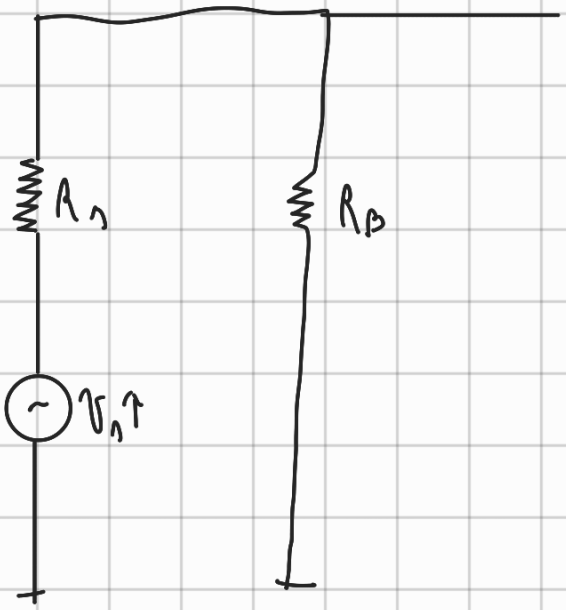
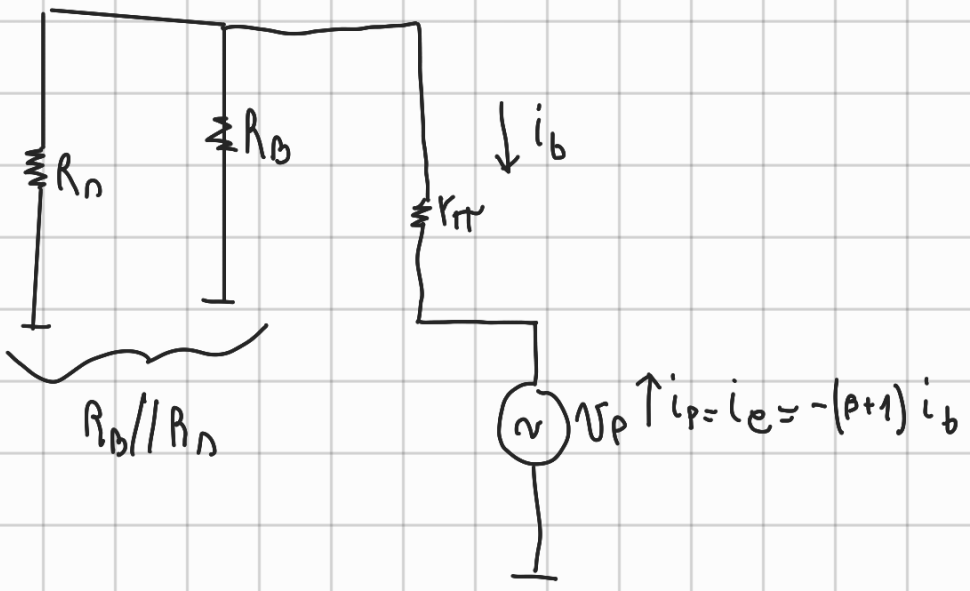
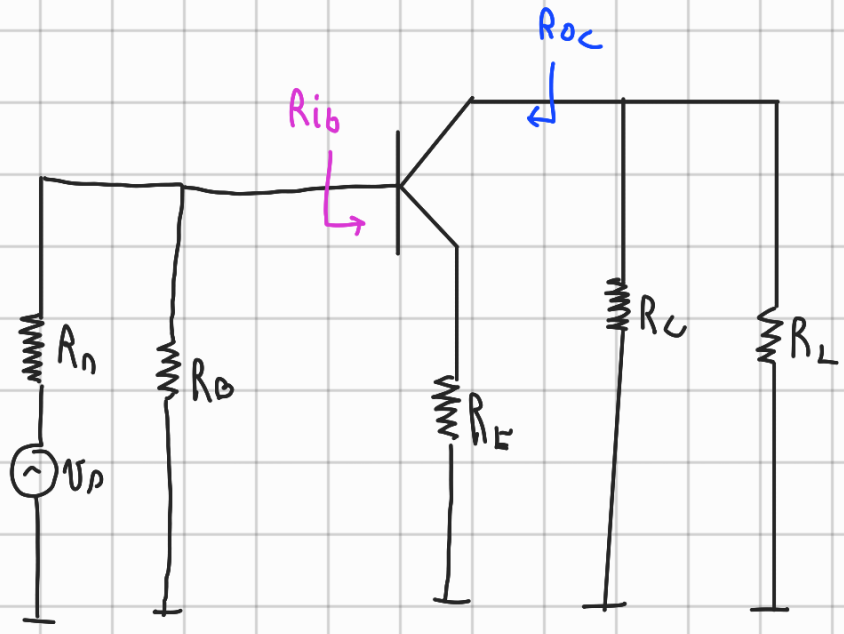
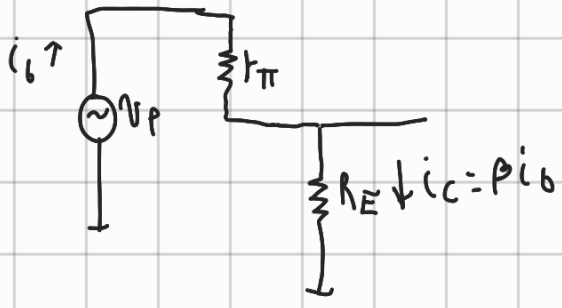




$$R_{oe} = \frac{-i_b (R_B // R_B + r_\pi)}{-(\beta+1) i_p} =$$



R_{ib}



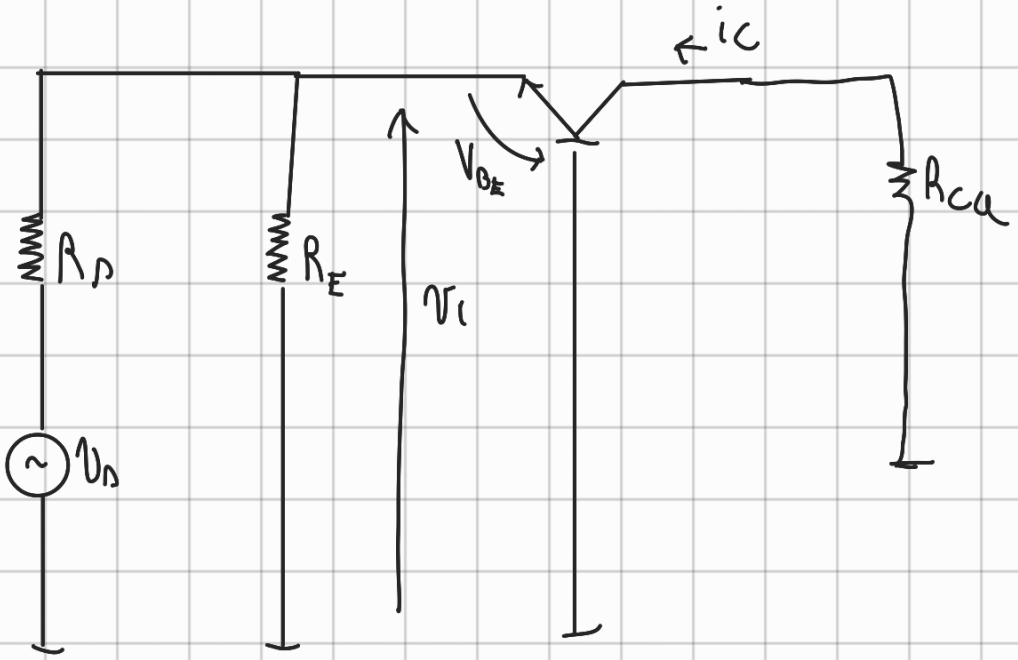
$$R_{ib} = \frac{v_p}{i_p} = r_\pi + \beta R_E$$

$$R_i = R_B // R_{ib}$$

R_{oc}

$$R_{oc} = r_o (1 + g_m R_E)$$

$$A_V = \frac{v_o}{v_i} = \frac{-i_c R_{ca}}{v_{be} + i_c R_E} \overset{r_o \to \infty}{\approx} -g_m v_{be} R_{ca}$$



$$A_V = \frac{-i_c R_{ca}}{-v_{be}} = \frac{-g_m v_{be} R_{ca}}{v_{be}} = -g_m R_{ca}$$