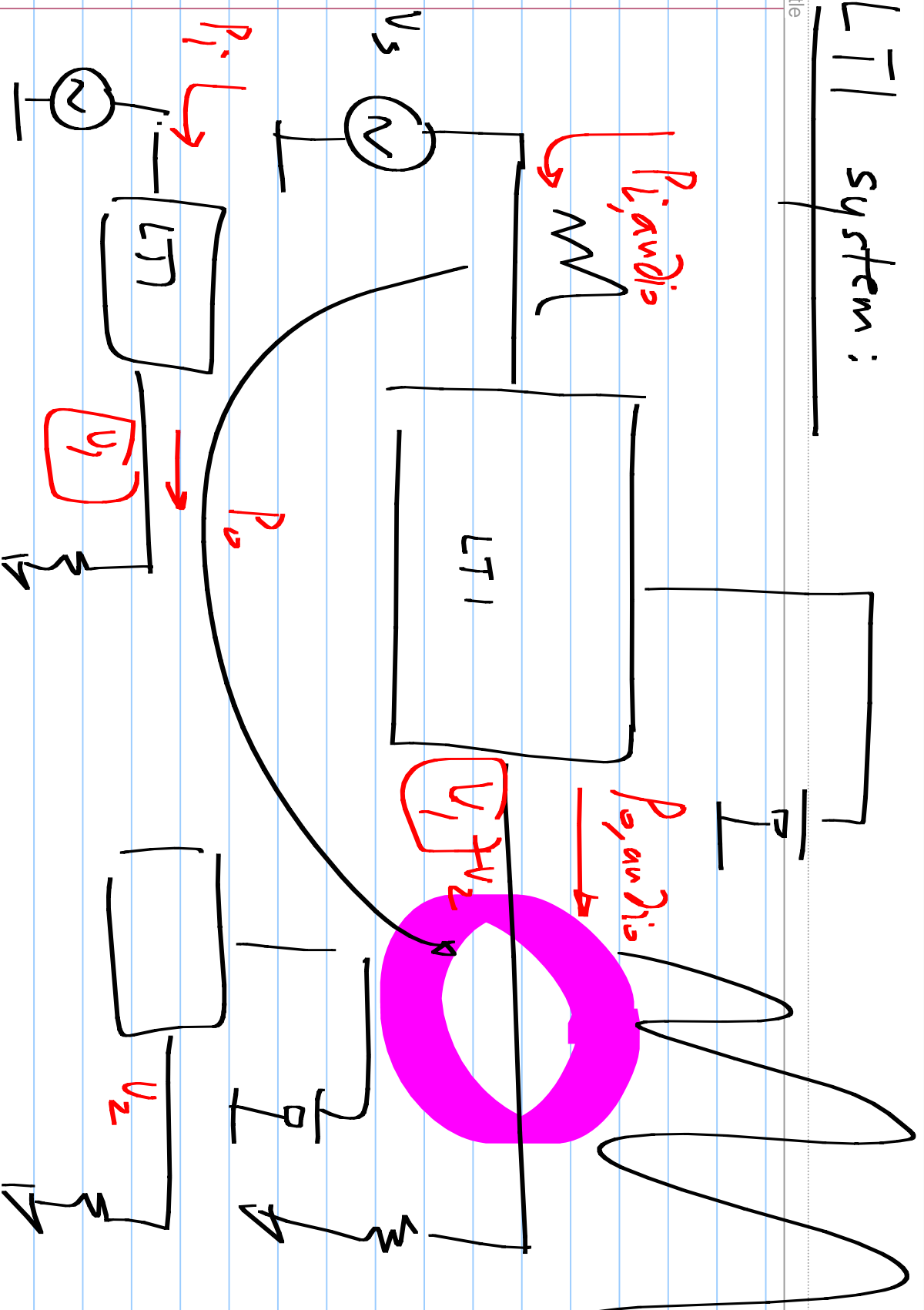


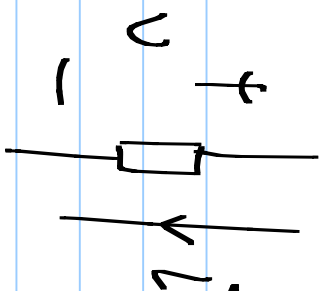
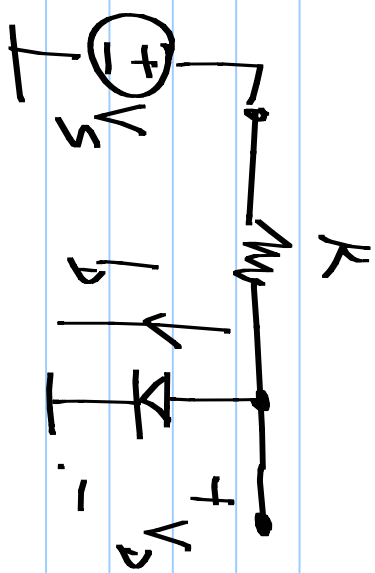
LT system:



Nonlinear circuits:

- necessary for amplifiers (convert power from the dc source to the signal frequency)

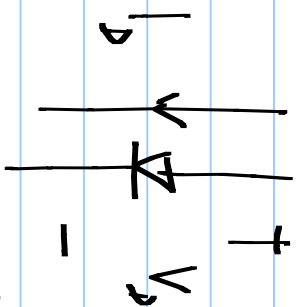
Need to analyze nonlinear circuits



$$I = \frac{V}{R}$$

$$v = g(\dot{v})$$

$$i = f(v)$$



$$I_D = I_s \left[\exp\left(\frac{V_D}{V_T}\right) - 1 \right]$$

Saturation current

$$\frac{kT}{q}$$

$$k: 1.38 \times 10^{-23} \text{ J/K}$$

$$T: 300 \text{ K}$$

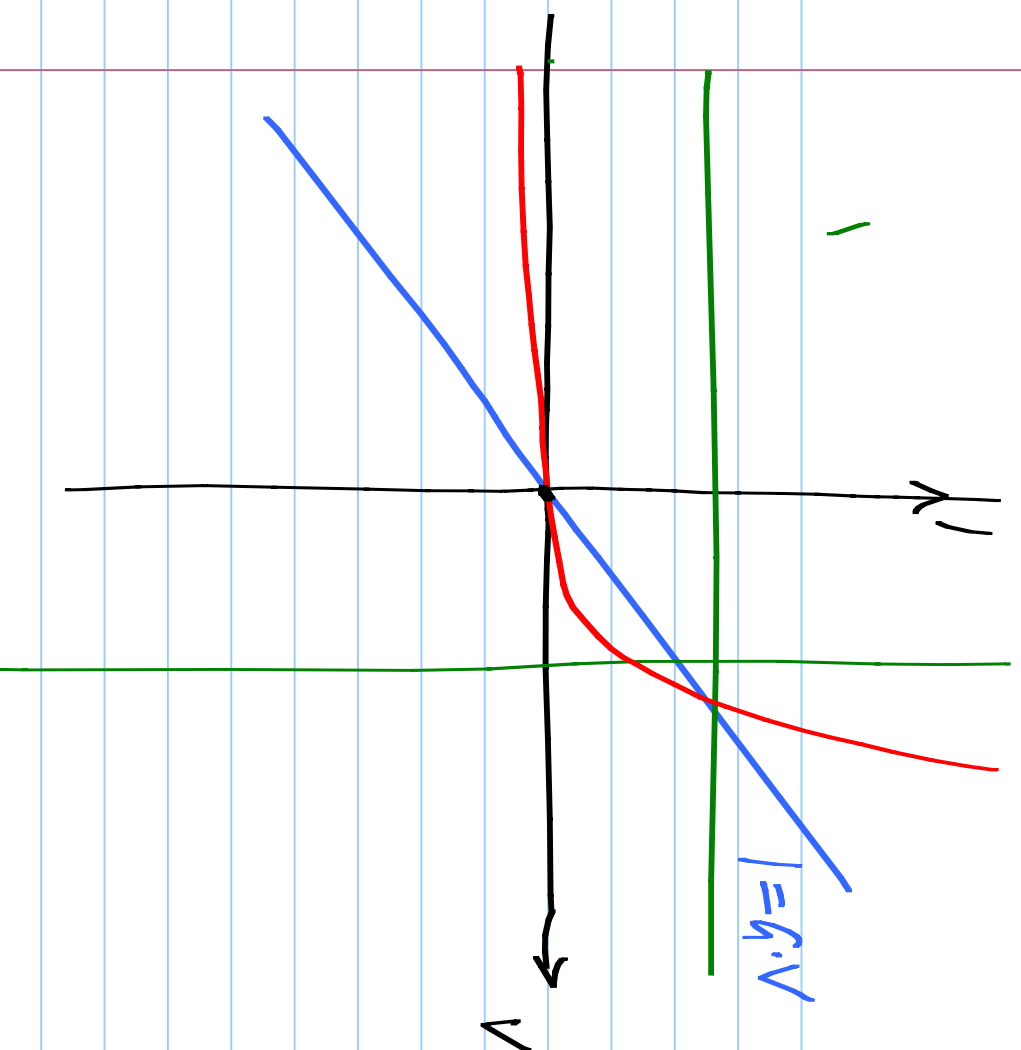
$$q: 1.6 \times 10^{-19} \text{ C}$$

$$25.9 \text{ mV} @ 300 \text{ K}$$

$$26 \text{ mV or } 25 \text{ mV}$$

$$= V_T =$$

$$\frac{kT}{q}$$



$$I_D = I_S \left[\exp\left(\frac{V_D}{V_T}\right) - 1 \right]$$

$$I_D = I_{SA}$$

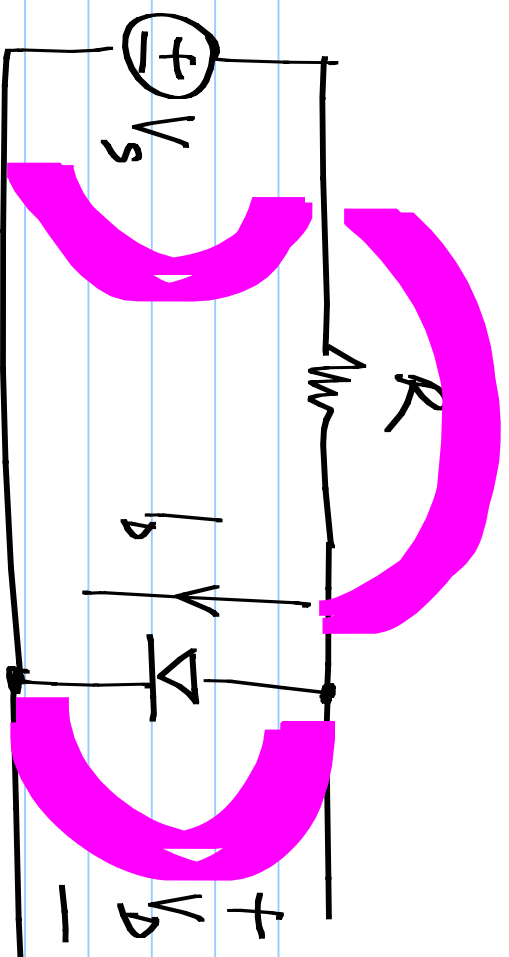
$$I_D = I_S \exp\left(\frac{V_D}{V_T}\right)$$

$$V_D = 0.7V$$

$$\exp\left(\frac{700mV}{25mV}\right)$$

$$\exp(28)$$

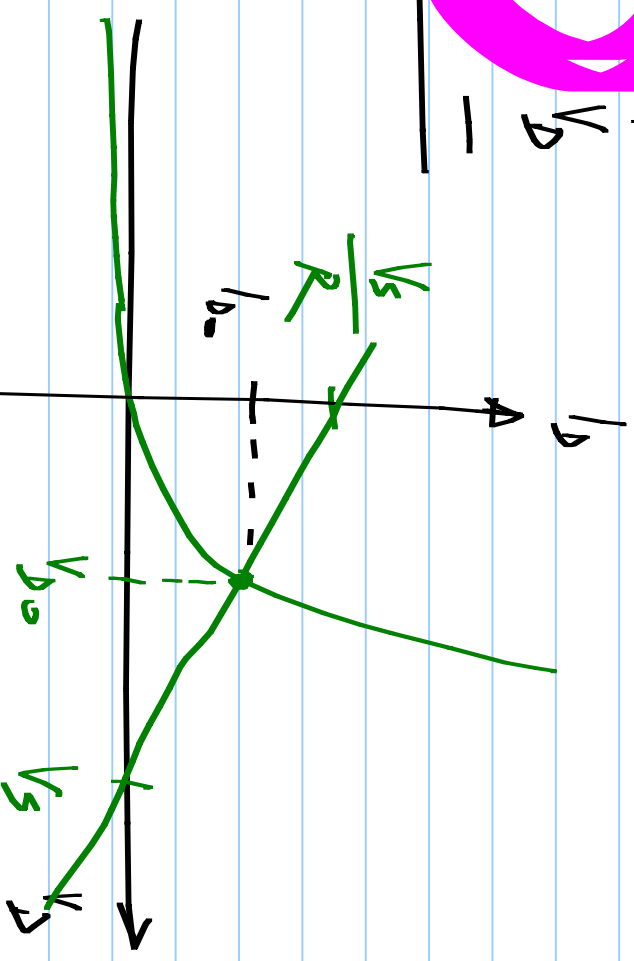
$R, L, C, V_{source}, I_{source} \dots$



$V_s = 3V$ operating point

$$V = V_d + I_d \cdot R$$

$$I_d = I_s \left[\exp\left(\frac{V_d}{V_T}\right) - 1 \right]$$



V_{d0}, I_{d0} : operating point of the diode