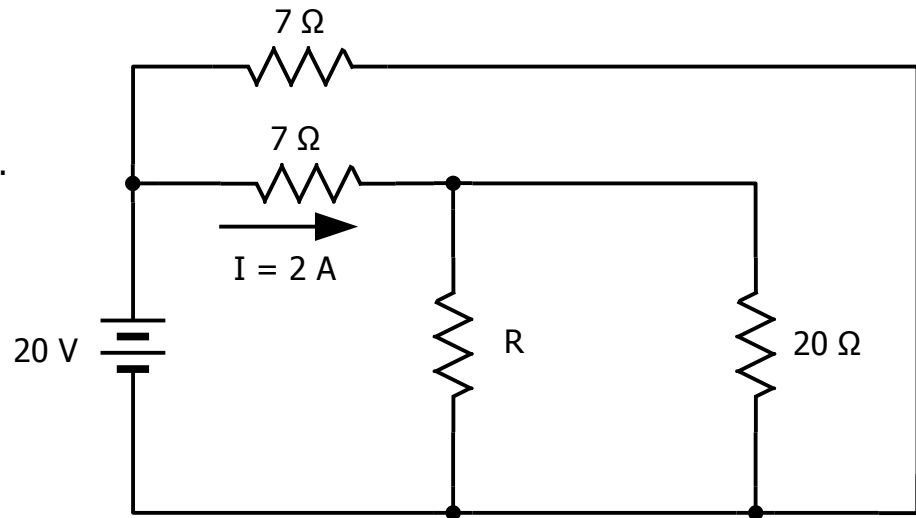# EE3 Fall 2020
Practice Problems 6

1. Determine the value of R.

NOTE:
If you think a bit before you start, this problem becomes A LOT easier.

$$R = 3.53 \ \Omega$$

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2.

Consider the series RLC circuit. Let R=100 Ω, C=1 µF, and L=0.2 H.
Questions (a) – (d) are answered intuitively by using the two questions
that I gave you in lecture. Questions (e) and (f) are answered
numerically. Question (g) is answered symbolically.

(a) If the output is taken across the inductor, what kind of filter is it?

(b) If the output is taken across the capacitor, what kind of filter is it?

(c) If the output is taken across the resistor, what kind of filter is it?

(d) If the output is taken across the capacitor and inductor, what kind
  of filter is it?

(e) If f=300 Hz, what impedance is given by the circuit?

(f) What is the resonant frequency of the circuit?

(g) In (d), what is the ratio v_{out}/v_{in} at resonance?
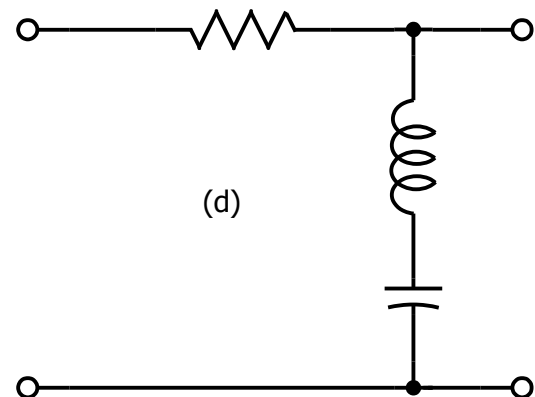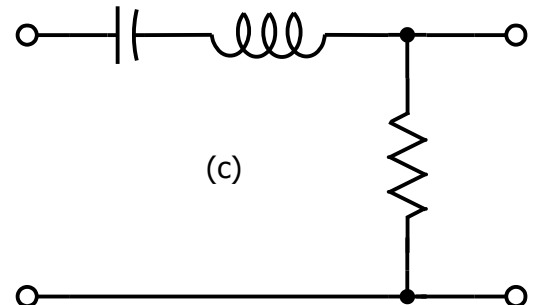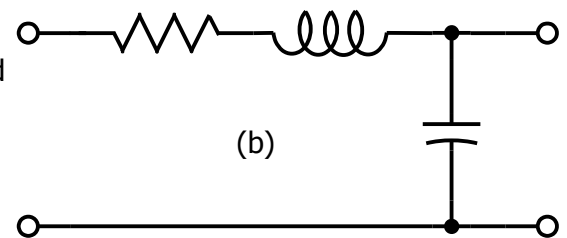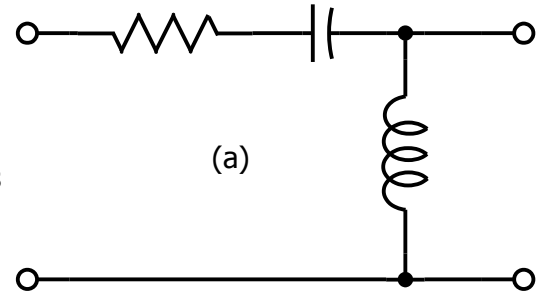
(e) $Z_T = 100 - j\,153.5$

(f) $f_0 = 355.9$ Hz

(g) the ratio is zero.

(a)

(b)

(c)

(d)

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3. Circuit $\mathbb{A}$ is a portion of a digital-to-analog converter (DAC) circuit. The point of this problem is to see how the use of a Thévenin Equivalent can simplify a circuit and make it easier to analyze.

   The first step is not obvious: disconnect the upper two resistors from each other and add a battery to maintain electrical equivalence (Circuit $\mathbb{B}$).

   Note that the circuit fragment inside the red box is now a one-port, and can be replaced with its Thévenin Equivalent. That is your task, and after doing so, find V_{out} as a function of V_S.
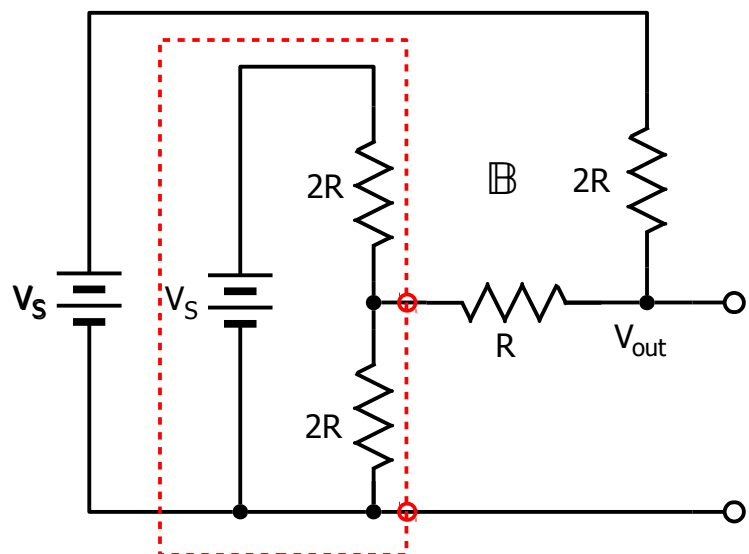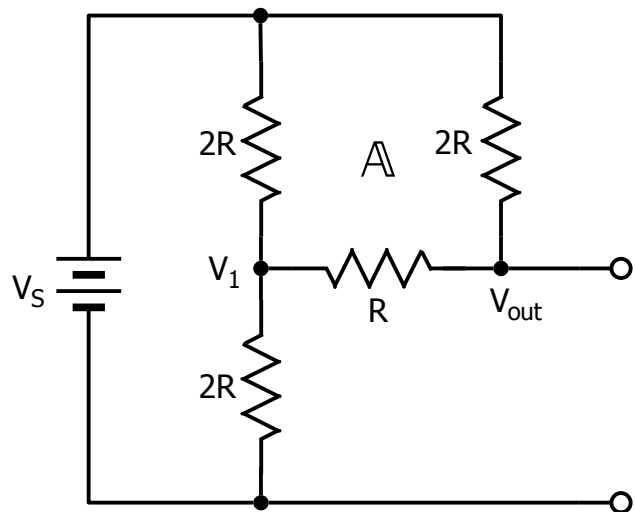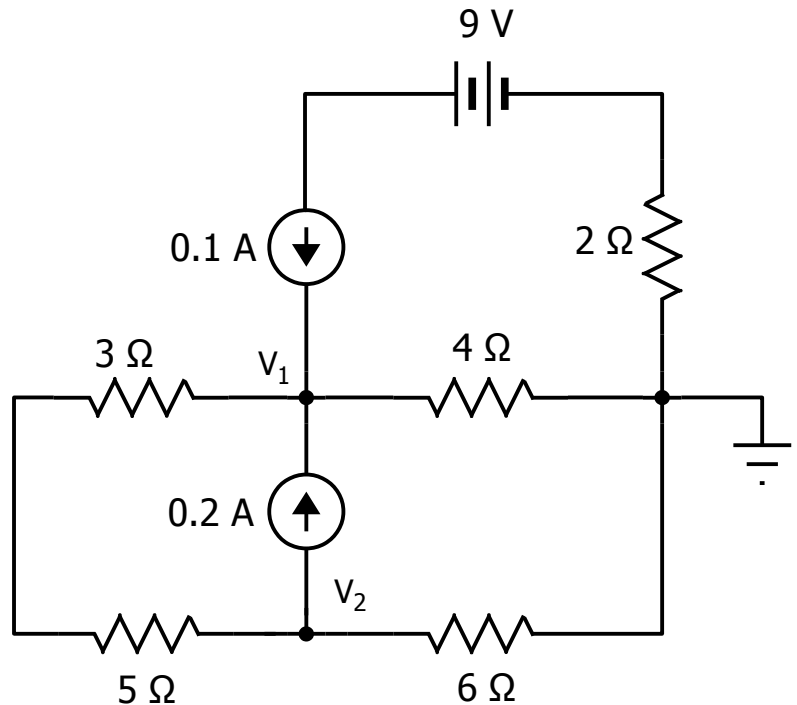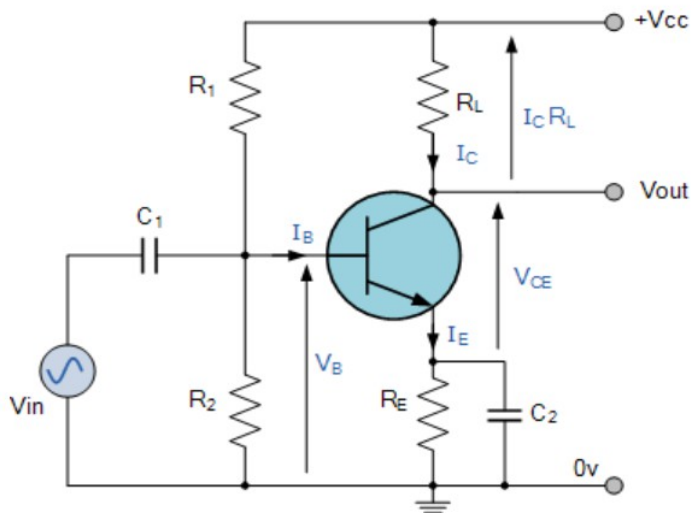
$$V_{out} = \frac{3\,V_S}{4}$$

4. Find the power provided or absorbed by the 0.1 A current source. Is it providing or absorbing?

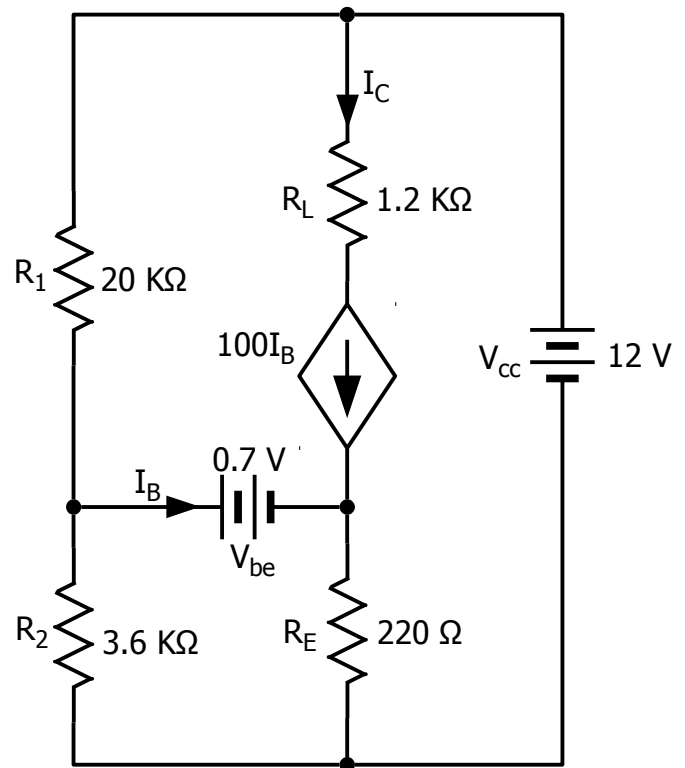HINT: find V_1 and V_2 first. Then write a KVL equation around the upper loop.

9 V

0.1 A

2 Ω

3 Ω V_1

4 Ω

0.2 A

V_2

5 Ω

6 Ω

$P_{0.1} = +0.8133 \text{ W (absorbing)}$

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https://www.electronics-tutorials.ws/amplifier/amp_2.html

5. On the left is a typical NPN Common Emitter amplifier circuit. On the right is a linearized equivalent circuit without the capacitors and input voltage. The key to analyzing the equivalent circuit is finding the base current, I_B.

You will be able to find I_B by using an Ohm''s Law expression and the ideas that you have learned earlier in this problem set. In particular, you will be able to simplify the circuit by using the same Thévenin Equivalent circuit trick that is in Problem 3 and you will know how to deal with the dependent source from working Practice Problems 4, #5.

Your task is to simplify the circuit with a Thévenin Equivalent, and find I_B by solving the KCL equation that will become obvious after the simplification.

$$I_B = 44.7 \; \mu A$$