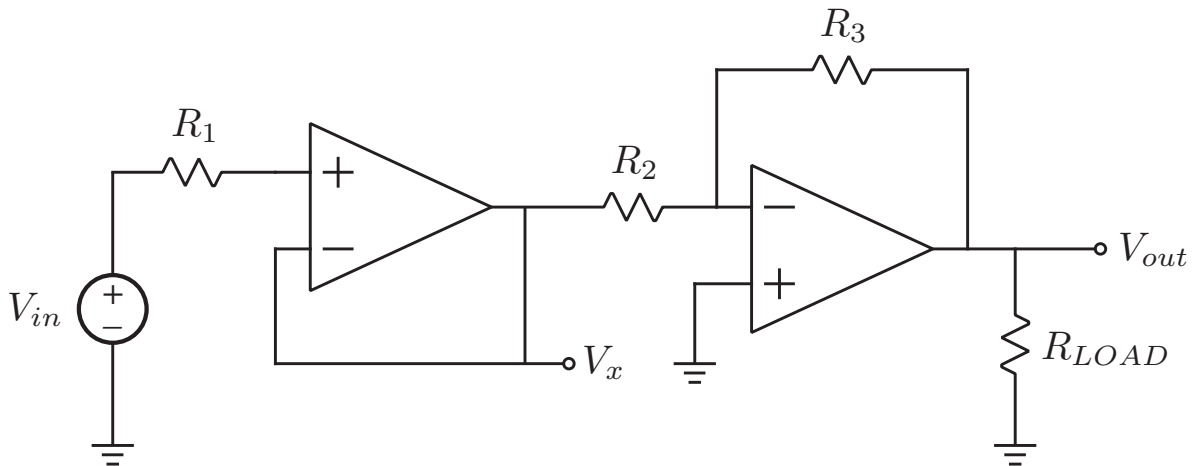


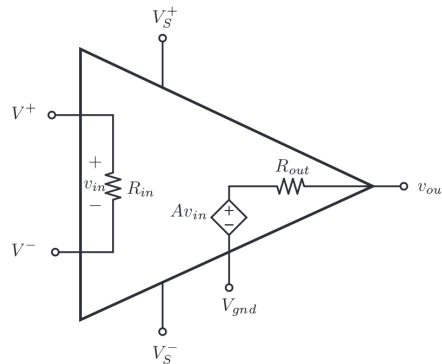
1. Thevenin's Theorem And Op-Amp Circuits!

You're given the below circuit – which basically cascades two opamps.



We're going to explore what this circuit does in several different ways.

- (a) Let's first assume that the Golden Rules hold ($R_{in} = \infty$, $R_{out} = 0\Omega$, and $A = \infty$ for both the opamps) Calculate V_x in terms of V_{in} . Calculate V_{out} in terms of V_x , and therefore in terms of V_{in} .



- (b) Now, suppose we remove the infinite gain assumption. So, $R_{in} = \infty$ and $R_{out} = 0$, but now A is finite for both opamps. This complicates our analysis... Thevenin and Norton, save us!
What is the Thevenin equivalent circuit at V_x with respect to ground *looking back*? (Imagine that you disconnect the rest of the circuit to the right of node x . Look at the rest of the circuit, and find the Thevenin voltage and equivalent resistance.)
- (c) Redraw the circuit using the Thevenin equivalent you have obtained. Does it look simpler?
- (d) Now, calculate the Thevenin equivalent circuit at V_{out} with respect to ground *looking back*. (Under the same finite-gain assumption as the previous part).

(e) Now, calculate V_{out} in the limit as $A \rightarrow \infty$. Do you get the same answer as before?