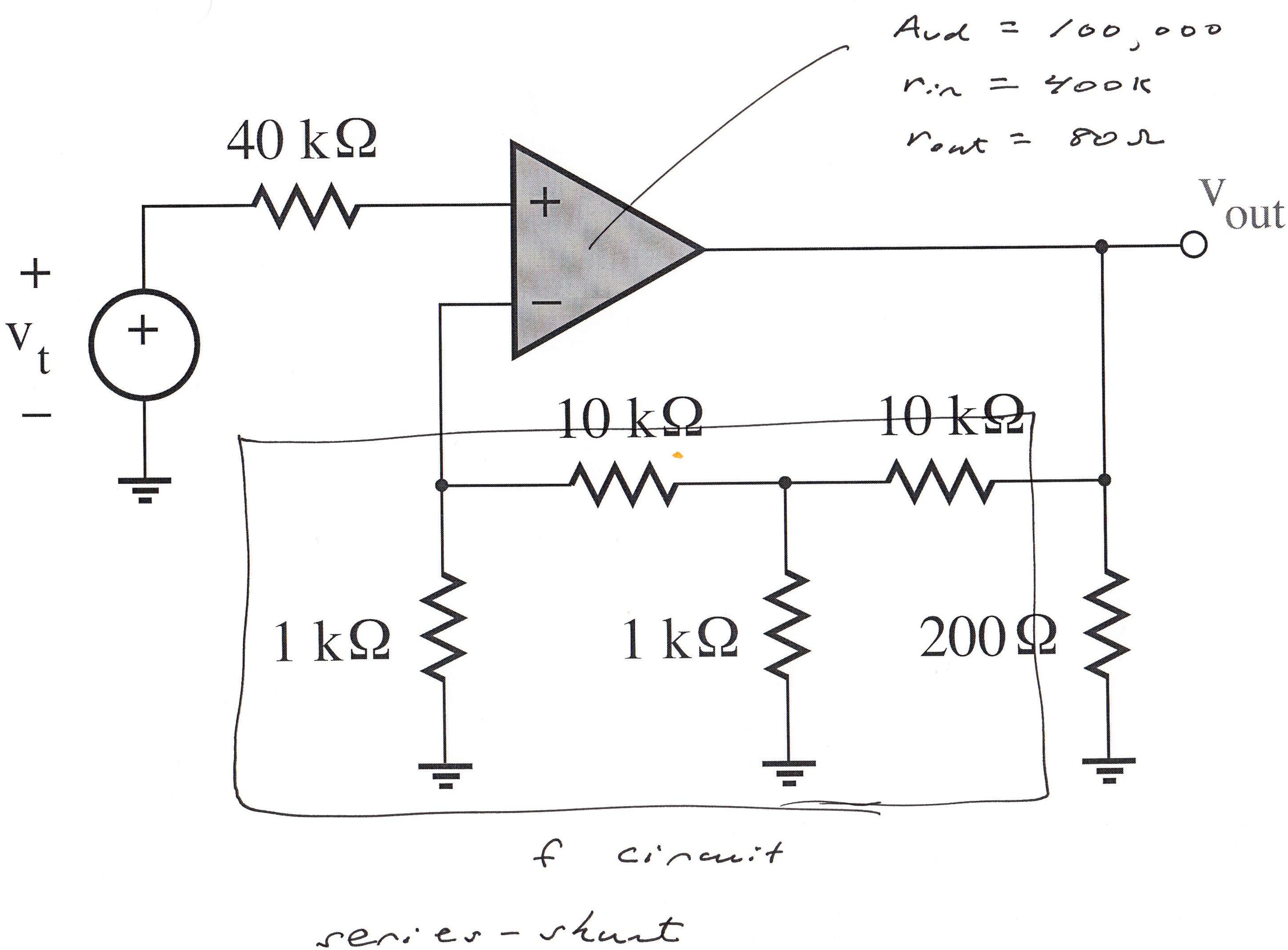
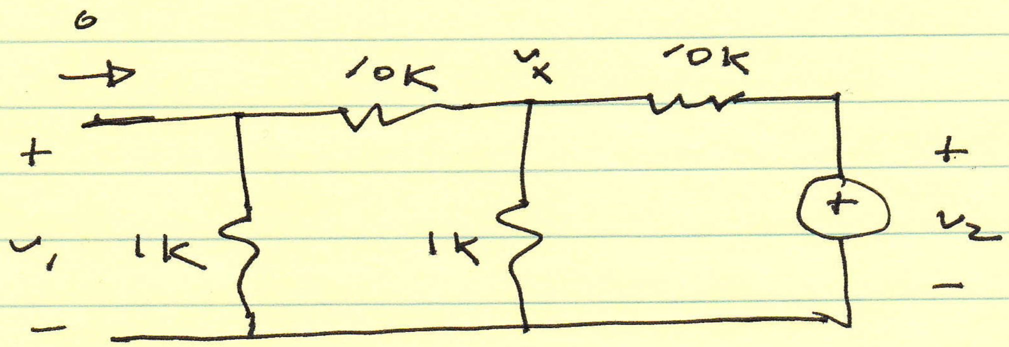
11.8


$A_{vd} = 100{,}000$
$r_{in} = 400k$
$r_{out} = 80\,\Omega$
40 kΩ
v_t
V_{out}
10 kΩ
10 kΩ
1 kΩ
1 kΩ
200 Ω
f circuit
series - shunt



$$f = \frac{v_1}{v_2} = \frac{v_1}{v_x}\,\frac{v_x}{v_2}$$

$$\frac{v_x}{v_2} = \frac{1K \,//\, 11K}{1K \,//\, 11K + 10K} = \frac{11}{131}$$

$$\frac{v_1}{v_x} = \frac{1K}{1K + 10K} = \frac{1}{11}$$

$$\longrightarrow \quad f = \frac{1}{131}$$

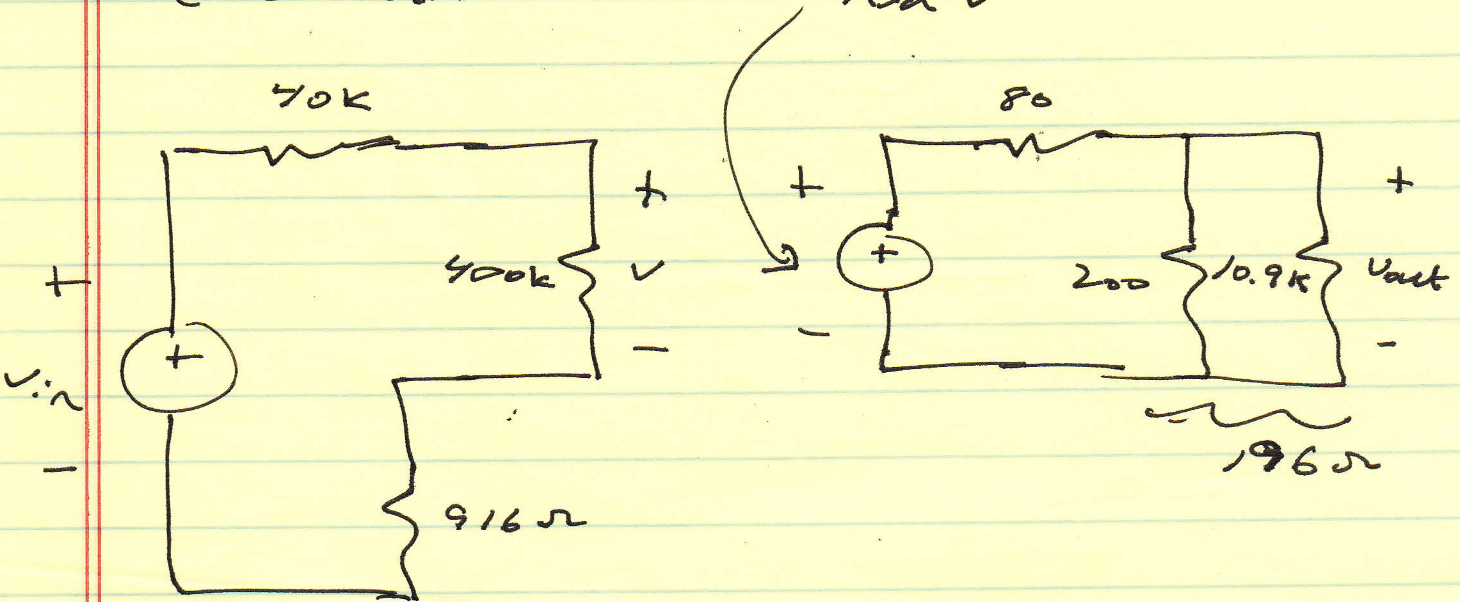
r_{left} (right side shorted)

$$= 1K \,//\, (10K + 1K \,//\, 10K) = 916\,\Omega$$

r_{right} (left side open)

$$= 10K + 1K \,//\, 11K = 10.9\,K$$

"a" circuit



$$a = \frac{v_{out}}{v_t} = \frac{400k}{40k + 400k + 0.916k} \times 100{,}000 \times \frac{196}{196 + 80}$$

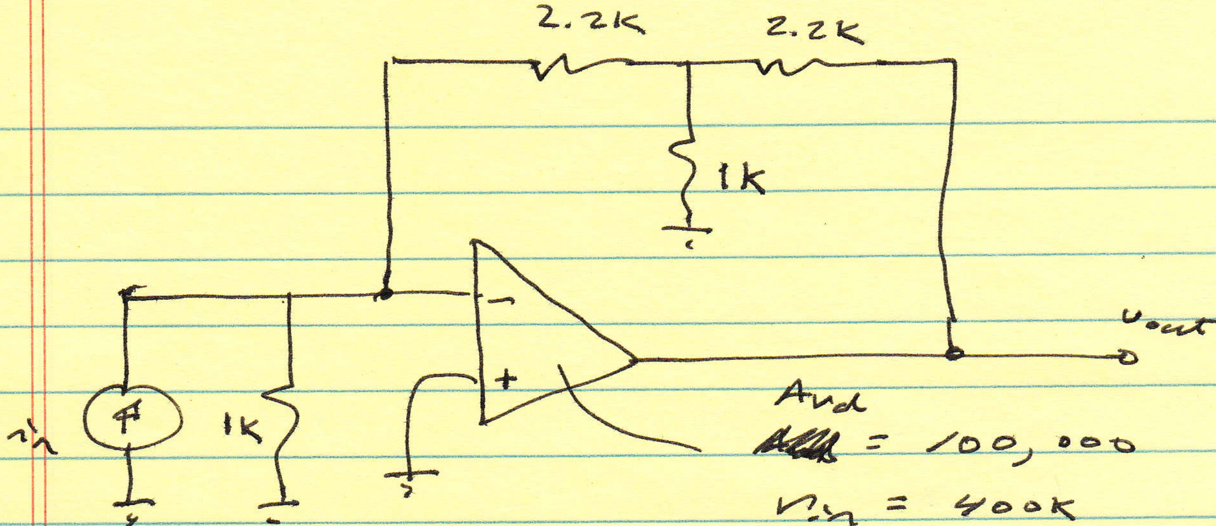
$$= 64{,}400$$

With feedback,

$$\frac{v_{out}}{v_t} = \frac{a}{1+af} = \frac{64{,}400}{1 + \frac{64{,}400}{131}}$$

$$= 130.7$$

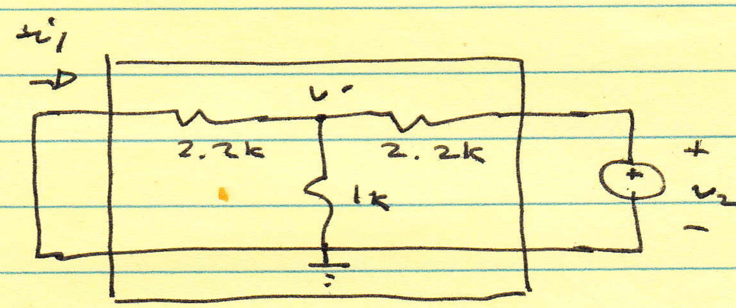
11.2.0



A_{vd} ~~[illegible]~~ $= 100{,}000$

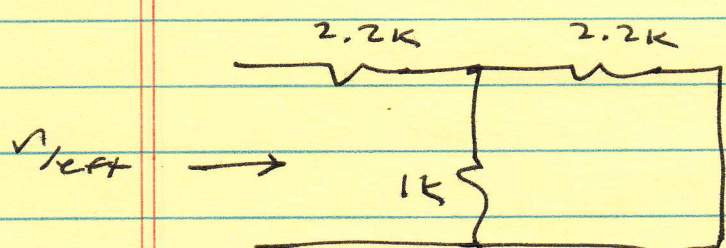
$r_{in} = 400k$

$r_{out} = 80\ \Omega$



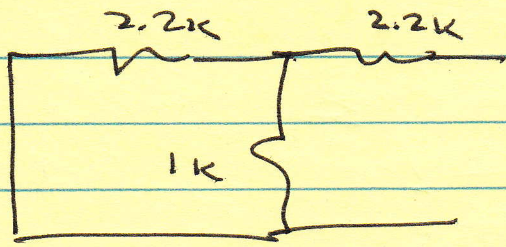
$$v' = v_2 \frac{2.2k \,//\, 1k}{2.2k // 1k + 2.2k} = 0.238\, v_2$$

$$f = \frac{i_1}{v_2} = \frac{-v'}{2.2k\, v_2} = -1.08 \times 10^{-4}\ \mho$$



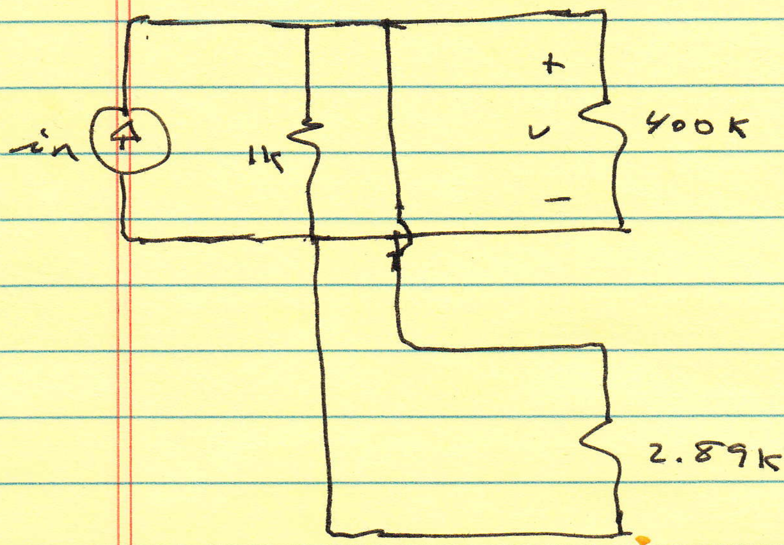
$r_{left} = 2.2k + 2.2k // 1k$

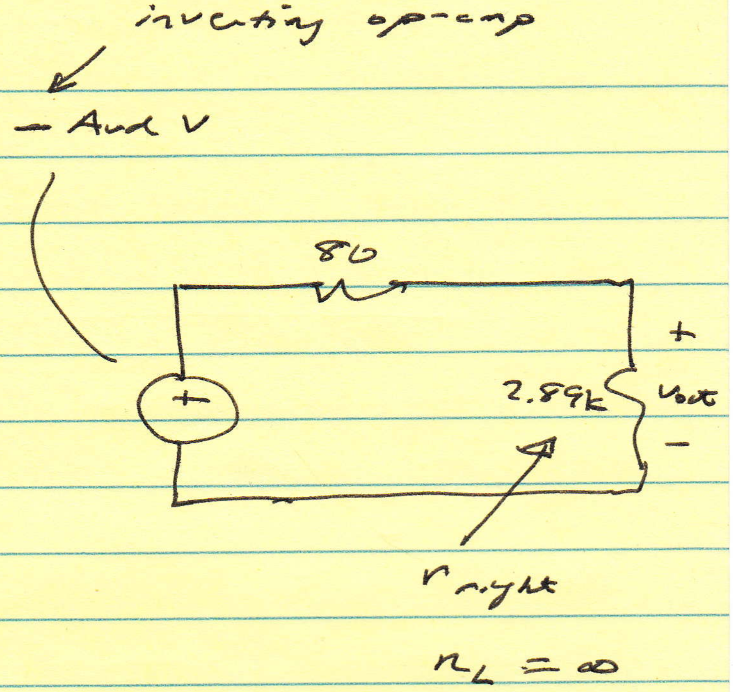
$= \cancel{[illegible]}$ 2.89k



$\leftarrow r_{right} = 2.89k$

"a" circuit





$$v_{out} = i_{in}\underbrace{(1k \,//\, 2.89k \,//\, 400k)}_{742\Omega}(-A_{vd})\left(\frac{2890}{80+2890}\right)$$

$$a = \frac{v_{out}}{i_{in}} = -7.22 \times 10^{7}\ \Omega$$

with feedback,

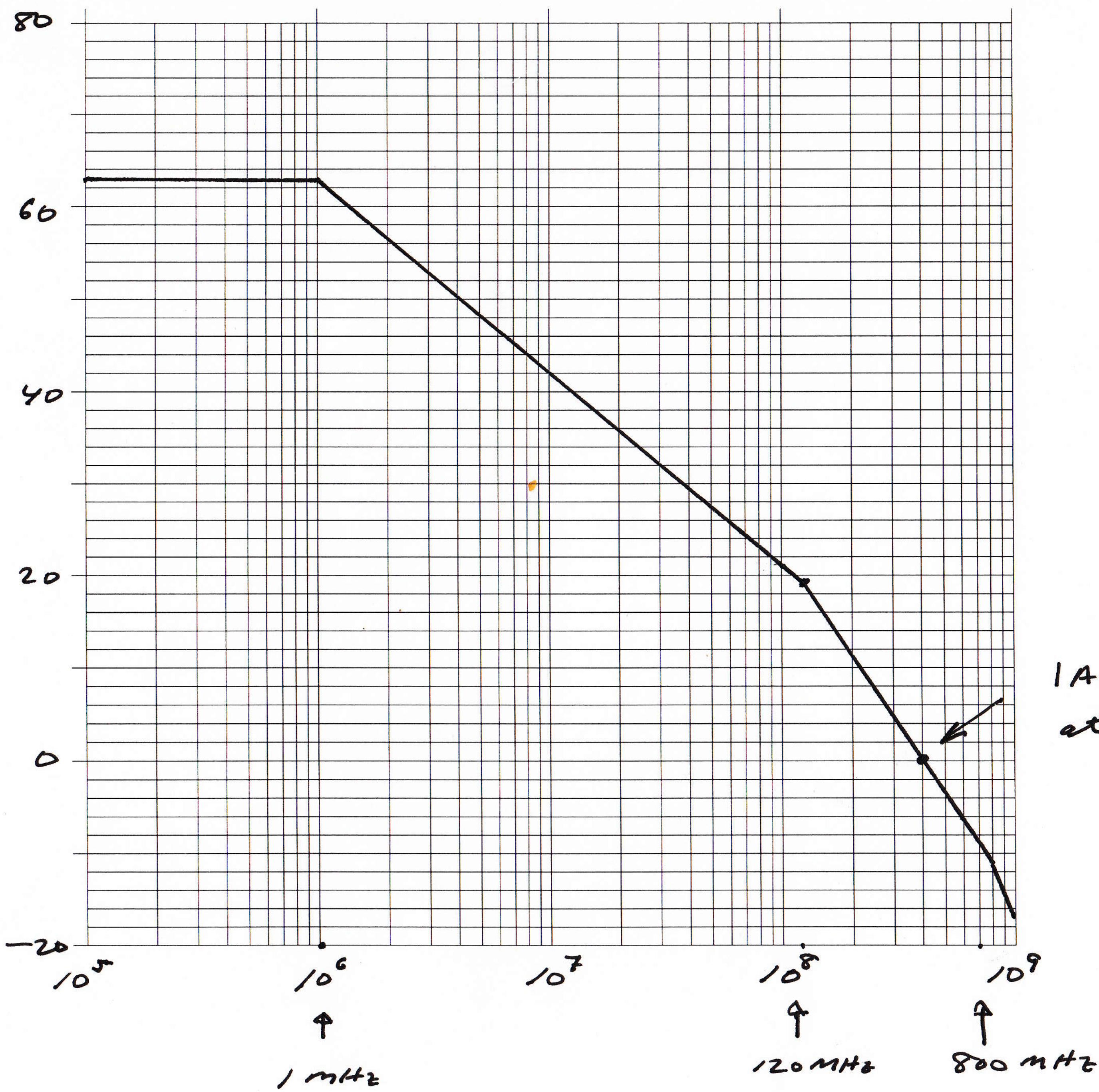
$$\frac{v_{out}}{i_{in}} = \frac{a}{1+af} = \frac{-7.22 \times 10^{7}\ \Omega}{1 + (-7.22\times10^{7})(-1.08\times10^{-4})}$$

$$= -9260\ \Omega$$

12.12

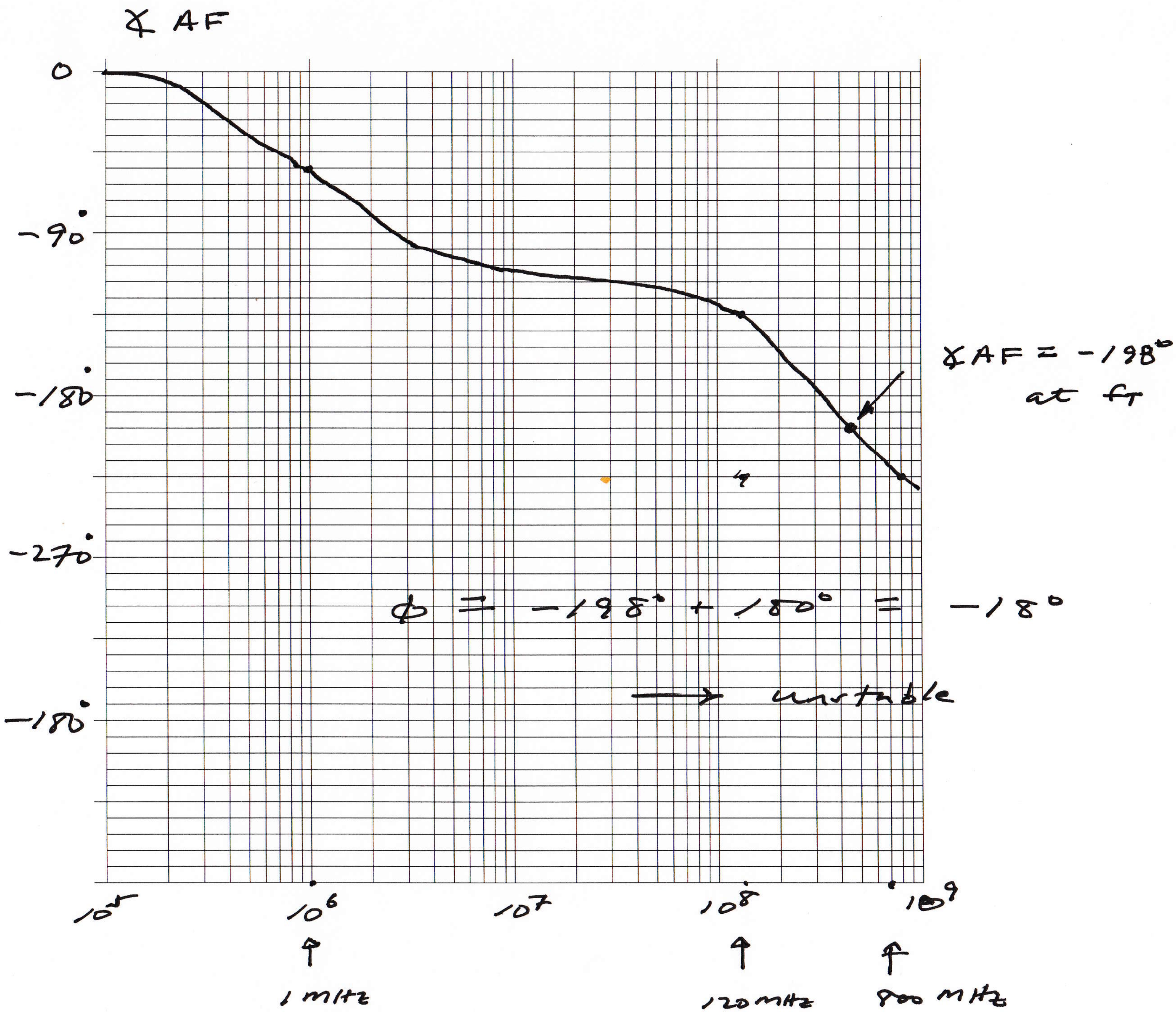
$A_0 = 1200 \qquad F = 1$

$|AF|_{dB} \qquad A_0 F = 1200 = 61.6\ dB$



$|AF| = 1$

at $f_T \approx 400$ MHz



∡ AF
0
-90°
-180°
-270°
-180°
10^5
10^6
10^7
10^8
10^9
1 MHz
120 MHz
800 MHz
∡ AF = -198° at f_T
Φ = -198° + 180° = -18°
→ unstable

12.70 $a_o = 40{,}000$

Let $F = 1$ (won't care)

$f_{p1} = 1\,MHz$, $f_{p2} = 40\,MHz$, $f_{p3} = 200\,MHz$

$\underline{\phi = 45^\circ}$

$\underline{\text{Add}}$ $f_{p0} = \frac{f_{p1}}{a_o F} = \underline{25\ Hz}$

$\underline{\phi = 70^\circ}$

Require $f_T = \overbrace{1\,MHz}^{f_{p1}} \tan(90^\circ - 70^\circ) =$ 364 kHz

Add $f_{p0} = \dfrac{364\,kHz}{\underbrace{40{,}000}_{a_o f} \cos(90^\circ - 70^\circ)}$

$= \underline{9.7\ Hz}$