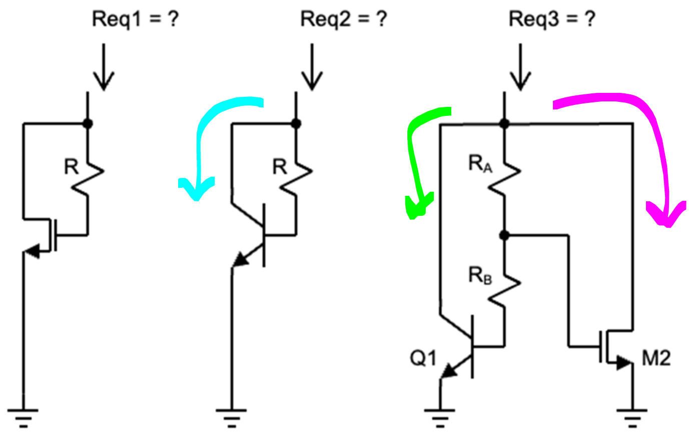
1. [10 pts total] Find the equivalent resistances Req1, Req2, and Req3.

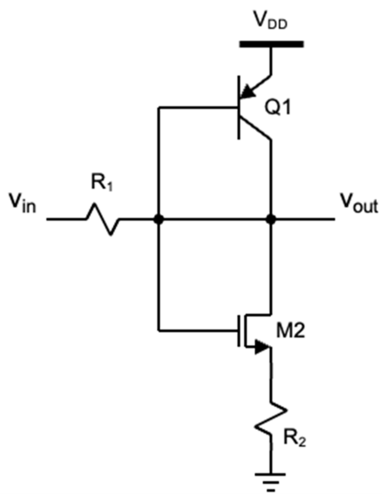


$$R_{eq1} = \frac{1}{g_m}$$

$$R_{eq2} = (R + r_\pi) \,||\, \left(\frac{r_\pi}{R + r_\pi} g_m\right)^{-1} = \frac{R + r_\pi}{1 + \beta}$$

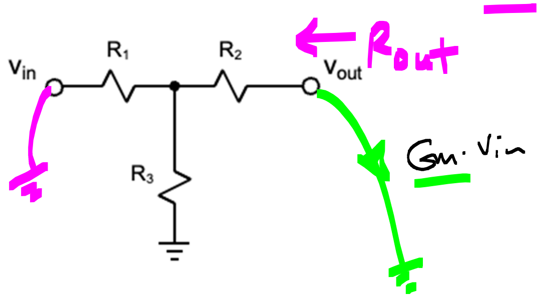
$$R_{eq3} = (R_A + R_B + r_{\pi 1}) \,||\, \left(\frac{r_{\pi 1} \cdot g_{m1}}{R_A + R_B + r_{\pi 1}}\right)^{-1} \,||\, \left(\frac{R_B + r_{\pi 1}}{R_A + R_B + r_{\pi 1}} \cdot g_{m2}\right)^{-1}$$

2. [10 pts total] Find the small-signal gain from v_{in} to v_{out}.



$$\text{gain} = \frac{\frac{r_{\pi 1}}{1+\beta_1} \,\|\, \left(\frac{1}{g_{m2}} + R_2\right)}{R_1 + \left[\frac{r_{\pi 1}}{1+\beta_1} \,\|\, \left(\frac{1}{g_{m2}} + R_2\right)\right]}$$

3. [10 pts total] Find the Norton-equivalent Rin, Rout, and Gm.



$$R_{in} = R_1 + R_3$$

$$G_m = \frac{1}{R_1 + (R_2 \| R_3)} \underbrace{\frac{R_3}{R_2 + R_3}}_{\text{current divider}} = \frac{R_3}{R_1(R_2+R_3) + R_2 R_3}$$

$$R_{out} = R_2 + (R_1 \| R_3)$$