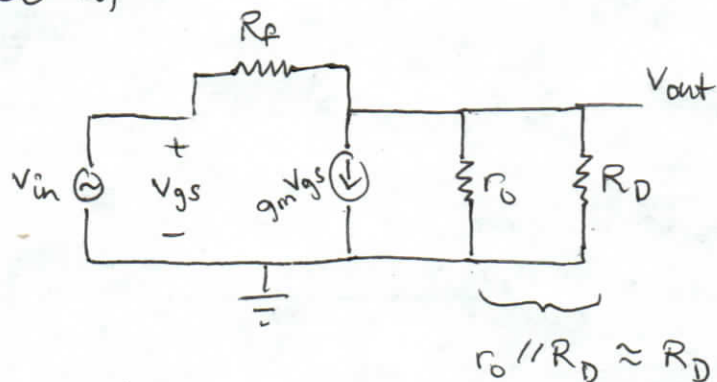


3.20 a)



KCL @ V_{out} node

$$\frac{V_{in} - V_{out}}{R_f} - g_m V_{in} - \frac{V_{out}}{R_D} = 0$$

$$\frac{V_{in}}{R_f} - \frac{V_{out}}{R_f} - g_m V_{in} - \frac{V_{out}}{R_D} = 0$$

$$V_{in} \left[\frac{1}{R_f} - g_m \right] = V_{out} \left[\frac{1}{R_f} + \frac{1}{R_D} \right]$$

$$\frac{V_{out}}{V_{in}} = \frac{\left[\frac{1}{R_f} - g_m \right]}{\left[\frac{1}{R_f} + \frac{1}{R_D} \right]}$$

Assume: $\frac{1}{R_f} \ll g_m$

$$\frac{V_{out}}{V_{in}} = \frac{\cancel{\frac{1}{R_f}} - g_m}{\frac{1}{R_f} + \frac{1}{R_D}} = \boxed{-g_m (R_f \parallel R_D)}$$