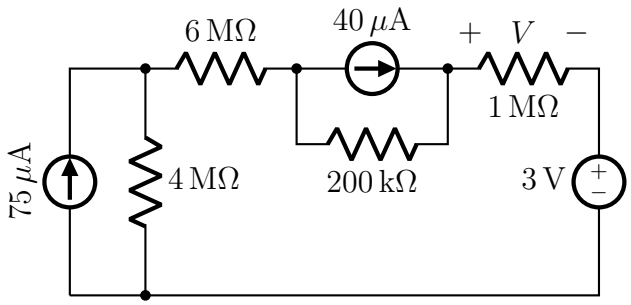
EE2015: Electric Circuits and Networks

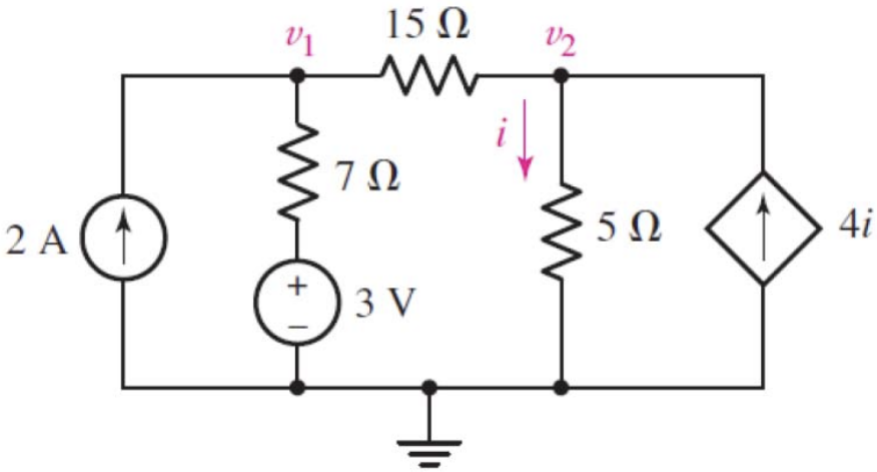
Tutorial 3: Solutions

(August 24, 2024)

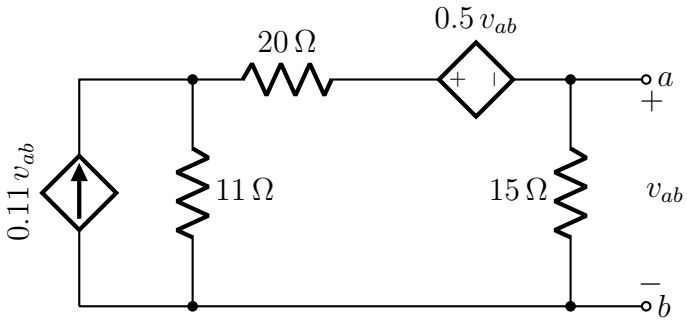
1. For the circuit shown on the right compute the voltage V across the 1 MΩ resistor by using repeated source transformation.



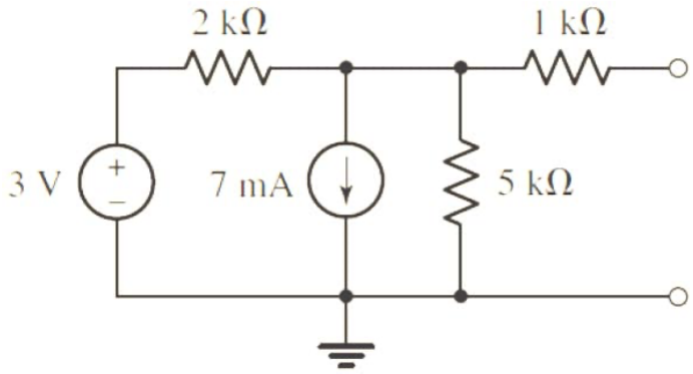
2. For the circuit below, use superposition to obtain the voltages v_1 and v_2.

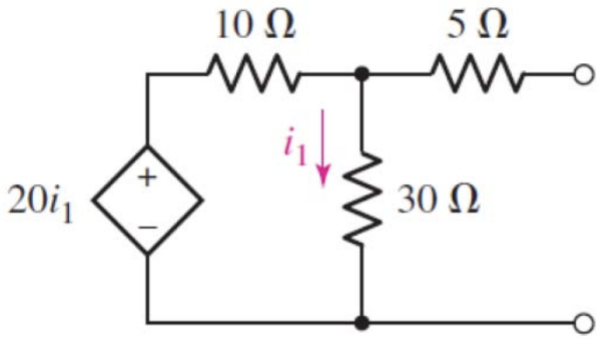


3. For the circuit shown on the right, find the Thevenin and Norton equivalents as seen across terminals ab.

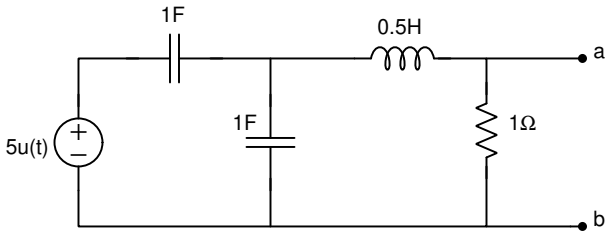


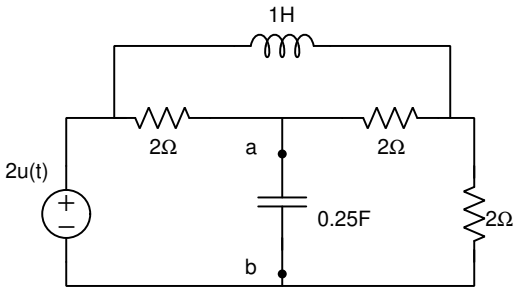
4. Determine the Thevenin and Norton equivalents of the circuits shown below.



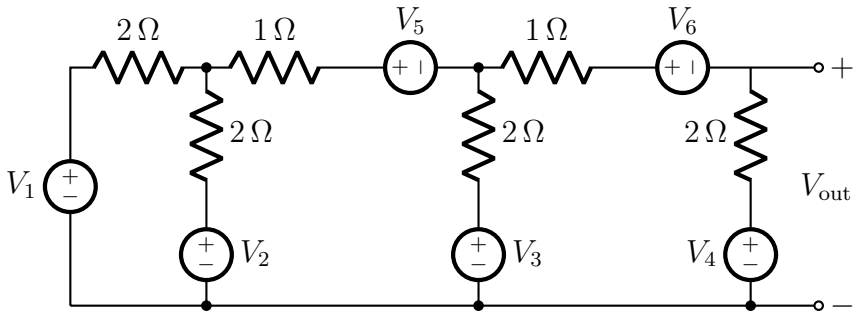


5. For the following circuits, find the Thevenin equivalent circuit as seen by (a) the 1Ω resistor and (b) 0.25F capacitor.

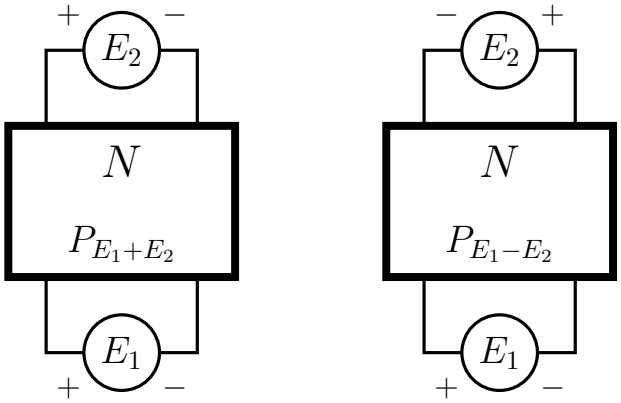




6. For the circuit given below, determine V_{out} in terms of V_k, $k = 1, 2, \ldots, 6$.



7.



A network N consists entirely of linear resistors and excited by two voltage sources E_1 and E_2, as shown in the figure. When E_2 is connected as shown on the left, the power dissipated is $P_{E_1+E_2}$, whereas it is $P_{E_1-E_2}$ when E_2 is connected as shown on the right (i.e., its polarity is reversed). Let P_{E_1} and P_{E_2} be the powers dissipated when E_1 and E_2 are acting alone (i.e., the other source is set to zero). Show that $P_{E_1} + P_{E_2} = \frac{1}{2}\left(P_{E_1+E_2} + P_{E_1-E_2}\right)$.

8. The network N shown on the right is composed entirely of resistors.
   (a) An ammeter is connected across FE and voltage sources of 6 V and 2 V across AB and CD. When A and C are positive, $I_{FE} = 14\,\text{A}$; when B and C are positive, $I_{EF} = 22\,\text{A}$.

   (b) The ammeter is now replaced by a voltmeter and voltage sources of 4 V and 5 V are connected across AB and CD, with A and C being positive. The voltmeter reads 8 V, F being at a higher potential

   With conditions as in the first part of (a), a variable resistance connected across EF is adjusted until it consumes maximum power. What is this power?