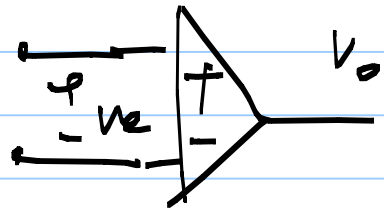
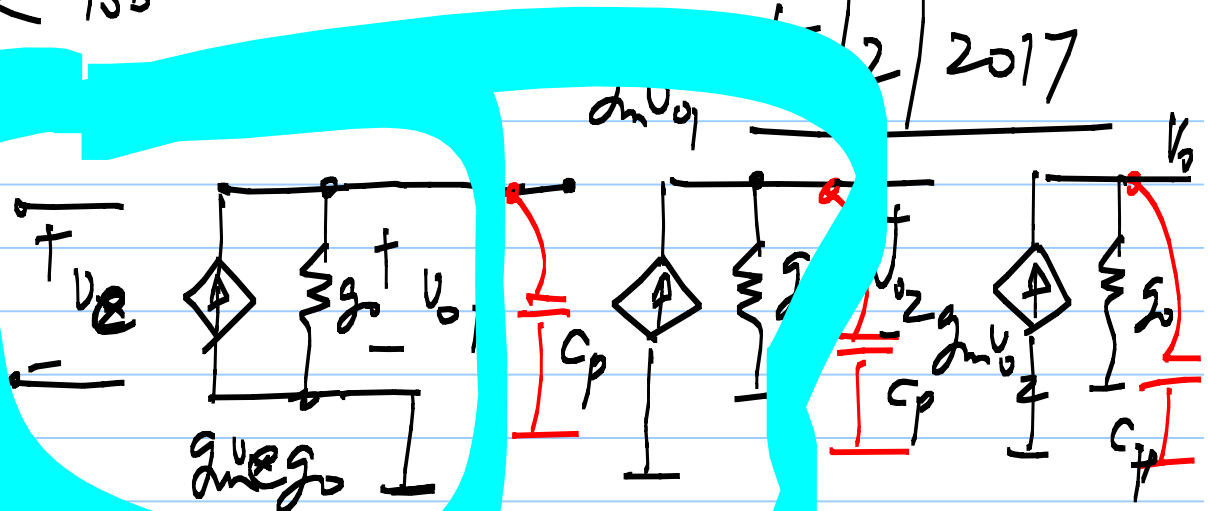
EE 209

$\frac{g_m}{g_o} < 100$



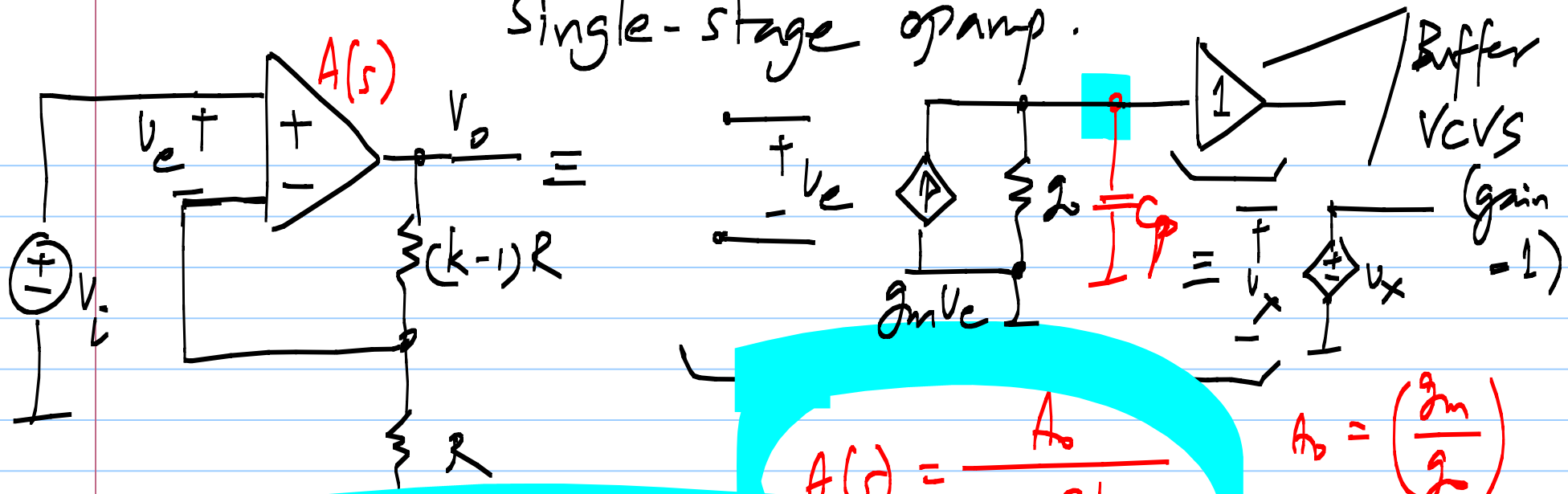


$$\frac{V_{o1}}{V_e} = \frac{g_m/g_o}{1 + s\frac{C_p}{g_o}} \qquad A_o \qquad \frac{1}{p_1}$$

$$\frac{V_{o2}}{V_e} = \frac{(g_m/g_o)^2}{(1 + s\,C_p/g_o)^2}$$

$$\frac{V_{o3}}{V_e} = \frac{(g_m/g_o)^3}{(1 + sC_p/g_o)^3}$$

Single-stage opamp.



$$A(s) = \frac{A_0}{1 + s/p_1}$$

$$A_0 = \left(\frac{g_m}{g_o}\right)$$

Closed-loop TF

$$\frac{V_o}{V_i} = \frac{k}{1 + \frac{k\left(1 + \frac{s}{p_1}\right)}{A_0}} = \frac{k}{1 + \frac{k}{A_0} + \frac{k}{A_0}\cdot\frac{s}{p_1}}$$

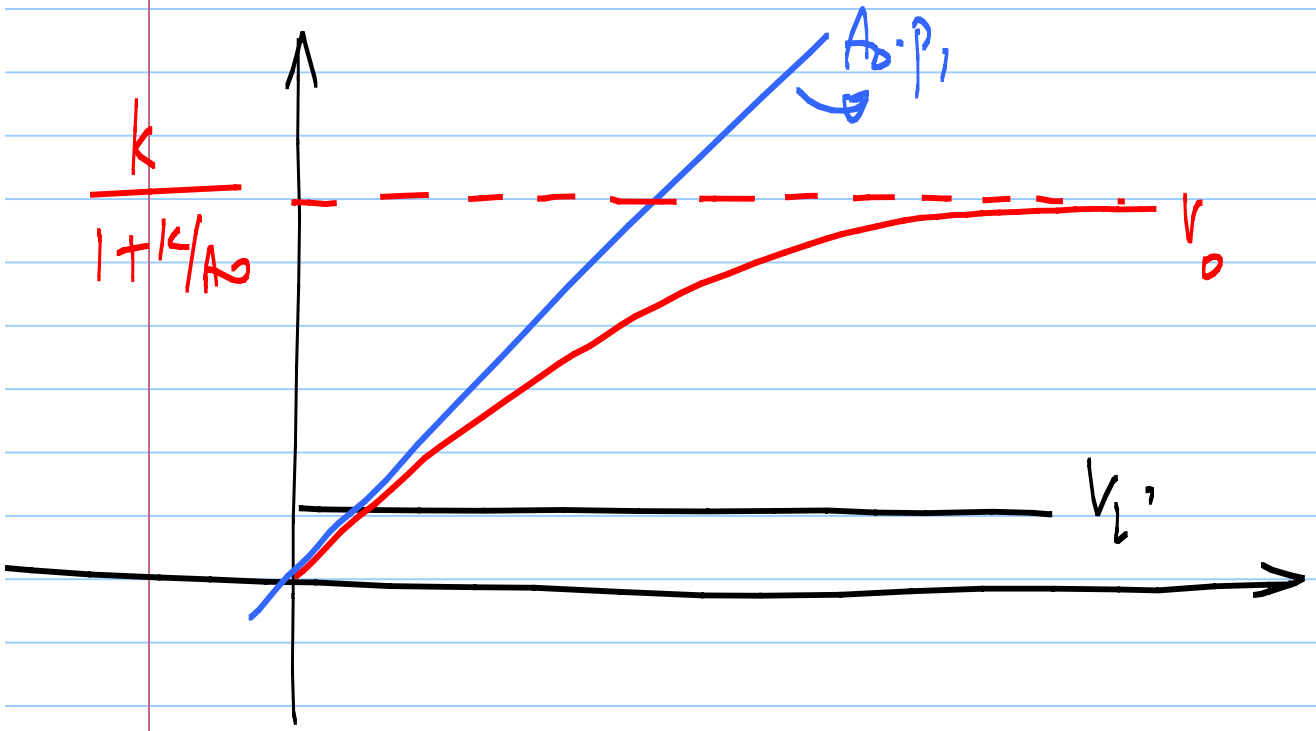
$$\frac{V_o}{V_i} = \frac{k}{1 + \frac{k}{A_0} + \frac{k}{A_0}\cdot\frac{s}{p_1}}$$

dc gain: $\frac{k}{1 + k/A_0}$

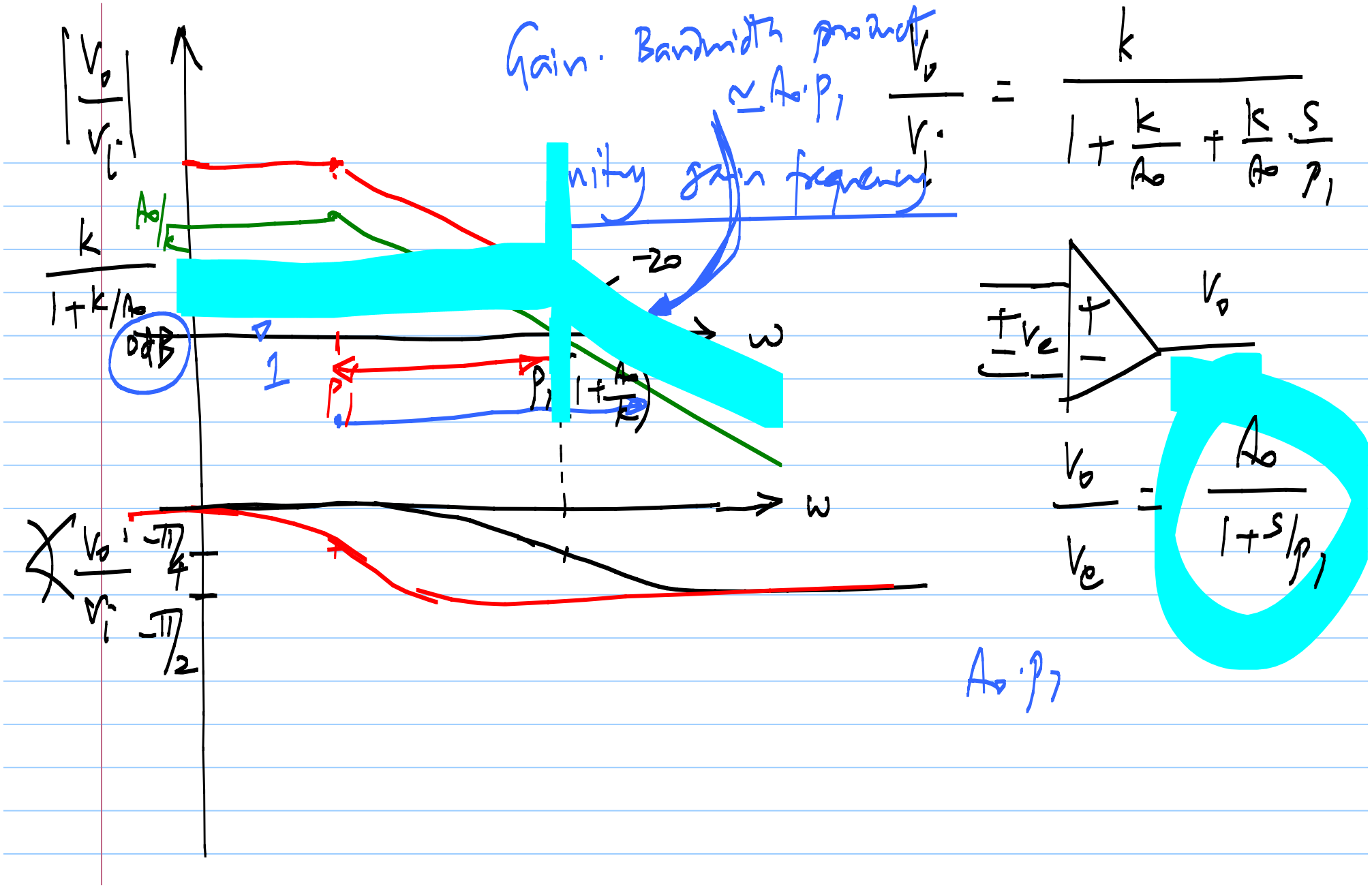
pole: $-p_1\left(1 + \frac{A_0}{k}\right) \simeq -p_1\cdot\frac{A_0}{k}$

$A_0 \gg k$

Unconditionally stable



$$\frac{k}{1+\frac{k}{A_0}}\left(1 - \exp\left(-\frac{t}{\tau}\right)\right)$$


Gain · Bandwidth product
$\simeq A_0 \cdot p_1$
$\frac{V_o}{V_i} = \frac{k}{1 + \frac{k}{A_0} + \frac{k}{A_0}\cdot\frac{s}{p_1}}$
unity gain frequency
$\left|\frac{V_o}{V_i}\right|$
A_0
$\frac{k}{1+k/A_0}$
0dB
-20
1
p_1
$p_1(1+\frac{A_0}{k})$
ω
$\angle\frac{V_o}{V_i}$
$-\pi/4$
$-\pi/2$
$\pm V_e$
V_o
$\frac{V_o}{V_e} = \frac{A_0}{1+s/p_1}$
$A_0 \cdot p_1$

$$\frac{k}{1+\frac{k}{A_0}}\left(1-\exp\left(-P_1\left(1+\frac{A_0}{k}\right)t\right)\right)$$