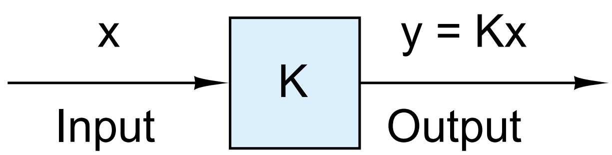
Linear functions

$f(K \cdot x) = K \cdot f(x)$

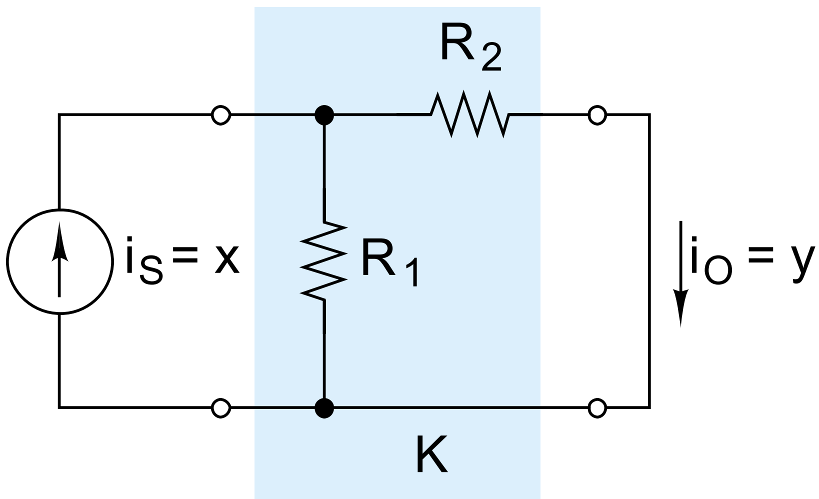
$f(x_1 + x_2) = f(x_1) + f(x_2)$

Linear circuits - part 1: proportionality property

$y = K \cdot x$

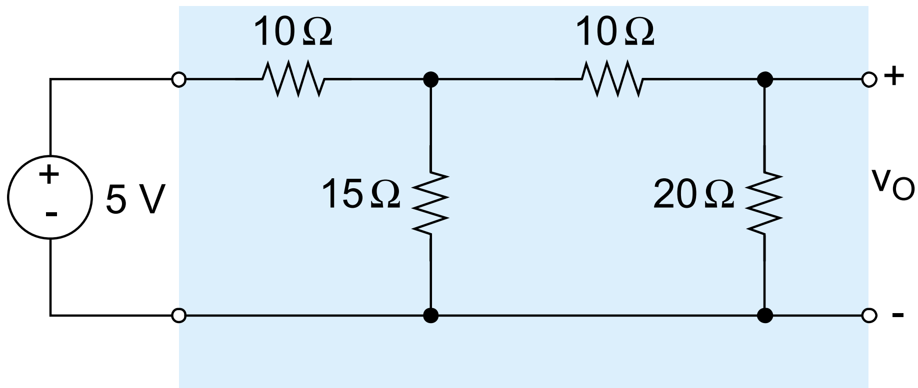


e.g.,



But how do you use this?

1) implicit in time varying i/o
2) unit output method
3) will pop up in subsequent engineering courses



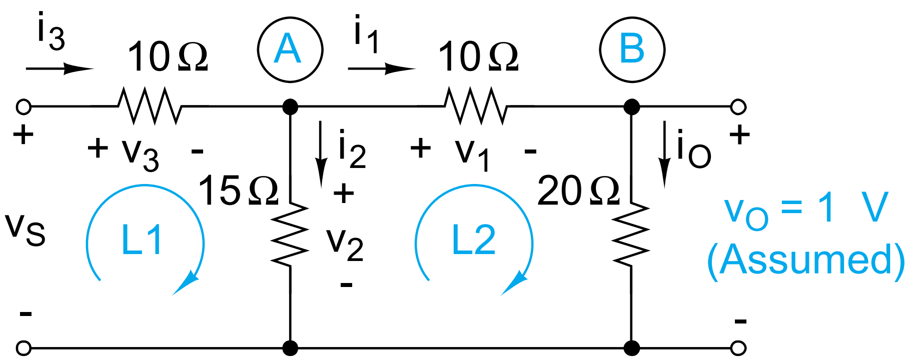
How do you find v_o?

Unit output method- one more tool for your toolbox

For circuits with one input,

First, turn the problem around, given a chosen output, what is the required input? Then use the proportionality property to find K and solve the circuit

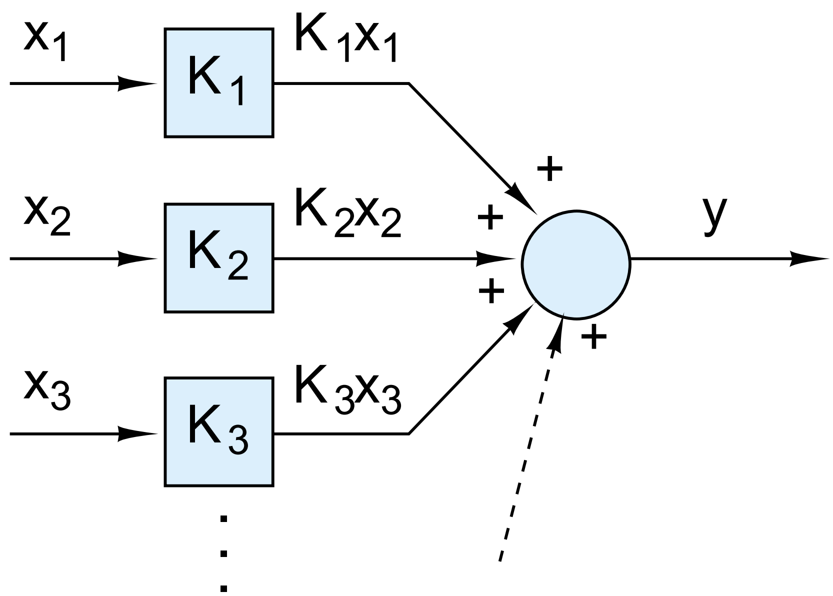
1) A unit output is assumed; i.e., v_o=1V or i_o=1A
2) Solve for the input using the tools we have already developed
3) K = output / input = 1 / input_for_unit_output



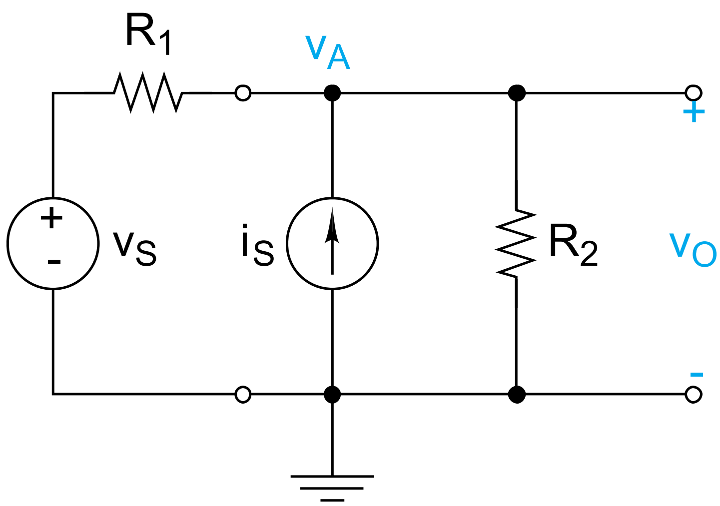
(this may seem like a trivial case, but trust me, you will appreciate this technique later in more complicated analysis)

Linear circuits - part 2: additivity property

$$y=K_1 \cdot x_1+K_2 \cdot x_2+K_3 \cdot x_3+...$$



e.g.,



But how do you use this?

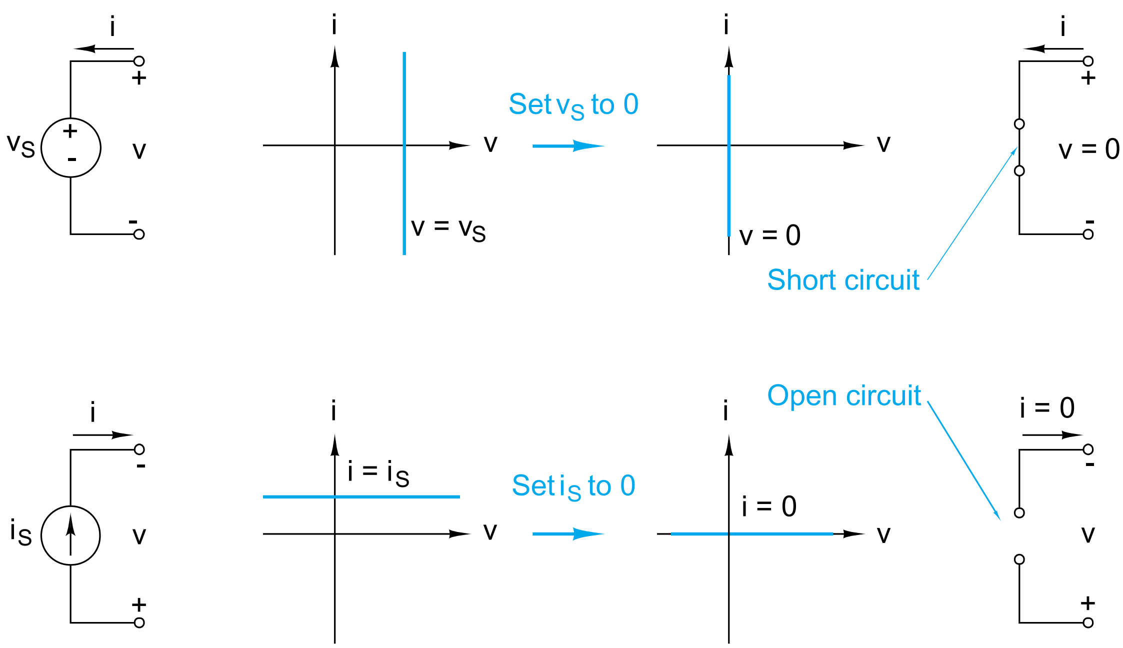
1) superposition principle
2) other analytical tools

Superposition principle-

In linear circuits, the contribution of each input is independent of all other inputs. So one can solve a linear circuit by successively turning off all but one of the inputs.

1) "Turn off" all <u>independent</u> sources except one and find the resulting output.
2) Repeat step 1 for each of the remaining independent sources.
3) The net output with all of the sources turned on is the algebraic sum of the outputs caused by each source acting alone.

But what do you mean by "turn off"?



Yes, you might call this an example...