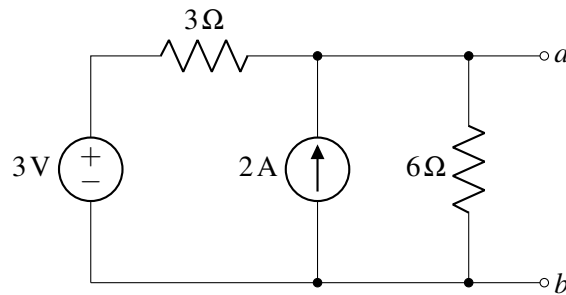

EECS 16A Designing Information Devices and Systems I

Spring 2023 Exam Prep 12B

1. Finding Mr. Thevenin (Fall 2022 Final Question 8)

For the following circuits, find the Thevenin and Norton equivalent resistance, voltage, and current between the nodes a and b .

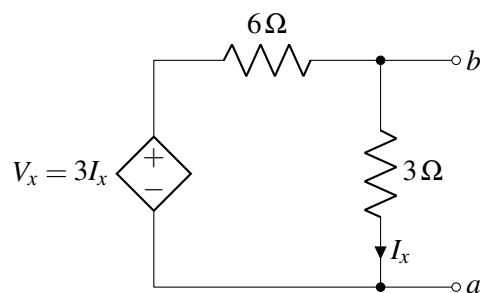
(a) Consider the circuit below:



- Can you turn off V_s (5V voltage source) and I_s (2A current source) to find R_{th} ?
- What is R_{th} ?
- What is V_{th} ?
- What is I_{no} ?

(b) Consider this new circuit with a current-dependent voltage source (that depends on I_x , the current through the $3\ \Omega$ resistor): $V_x = 3\ \Omega \cdot I_x$ [V].

Hint: To find R_{th} , you will need to use a test voltage V_{test} (or test current) and find the relationship to its current I_{test} (or voltage).



- i. Should you turn off V_x to find R_{th} ?
- ii. What is R_{th} ?
- iii. What is V_{th} ?
- iv. What is I_{no} ?

2. An Easier Way To Do Math Homework (Spring 2022 Final Question 13)

You're working on your Math 1B homework and you don't know how to calculate an integral. Instead, you decide to put your circuit skills to use to solve this problem!

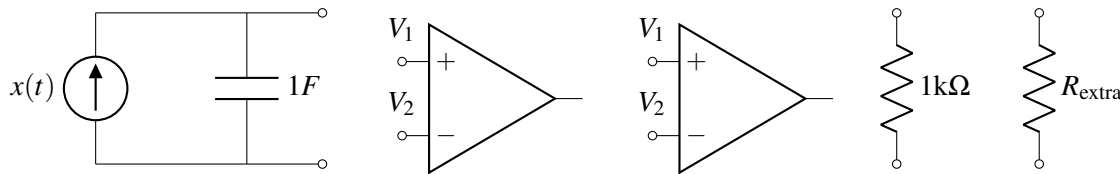
The integral that you're trying to solve is of the form

$$-\frac{1}{5} \int_0^{\tau} x(t) dt$$

Your helpful lab TA, Raghav, gives you several circuit elements that you can use.

These elements are:

- A current source $I_s = x(t)$ amps in parallel with a capacitance of 1F.
- **Two** op-amps (assume that the supply voltages to the op-amps are provided).
- A resistor $R_{\text{fixed}} = 1\text{k}\Omega$.
- One additional resistor R_{extra} that can have **any value**. Be sure to specify the resistance you use.



Design a circuit to have the above output using the provided elements. Clearly specify the resistance of R_{extra} if used.