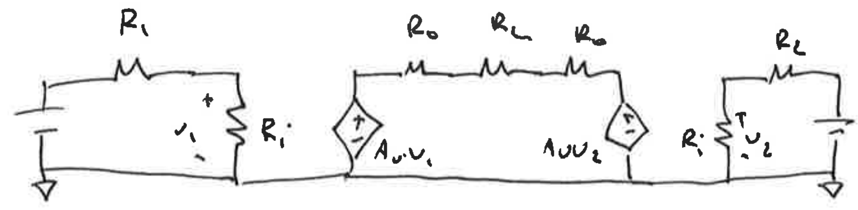
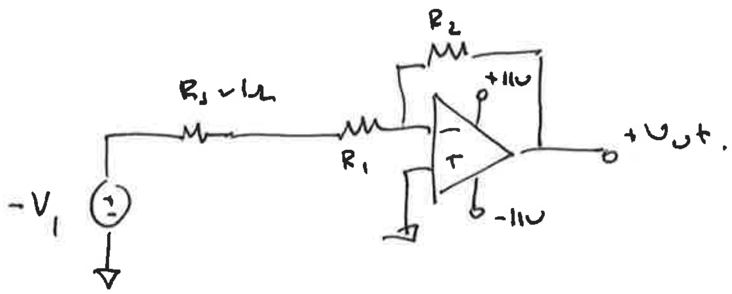
1)



a) $$V_L = \frac{R_o + R_L}{2R_o + R_L}\left(\frac{R_i}{R_i + R_1}\cdot V_1 - \frac{R_i}{R_i + R_2}\cdot V_2\right)$$

b) $R_i \to \infty$, $R_o \to 0 \Rightarrow V_L = A_v(V_1 - V_2)$

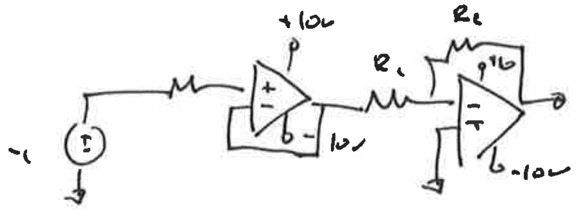
2)



Om $R_1 >> R_s$ (ex $R_1 = 1k\Omega$) blir R_s försumbar!

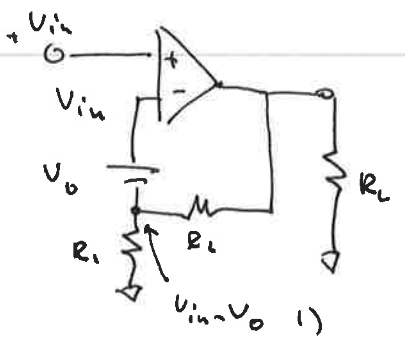
→ $U_{ut} = -\frac{R_2}{R_1}(-V_1) \Rightarrow$ $R_2 = 10k\Omega$, $R_1 = 1k\Omega$

alt.



med $R_1 = 1k\Omega$, $R_2 = 10k\Omega$

3)



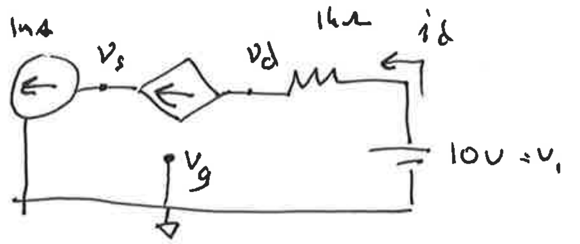
$$\boxed{\begin{matrix} V_n = V_p \\ i_n = i_p = 0 \end{matrix}}$$

KCL på 1) $$\frac{V_{in} - V_0}{R_1} + \frac{(V_{in} - V_0) - V_L}{R_2} = 0$$

$$V_{in} - V_0\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{V_L}{R_2}$$

$$\Rightarrow V_L = V_{in} - V_0\left(1 + \frac{R_2}{R_1}\right)$$

4) I mättnadsområdet



a) $V_d = 10 - i_d \cdot 10^3 =$

$= \underline{9V}$

Från kcl: $i_d = 1mA$

b) $i_d = K(V_g - V_s - V_T) \Rightarrow 10^{-3} = 10^{-3}(-V_s - 2) \Rightarrow \underline{\underline{V_s = -3V}}$

$V_g = 0V$, $V_T = 2V$

c) Mättnadsområdet: $V_{ds} \geq V_{gs} - V_T = 0 - (-3) - 2 = 1V$

$\Rightarrow V_d - V_s \geq 1V \Rightarrow V_d \geq 1 + V_s = \underline{\underline{-2V}}$

$V_d = \cancel{10} \; V_1 - i_d \cdot 10^3 = V_1 - 1 \Rightarrow \underline{\underline{V_1 \geq -1V}}$

5)

a)

A	B	C'	C
0	0	1	0
1	0	1	0
0	1	1	0
1	1	0	1

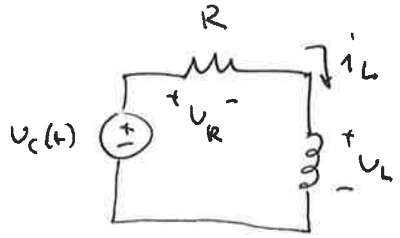
b) Om $V_{dd} = 0V \rightarrow \underline{\underline{V_c = 0V}}$

6) a)

(då $i_L = 0$)

$V_C = V_0(1 - e^{-t/\tau}),\ \tau = RC$ (vanlig RC-uppladdning)

b) Buffer →



KVL: $V_R + V_L = V_C \Rightarrow R\, i_L(t) + L\cdot\frac{di}{dt} = V_C \Rightarrow i_L' + \frac{i_L}{\tau} = \frac{V_C(t)}{L}$, $\tau = \frac{L}{R}$ ($= RC$)

$$\left(i(t)\cdot e^{t/\tau}\right)' = \frac{V_C(t)}{L}\cdot e^{t/\tau} = \frac{V_0}{L}\left(1 - e^{-t/\tau}\right)\cdot e^{t/\tau} = \frac{V_0}{L}\left(e^{t/\tau} - 1\right)$$

→ Integrera: $\left[i(t)\, e^{t/\tau}\right]_0^t = \frac{V_0}{L}\left[\tau e^{t/\tau} - t\right]_0^t =$

$$= i(t)e^{t/\tau} - \underbrace{i(0)}_{=0} = \frac{V_0}{L}\left(\tau e^{t/\tau} - t - \tau\right) \Rightarrow i(t) = \frac{V_0}{L}\cdot\left(\tau - (t+\tau)\cdot e^{-t/\tau}\right)$$

$$V_L(t) = L\cdot\frac{di}{dt} = V_0\cdot\frac{d}{dt}\left(\tau - (t+\tau)\cdot e^{-t/\tau}\right) = V_0\left(-e^{-t/\tau} - \frac{t}{\tau}\cdot e^{-t/\tau} + e^{-t/\tau}\right) =$$

$$= \underline{\underline{V_0\cdot\frac{t}{\tau}\cdot e^{-t/\tau}}}$$

c) $t \to \infty$: → ⇒ $V_C \to V_0$

$V_L \to 0$ (även från a och b)