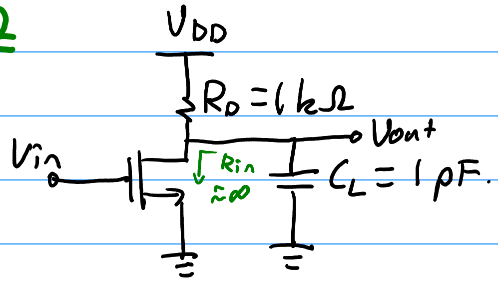
11.2



Find f at which gain falls by 10%. Bias network not shown.

DC gain $= -g_m R_D = -1000 g_m$.

One pole at $\omega_p = \dfrac{1}{R_D C_L} = \dfrac{1}{1000 C_L}$

$\therefore$ Transfer function is $H(s) = \dfrac{-1000 g_m}{1 + \frac{s}{\omega_p}} = \dfrac{-1000 g_m}{1 + 1000 s C_L}$

Note: could also have found this by circuit analysis.

$$H(s) = \frac{V_{out}}{V_{in}} = -g_m \left(R_D \,\|\, \frac{1}{sC_L}\right) = -g_m \frac{\frac{R_D}{sC_L}}{R_D + \frac{1}{sC_L}}$$

$$= \frac{-g_m R_D}{sR_D C_L + 1} = \frac{-1000 g_m}{1 + 1000 s C_L}.$$

However finding poles by inspection leads to insight! It is better to think than do algebra.

Want $\left| \dfrac{H(j\omega)}{H(0)} \right| = 0.9$

$$\left| \frac{1}{1 + j\omega 1000 C_L} \right| = 0.9$$

$$1.1111 = \sqrt{1^2 + (1000 \omega C_L)^2}$$

$$1.2346 = 1 + \omega^2 (1000 C_L)^2 \qquad (C_L = 1\,pF)$$

$$\omega = 4.84 \times 10^8 \text{ rad/s}$$

$$f = \frac{\omega}{2\pi} = 77 \text{ MHz}.$$