Superposition

Output can be found by finding the contribution to the output from each source.

1. "Turn off" all independent sources except one and find output from that one alone.

2. Repeat 1 for each independent source.

3. Algebraically sum all outputs from each source.

Turning off an independent voltage source means replacing it by a short.

Move $v_s$ to origin to be "off".

This is electrically identical to a "short".

Move $i_s$ to zero to turn it off.

This is electrically identical to an "open".
Solve for $V_0$ using superposition.

(a) "Turn off" $i_s$ and find output due to $V_s$.

$v_0 = \frac{R_2}{R_1 + R_2} v_s$

$i_s$ becomes an "open" and the circuit is a voltage divider.

(b) "Turn off" $v_s$ and find output due to $i_s$.

This looks like two resistors in parallel.

$v_0 = i_s \frac{R_1 R_2}{R_1 + R_2}$

$\therefore v_0 = v_{0,v} + v_{0,i} = \frac{R_2}{R_1 + R_2} v_s + \frac{R_1 R_2}{R_1 + R_2} i_s$
Example 3-12.

Show that the output is a weighted sum of the inputs $V_{S1}$, $V_{S2}$, and $V_{S3}$.

Turn off $V_{S2}$ and $V_{S3}$.

Redrawing

$$V_o = \frac{R/2}{R + R/2} V_{S1} = \frac{R/2}{3R/2} V_{S1} = \frac{1}{3} V_{S1}$$

The other two source calculations are identical.

$$V_o = V_{o1} + V_{o2} + V_{o3} = \frac{1}{3} V_{S1} + \frac{1}{3} V_{S2} + \frac{1}{3} V_{S3}$$