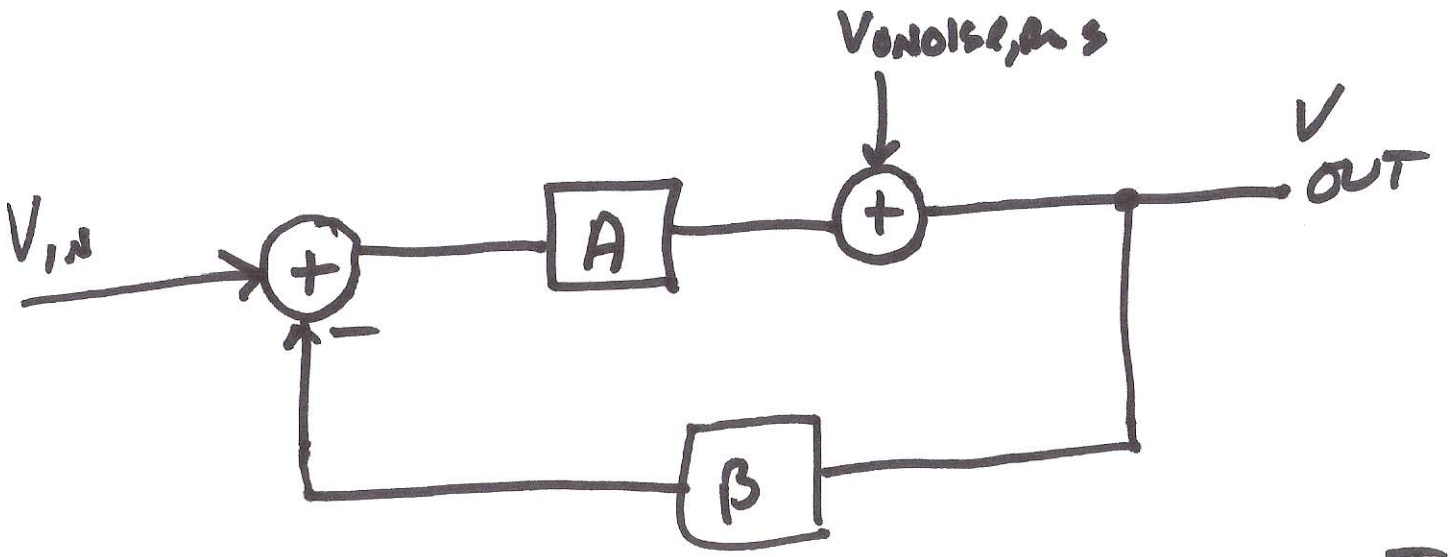
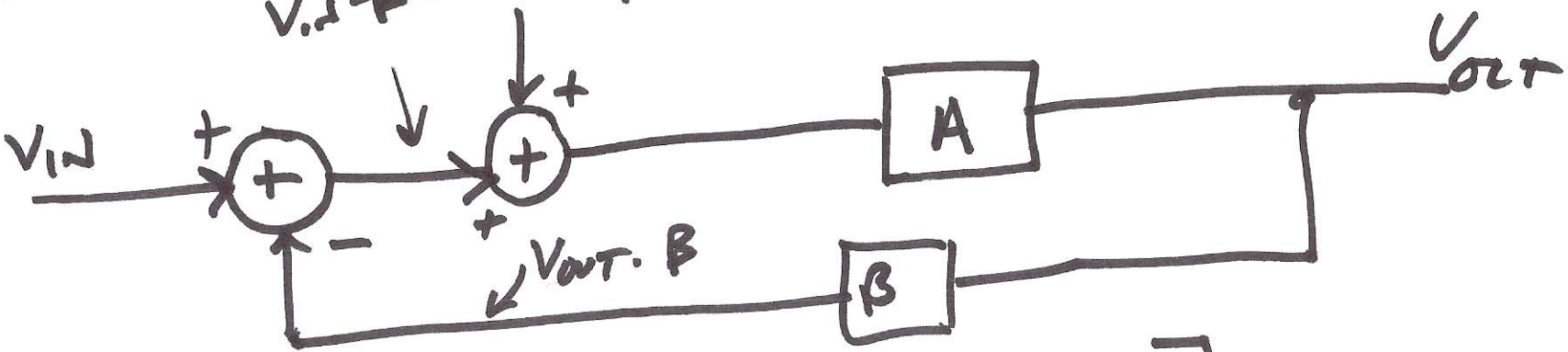


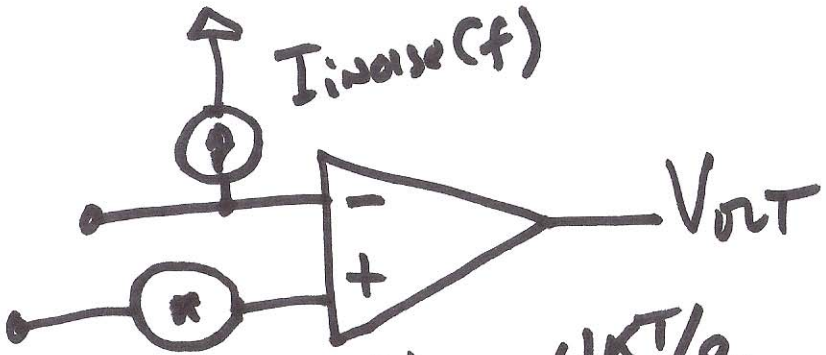
refer the noise back to the input of the amplifier

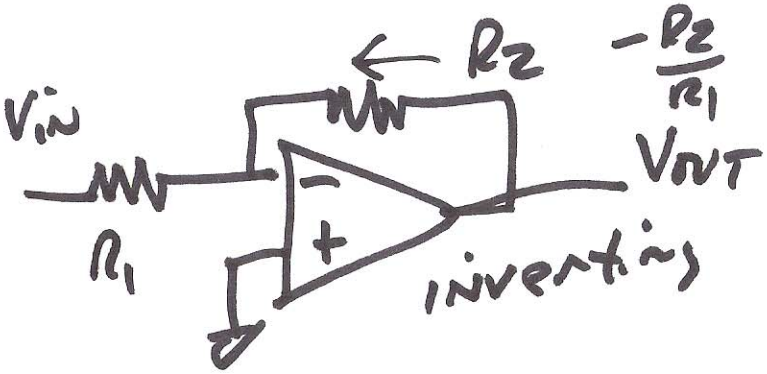
$$V_{n1-RMS} \; V_{NOISE,rms} = \frac{V_{NOISE,rms}}{A}$$

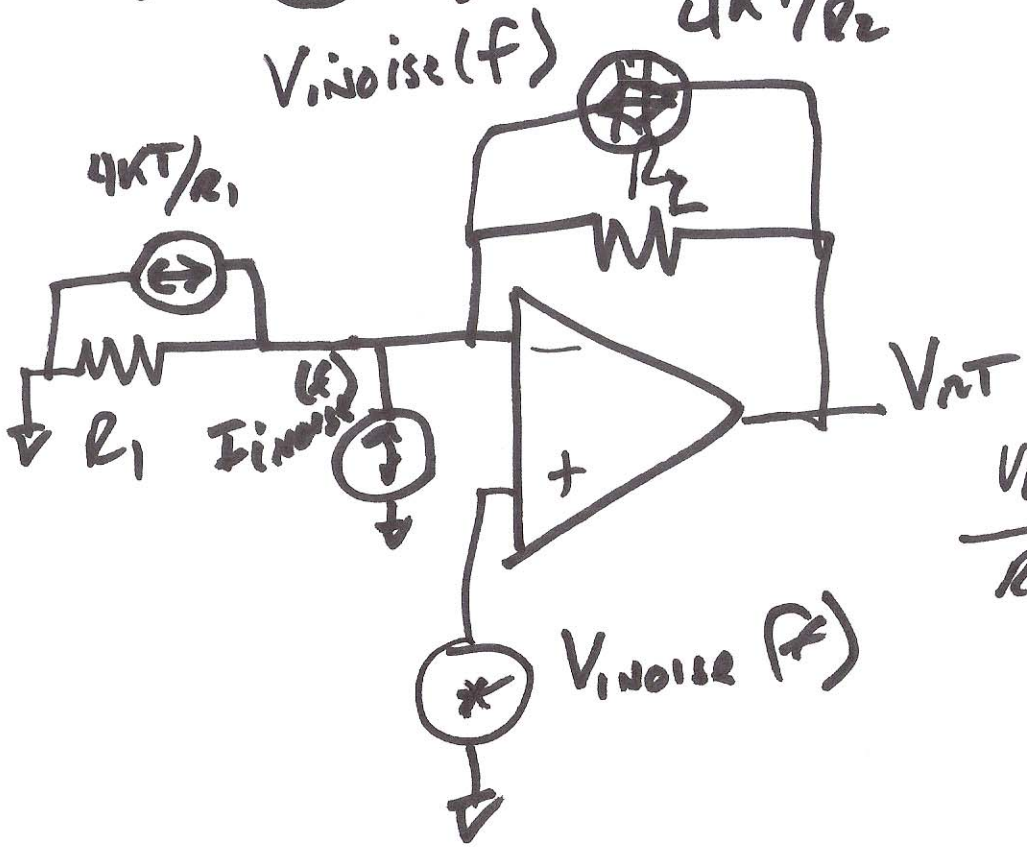


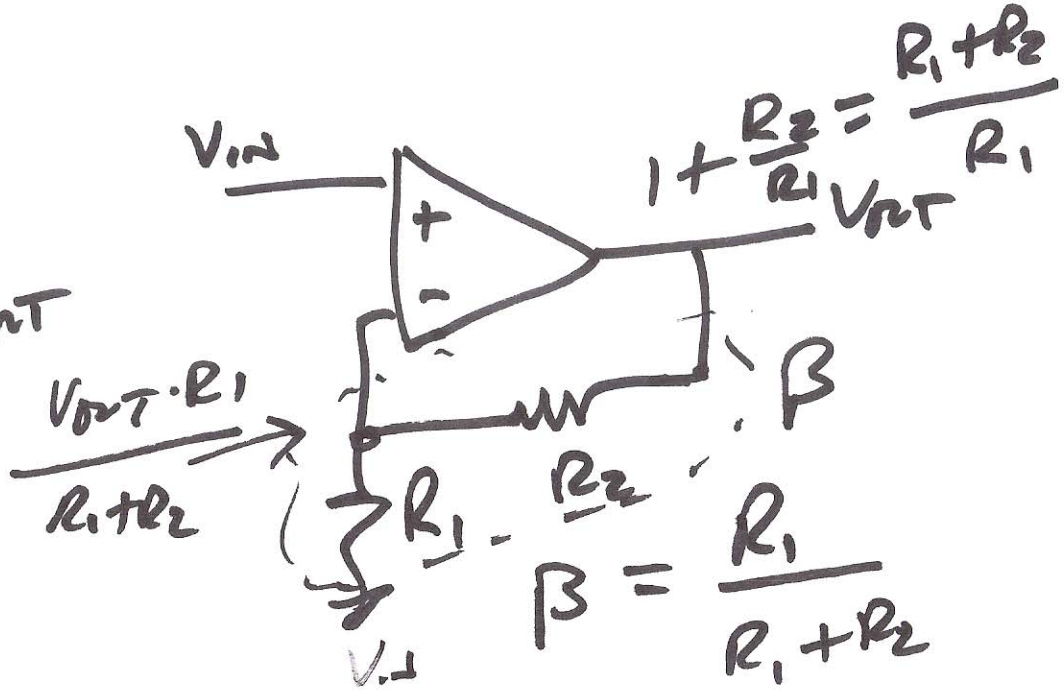
$$V_{DUT} = A \cdot \left[V_{INOISE,rms} + V_{IN} - \beta V_{OUT} \right]$$

$$V_{OUT} = \frac{A}{1+\beta A} \left(V_{IN} + V_{IN,NOISE} \right)$$









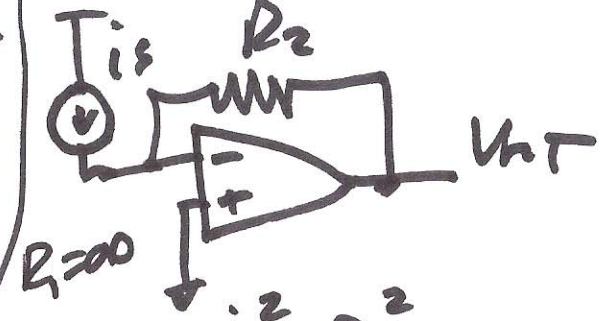
$$V^2_{OUT\,NOISE}(f) = V^2_{inoise}(f)\cdot\left(1+\frac{R_2}{R_1}\right)^2 + I^2_{inoise}(f)\,R_2^2 + \cancel{\quad}\cdot\frac{4KT}{R_1}\cdot R_2^2 + \frac{4KT}{R_2}\cdot R_2^2$$

$$V_{oNoise}^2(f) = V_{iNoise}^2(f) \cdot \left(1 + \frac{R_2}{R_1}\right)^2 +$$

$$I_{iNoise}^2(f) \cdot R_2^2 +$$

$$\frac{4KT}{R_1} \cdot R_2^2 +$$

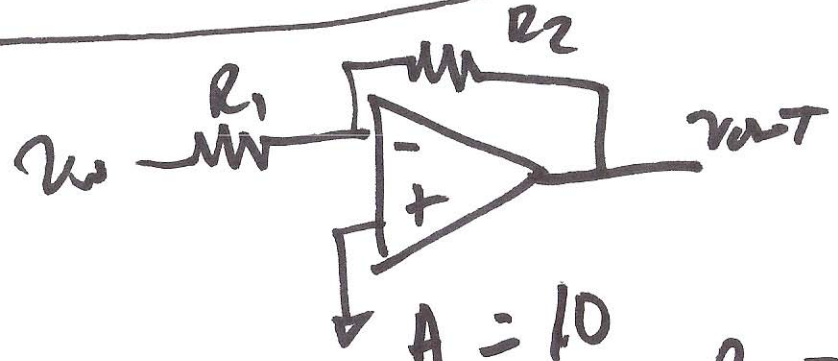
$$\frac{4KT}{R_2} \cdot R_2^2$$



$$SNR = \frac{i_s^2 \cdot R_2^2}{V_{iNoise}^2 + I_{iNoise}^2 R_2^2 + 4KTR_2}$$

TIA

we WANT big R_2



$$SNR = \frac{\left|\frac{R_2}{R_1}\right|^2}{V_{oNoise}^2(f)}$$

$R_2 = 10K$ $R_1 = 1K$ over $R_2 = 100K$ $R_1 = 10K$

See Sec. 30.2 for op-Amp BW

op-Amp's gain · BW $= f_{UW} = \left(1 + \frac{R_2}{R_1}\right) \cdot f_{3dB}$

$$NEB = \frac{\pi}{2} \cdot f_{UW} \cdot \frac{R_1}{R_1 + R_2}$$

$$V_{ONOISE\,RMS} = \sqrt{V^2_{ONOISE}(f) \cdot \frac{\pi}{2} \cdot f_{UW} \cdot \frac{R_1}{R_1 + R_2}}$$

↑ Low frequency value see fig.

Some ~~mistakes~~ comments

$V_{ONOISE,RMS} = 100\mu V$

$\overline{V^2} \neq 4KTR$

$\overline{V^2}$: number, V^2

$4KTR$: spectrum, $\frac{V^2}{Hz}$

$$V_R^2(f) = 4KTR = \frac{V_{RMS}^2}{f_{RES}} = \frac{\overline{V_2}}{\Delta f}$$

$\frac{\overline{V_2}}{\Delta f}$: NARROW band resolution of spectrum analyzer

$\frac{V_{RMS}^2}{f_{RES}}$

$$\int_{f_L}^{f_H} 4KTR\,df = 4KTRB$$

$4KTRB$: may be wideband spectrum analyzer

$B \neq f_{RES} \neq \Delta f$

27:04

5)