

Problem Set II

The **due date** for this homework is **Mon 4 Feb 2013 9:59 PM PST**.

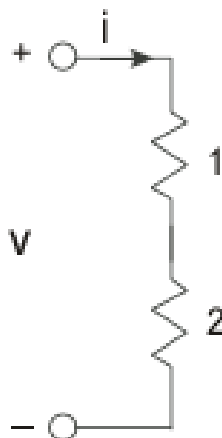
Starting this problem set, you will only be given a total of three attempts. Explanations and answers to the problem set will be available after the due date. Since the homework problems will become gradually more challenging as the course proceeds, we highly recommend you to start the habit of printing out the problems and working on them with paper and pencil. Also, please be sure to read the problem statements carefully and double check your expressions before you submit.

A [pdf](#) version of this problem set is available for you to print.

Note: all mathematical expressions have to be exact, even when involving constants. Such an expression is required when a function and/or a variable is required in the answer. For example, if the answer is $\sqrt{3}x$, you must type `sqrt(3)*x`, not `1.732*x` for the answer to be graded as correct.

Question 1

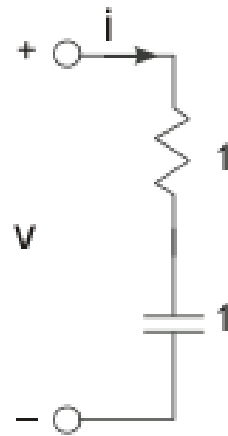
In the following circuit, the current i equals $\cos 2\pi t$. What is the voltage v ?



Preview

Question 2

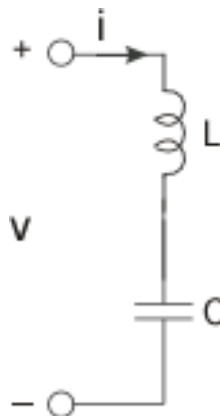
In the following circuit, the current i equals $\cos 2\pi t$. What is the voltage v ?



Preview

Question 3

In the following circuit, the current i equals $\cos 2\pi t$. What is the voltage v ? Please assume 1F for C and 1H for L.

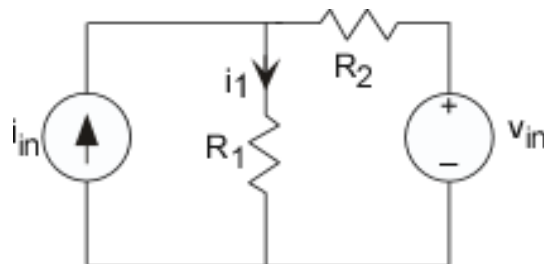


Preview

Question 4

One of the most important consequences of circuit laws is the **Superposition Principle**: The current or voltage defined for any element equals the sum of the currents or voltages produced in the element by the independent sources. This Principle has important consequences in simplifying the calculation of circuit variables in multiple source circuits.

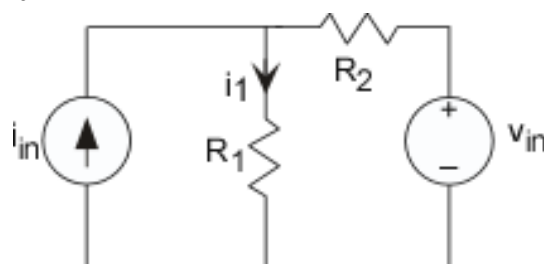
Solve the following circuit for i_1 as a function of i_{in} , R_1 , R_2 , and v_{in} . Use any technique you like; probably the simplest is best. Use the spelling and capitalization of the variables provided in the question to write your answer. *i.e.* Write i_{in} for i_{in} , v_{in} for v_{in} and R_1 , R_2 for the resistors.



Preview

Question 5

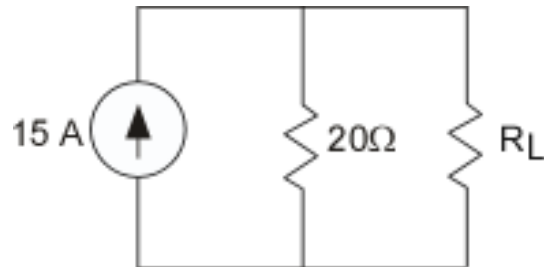
You should have found that the current i_1 is a linear combination of the two source values: $i_1 = C_1 v_{in} + C_2 i_{in}$. This result means that we can think of the current as a superposition of two components, each of which is due to a source. We can find each component by setting the other sources to zero. Thus, to find the voltage source component, you can set the current source to zero (an open circuit) and use the usual tricks. To find the current source component, you would set the voltage source to zero (a short circuit) and find the resulting current. You then simply add the two results to obtain the current. Calculate the current i_1 using the Superposition Principle as a function of i_{in} , R_1 , R_2 , and v_{in} . Use the spelling and capitalization of the variables provided in the question to write your answer.



[Preview](#)

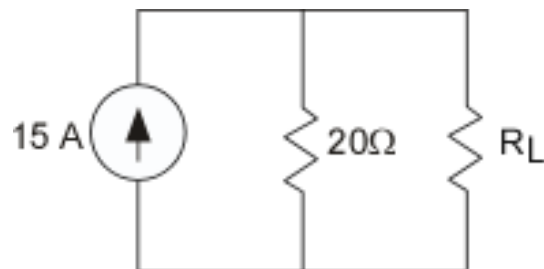
Question 6

For the following circuit, find the value of R_L that results in a current of 5A passing through it.



Question 7

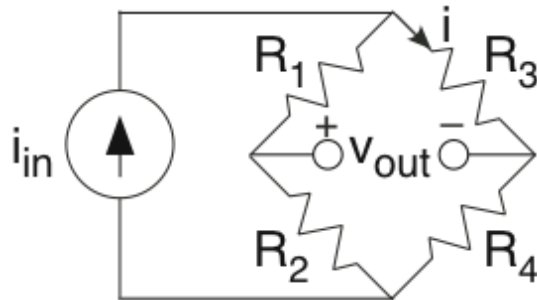
For the following circuit, you found in the previous question the value of R_L that results in a current of 5A passing through it.



In this case, what is the power dissipated in the load resistor R_L ? A numeric answer is wanted, though it will have units of watts you should not include the unit in the answer.

Question 8

In the following circuit, known as a **bridge circuit**, what voltage does v_{out} see when nothing is connected to the output terminals? State your answer in terms of R_1 , R_2 , R_3 , R_4 and i_{in} , taking care to note the spelling and capitalization of variables.

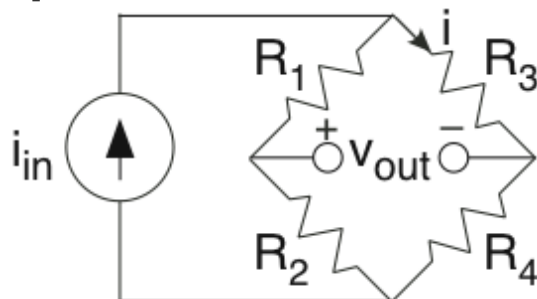


Preview

Question 9

For the following three questions, you will be asked to find the equivalent resistance. The expressions for the answers are complicated. A simple way to check whether answer has *any* chance of being correct is to make sure your results has units of ohms.

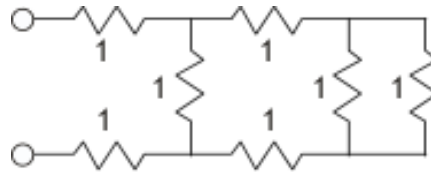
In the following circuit, suppose that $R_1 = 1\Omega$, $R_2 = 2\Omega$, $R_3 = 2\Omega$, and $R_4 = 4\Omega$. Find the current i when the current source i_{in} is $\text{Im}[(4 + 2j)e^{j2\pi 20t}]$. Express your answer as a single sinusoid.



Preview

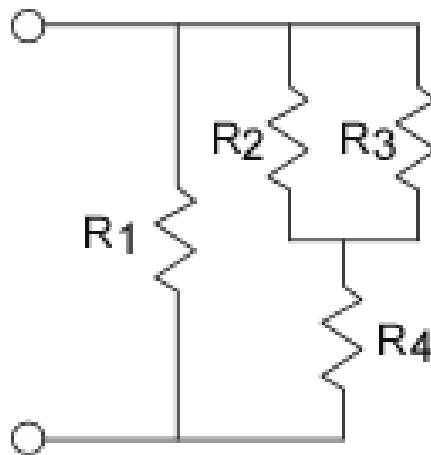
Question 10

Find the equivalent resistance for the following circuit using the series and parallel combination rules. Express your answer numerically as a decimal.



Question 11

Find the equivalent resistance for the following circuit using the series and parallel combination rules. Express your answer as an expression of R_1 , R_2 , R_3 and R_4 .

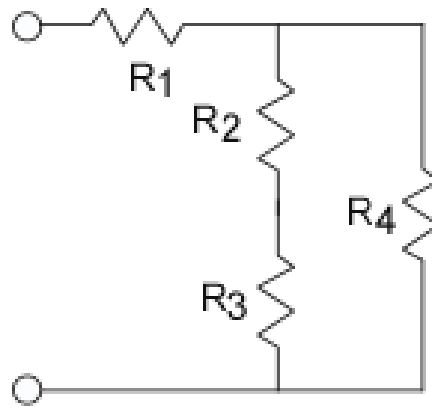


Preview

Question 12

Find the equivalent resistance for the following circuit using the series and parallel combination rules. Express your answer as an expression of R_1 , R_2 , R_3

and R_4 ..



Preview

☐ In accordance with the Honor Code, I certify that my answers here are my own work.

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