Solutions for Chapter 1

Exercise 1.30

V_{out} is the voltage at the output of the impedance voltage divider. We know that $Z_R = R$ and $Z_C = \frac{1}{j\omega C}$. So we have

$$V_{\text{out}} = \frac{Z_C}{Z_R + Z_C} V_{\text{in}} = \frac{\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}} V_{\text{in}} = \frac{1}{1 + j\omega RC} V_{\text{in}}$$

The magnitude of this expression follows:

$$|V_{\text{out}}| = \sqrt{V_{\text{out}} V_{\text{out}}^*} = \frac{1}{\sqrt{1 + \omega^2 R^2 C^2}} V_{\text{in}}$$

where V_{out}^* is the complex conjugate of V_{out}

Exercise 1.37

The Norton equivalent circuit can be found by measuring I_{short} and V_{open}:

$$I_{\text{Norton}} = I_{\text{short}} = \frac{10\text{V}}{10\text{k}\Omega} = \boxed{\mathbf{1}\text{mA}}$$

and since $V_{\text{open}} = 5\text{V}$, we have

$$R_{\text{Norton}} = \frac{5\text{V}}{1\text{mA}} = \boxed{\mathbf{5}\text{k}\mathbf{\Omega}}$$