

```

> restart :
> NODEvn :=  $\frac{Vn - Vin}{Rs} + \frac{Vn}{Ri} + \frac{Vn - Vout}{Rf} = 0$ 
      NODEvn :=  $\frac{Vn - Vin}{Rs} + \frac{Vn}{Ri} + \frac{Vn - Vout}{Rf} = 0$  (1)
> NODEout :=  $\frac{Vout - (-A \cdot Vn)}{Ro} + \frac{Vout - Vn}{Rf} + \frac{Vout}{Rl} = 0$ 
      NODEout :=  $\frac{Vout + A Vn}{Ro} + \frac{Vout - Vn}{Rf} + \frac{Vout}{Rl} = 0$  (2)
> solve( {NODEvn, NODEout}, [Vout, Vn])
[[ Vout = - (Ri Vin Rl ( -Ro + Rf A )) / (Ro Rf Ri + Rf Rl Rs + Ri Rf Rl + Rs Ri Rl A + Rf Ro Rs
+ Ro Rl Rs + Rl Rs Ri + Ro Rs Ri + Ro Rl Ri), Vn = (Ri Vin (Rf Rl + Ro Rl
+ Ro Rf)) / (Ro Rf Ri + Rf Rl Rs + Ri Rf Rl + Rs Ri Rl A + Rf Ro Rs + Ro Rl Rs + Rl Rs Ri
+ Ro Rs Ri + Ro Rl Ri) ]]
> Gain := (Rs, Ri, Rf, Rl, Ro, A) → - (Ri Rl ( -Ro + Rf A )) / (Ro Rf Ri + Rf Rl Rs + Ri Rf Rl
+ Rs Ri Rl A + Rf Ro Rs + Ro Rl Rs + Rl Rs Ri + Ro Rs Ri + Ro Rl Ri)
Gain := (Rs, Ri, Rf, Rl, Ro, A) → - (Ri Rl ( -Ro + Rf A )) / (Ro Rf Ri + Rf Rl Rs + Ri Rf Rl
+ Rs Ri Rl A + Ro Rf Rs + Ro Rl Rs + Rs Ri Rl + Ro Rs Ri + Ro Rl Ri) (4)
> Gain(Rs, Ri, Rf, Rl, Ro, A) #This is the equation for the closed loop gain!
- (Ri Rl ( -Ro + Rf A )) / (Ro Rf Ri + Rf Rl Rs + Ri Rf Rl + Rs Ri Rl A + Rf Ro Rs + Ro Rl Rs
+ Rl Rs Ri + Ro Rs Ri + Ro Rl Ri) (5)
> Gain(1e3, 1e9, 3e3, 10, 0, 1e9) #Substituting in some values gives the expected result.
-2.999999988 (6)
>

```