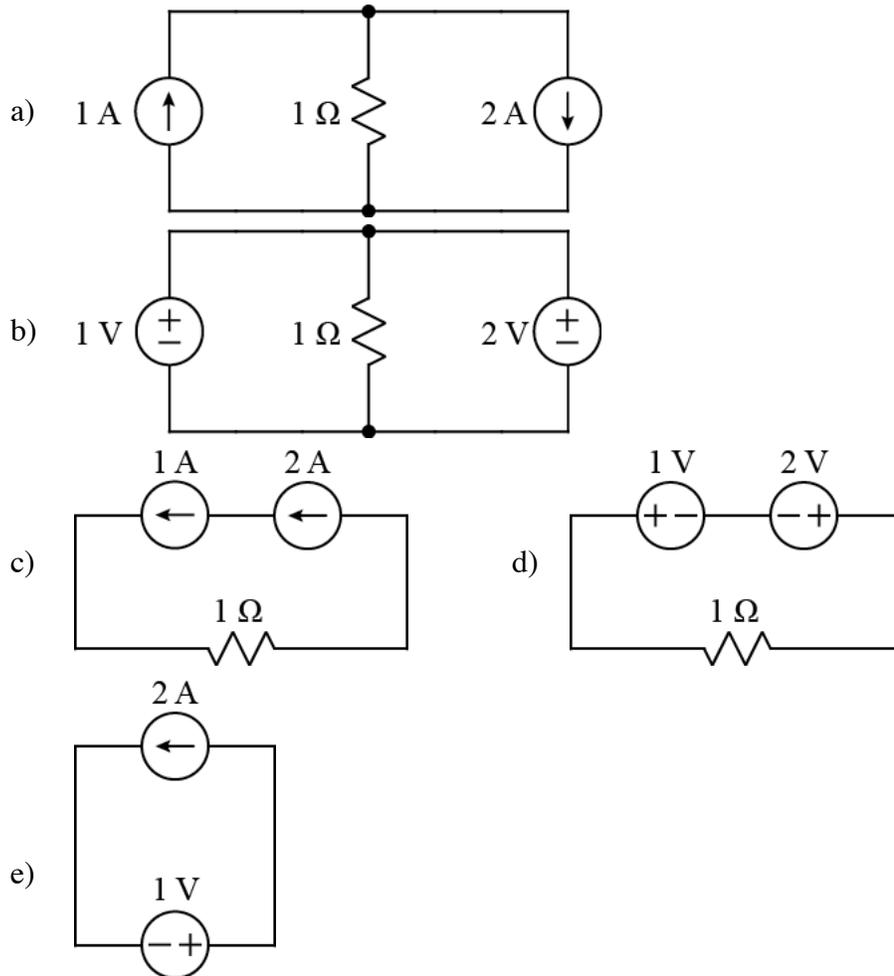


Ex: Determine whether each of the following circuits is valid or invalid.



SOL'N: a) Circuit is valid. Current sources may have whatever voltage is necessary in order to produce their current, so Kirchhoff's law saying all voltage loops must sum to zero can be satisfied. For Kirchhoff's current law, we must have currents at the top (or bottom) node that sum to zero. If we look at the top node, we must have 1A flowing down through the 1Ω resistor. That allows the current law to be satisfied, and the circuit is valid. By Ohm's law (to be covered in class shortly), the voltage across the 1Ω resistor must be 1 V. To satisfy the voltage loops, the two current sources will also have a 1 V drop. Note that the current sources produce different currents with the same voltage drop.

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- b) This circuit is invalid. Voltage sources in the outer loop fail to sum to zero, so the circuit violates Kirchhoff's voltage law. The voltage loop on the outside yields $1\text{ V} - 2\text{ V} = -1\text{ V} \neq 0\text{ V}$.
- c) This circuit is invalid. If we pick a point between two components that are in series and call it a node, then by Kirchhoff's current law, the two components must carry the same current. In this circuit, the current sources are in series but have different currents. Thus, the circuit cannot be valid.
- d) This circuit is valid. The voltage sources may whatever current is necessary, and so they and the $1\ \Omega$ resistor all carry the same current. For the voltage loop, we find that the voltage drop across the resistor is 1 V if we measure with the $+$ sign (red lead of voltmeter) on the right side of the resistor.
- e) This circuit is valid. The current source has 1 V across it ($+$ sign on right so as to obey the passive sign convention), and the voltage source has -2 A flowing through it (with measurement arrow pointing to the left).