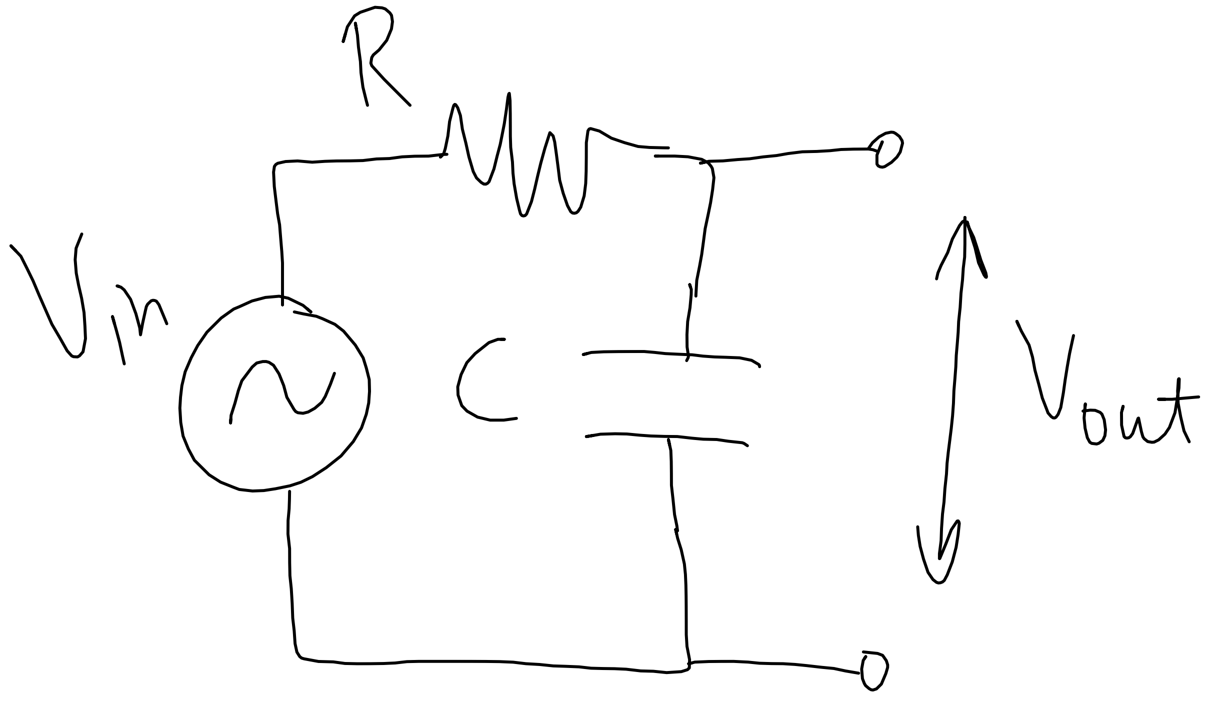
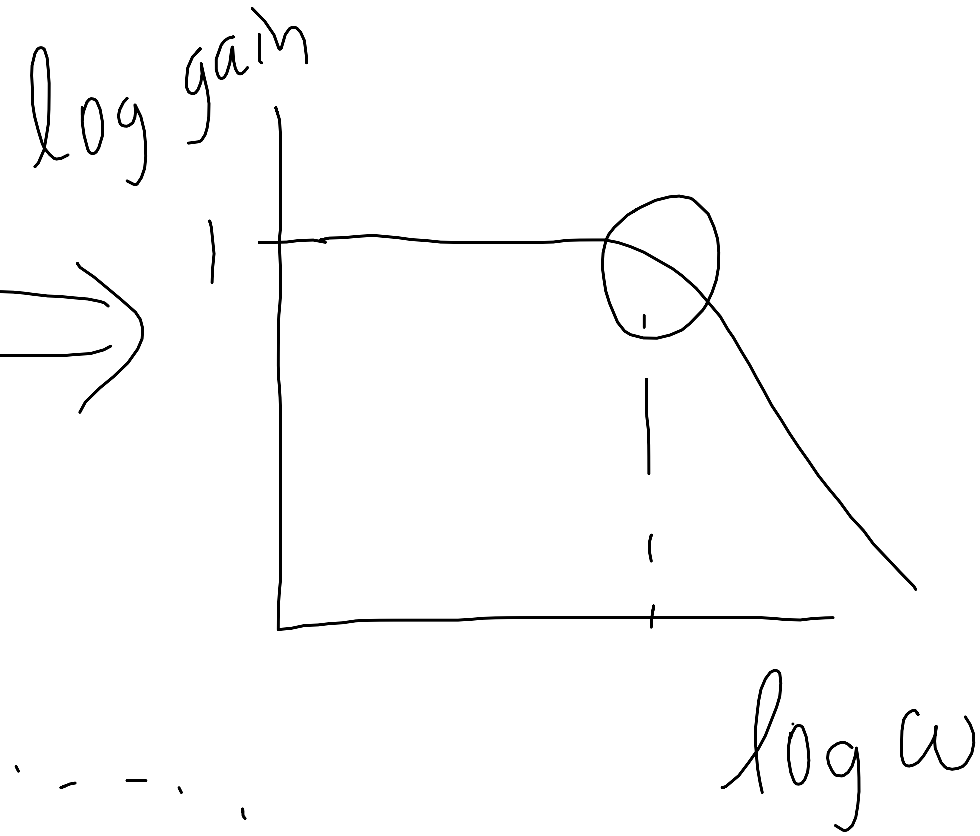


$$\frac{V_{out}}{V_{in}} = \frac{-i/\omega C}{R - \frac{i}{\omega C}} \Rightarrow \frac{1 - i\omega RC}{(\omega RC)^2 + 1}$$

$$\frac{1 - i\omega RC}{(\omega RC)^2 + 1} \Rightarrow \frac{\sqrt{1+(\omega RC)^2}}{1+(\omega RC)^2}$$

$$= \frac{1}{\sqrt{1+(\omega RC)^2}} \Rightarrow$$

$\Uparrow$ gain



Aside . . . .

Bell $\Rightarrow$ $\log\left(\frac{P_{out}}{P_{in}}\right) \Rightarrow$ "bel"

$$10 \log\left(\frac{P_{out}}{P_{in}}\right) \Rightarrow \text{deciBel}$$

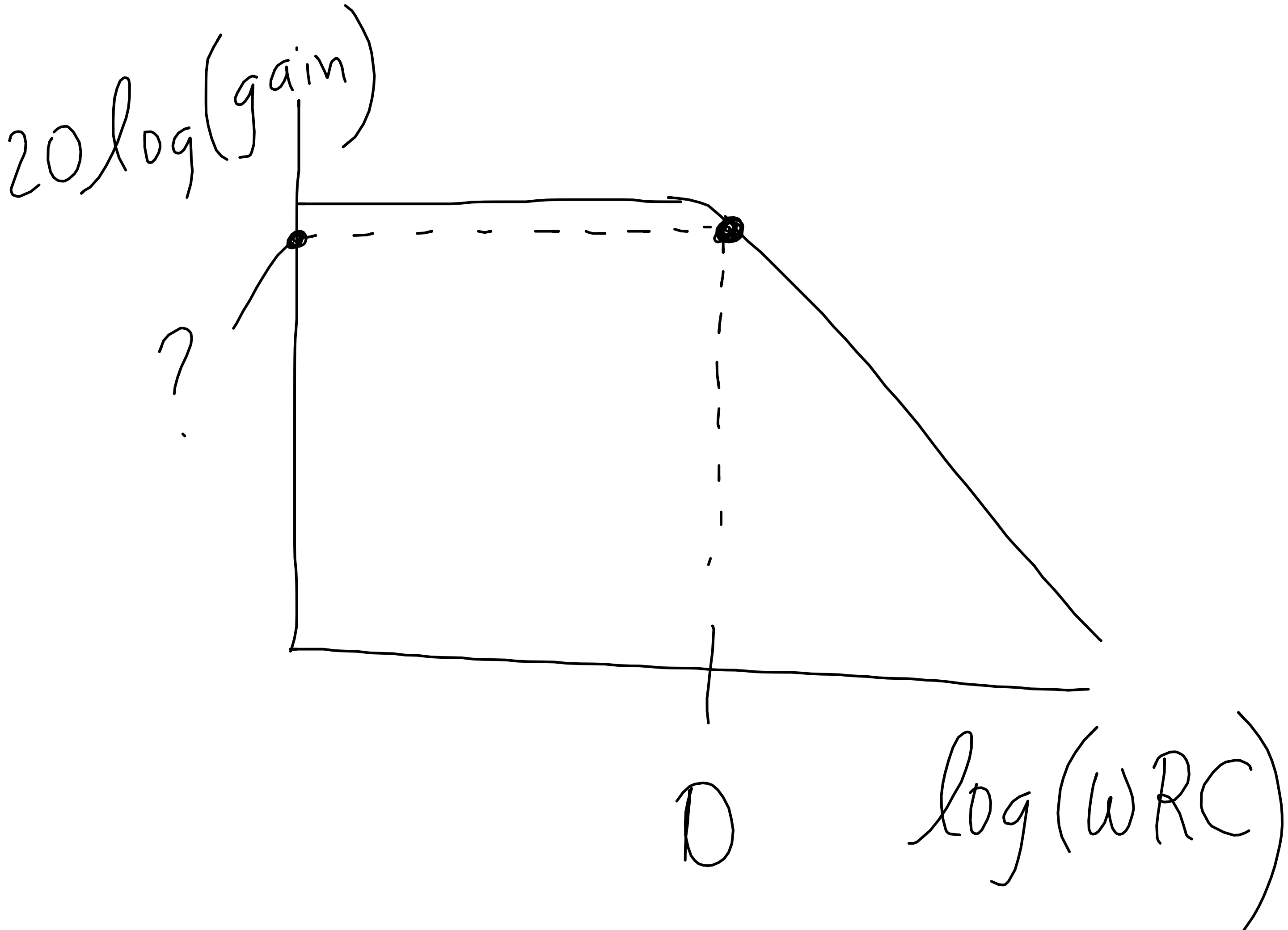
Recall $P = \frac{V^2}{R}$ for resistor

$$10 \log \frac{V_{out}^2}{V_{in}^2} = 20 \log\left(\frac{V_{out}}{V_{in}}\right)$$ ← Bode plot

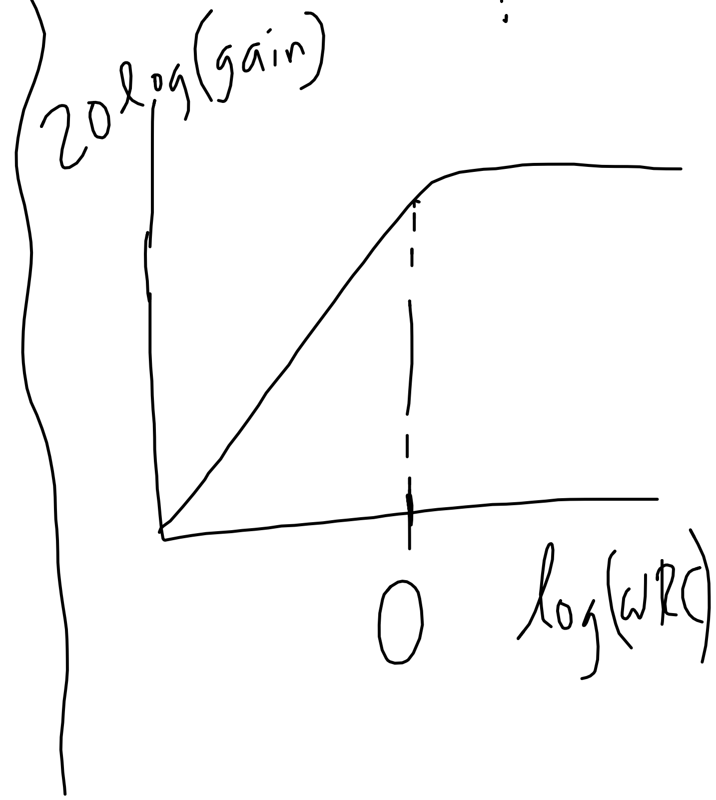
So @ "half power point"

$$\frac{V_{out}}{V_{in}} = \frac{1}{\sqrt{2}} \quad (\text{since } P \propto V^2)$$

So $\frac{1}{\sqrt{1+(\omega RC)^2}} = \frac{1}{\sqrt{2}}$ when $\omega = \frac{1}{RC}$

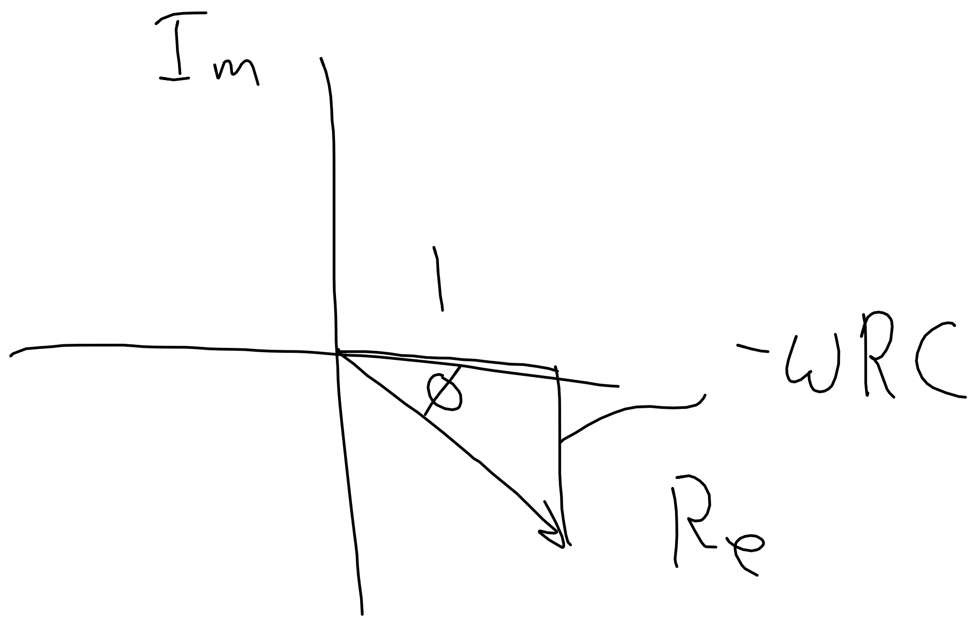


For hi-pass



$$20\log\left(\frac{1}{\sqrt{2}}\right) = -3.01 \text{ dBV}$$

$$\frac{V_{out}}{V_{in}} = \frac{1 - i\omega RC}{(\omega RC)^2 + 1}$$ for low pass



$$\phi = \tan^{-1}\left(\frac{-\omega RC}{1}\right)$$

$$= -\tan^{-1}(\omega RC)$$