PHY 240: Basic Electronics
Homework Problem H12

November 21, 2024
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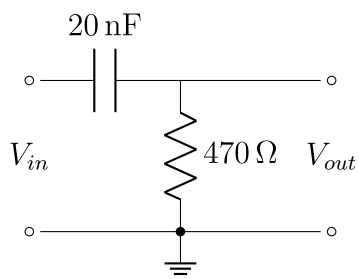
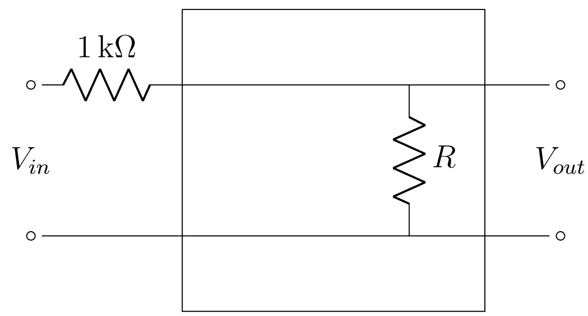
1. **What Does it Do?**
   Consider this circuit:



   (a) meow!

   (b) meow2

Solution: Finding R is easier, so let's do that first.
We know that $V_{in} = 10V$, $V_{out} = 8V$ and our chosen r is $1\,\mathrm{k}\Omega$
At t = 0, the capacitor is fully charged, so it acts like an open circuit...



$$V_{in} = I(R_1 + R_2)$$

$$10V = I \cdot 1000\Omega + I \cdot R_2$$

The voltage drop across R_2 is V_{out} which is 8V, meaning

$$I \cdot 1000\Omega = 2V$$

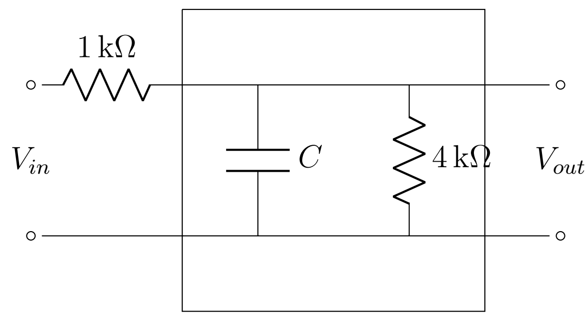
$$I \cdot R_2 = 8V$$

So $I = 0.002A$, naturally...

$$0.002A \cdot R_2 = 8V$$

$$R_2 = 4\,\mathrm{k}\Omega$$

Now, we find C.



First, we must find R_{eff} which is just the resistances of these resistors in parallel.

$$R_{eff} = 800\,\Omega$$

The equation $V_{in} \cdot e^{\frac{-t}{RC}}$ tells us the voltage across the capacitor over time. Eyeballing the curve and plugging in known values, we get

$$2.3 = 8 \cdot e^{\frac{-0.0005}{800 \cdot C}}$$

Solving for C now...

$$C = \frac{-0.0005}{800 \cdot \ln \frac{2.3}{8}} \approx 0.5\mu\text{F}$$