_5 H_3 + G_2 G_5 H_1 H_2}$