1) For the circuit below:

```
I_{in}  1mA
     +
     |
     |
     V

100Ω  10kΩ  1kΩ
```

a) What is the maximum value that V could possibly be?

b) Now calculate the voltage V to within 3 significant figures. Do it 4 ways: Mesh Analysis, Node analysis, by converting the current source and the 10K resistor into its Thevenin Equivalent and finally by using the current divider formula. Do each method symbolically, plug in numbers at the end. Which way is easier?
2) Below is the schematic of part a circuit that you found when dismantling and attempting to “fix” your housemates speaker. In order to figure out what it is doing there you need to compute a few things:

a) Find the input impedance $Z_{in}$ as a function of frequency (this is so you can figure out how this loads the amplifier).

\[ R \quad - \quad C \quad \rightarrow \quad V_{out} \]

\[ V_{in} \]

b) Find the complex ratio of the phasors for $\frac{V_{out}}{V_{in}}$ (this is the “gain” or transfer function of the network)

c) Next you need to figure out what the voltage amplitude you will measure on your oscilloscope when you test the circuit will be so you need to compute $|\frac{V_{out}}{V_{in}}|$ which is the magnitude of the response.
d) Find and expression for the phase shift of the signal through this network as a function of frequency.

e) Sketch the Bode plot of the magnitude response and the phase change through this network verses frequency. Label the axes the break points and any values that you know. The resistor is labeled as 1 ohm and the capacitor is 800 micro-Farads.
3) Plot and label the following points and their **complex conjugates** in the complex plane:

- $Z_1 = 1 + j$
- $Z_2 = 2 \exp(j \frac{3\pi}{4})$
- $Z_3 = \frac{1}{j}$

4) What is the output resistance of the following amplifiers? Explain your answers, that is why is that the output resistance?
What does output resistance of an amplifier mean?

Why do we care what the output resistance of an amplifier is?