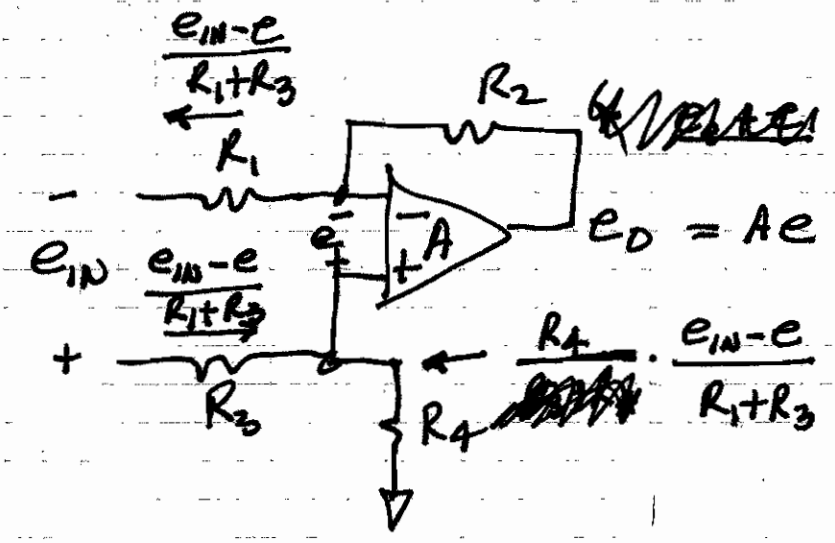
Differential Input Impedance with Finite Gain = A



$$e_o = \frac{R_4}{R_3} \cdot \frac{e_{IN}-e}{R_1+R_3} - e + \frac{e_{IN}-e}{R_1+R_3} R_2$$

$$e_o = \frac{R_2+R_4}{R_1+R_3} \cdot e_{IN} - e\left[1 + \frac{R_4+R_2}{R_1+R_3}\right]$$

$$e_o = \frac{R_2+R_4}{R_1+R_3} \cdot e_{IN} - \frac{e_o}{A}\left[\frac{R_1+R_2+R_3+R_4}{R_1+R_3}\right]$$

$$e_o\left[1 + \frac{R_1+R_2+R_3+R_4}{A(R_1+R_3)}\right] = \frac{R_2+R_4}{R_1+R_3} e_{IN}$$

$$e_o\left[\frac{A(R_1+R_3)+R_1+R_2+R_3+R_4}{A}\right] = (R_2+R_4)\, e_{IN}$$

$$\frac{e_o}{e_{IN}} = \frac{A(R_2+R_4)}{A(R_1+R_3)+R_1+R_2+R_3+R_4}$$

$$Z_{IN} = \frac{e_{IN} - e}{\frac{(R_1+R_3)}{}} = \frac{e_{IN} - \frac{e_o}{A}}{R_1+R_3}$$

$$Z_{IN} = \frac{e_{IN}}{(e_{IN} - e)} (R_1+R_3)$$

$$Z_{IN} = \frac{e_{IN}}{\left(e_{IN}\cdot 1 - \frac{e_o}{A}\right)} (R_1+R_3)$$

$$\frac{e_o}{A} = \frac{R_2+R_4}{A(R_1+R_3)+R_1+R_2+R_3+R_4} e_{IN}$$

$$Z_{IN} = \frac{e_{IN}(R_1+R_3)}{e_{IN}\,1 - \frac{(R_2+R_4)}{A(R_1+R_3)+R_1+R_2+R_3+R_4} e_{IN}}$$

$$Z_{IN} = \frac{\left[A(R_1+R_3)+R_1+R_2+R_3+R_4\right]\cdot(R_1+R_3)}{A(R_1+R_3)+R_1+R_2+R_3+R_4-(R_2+R_4)}$$

$$Z_{IN} = \frac{A(R_1+R_3)+R_1+R_2+R_3+R_4}{A+1}$$