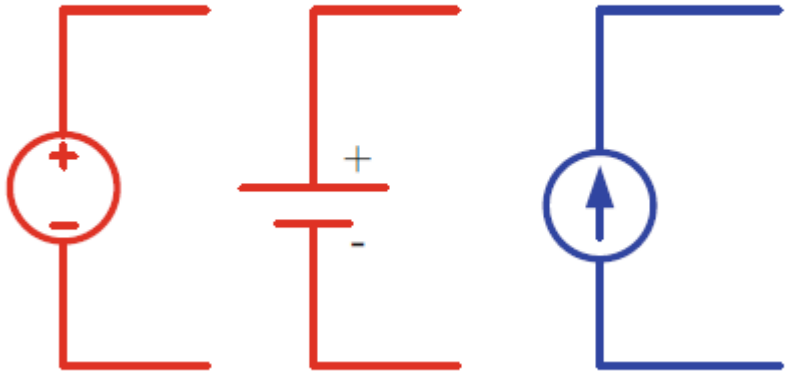
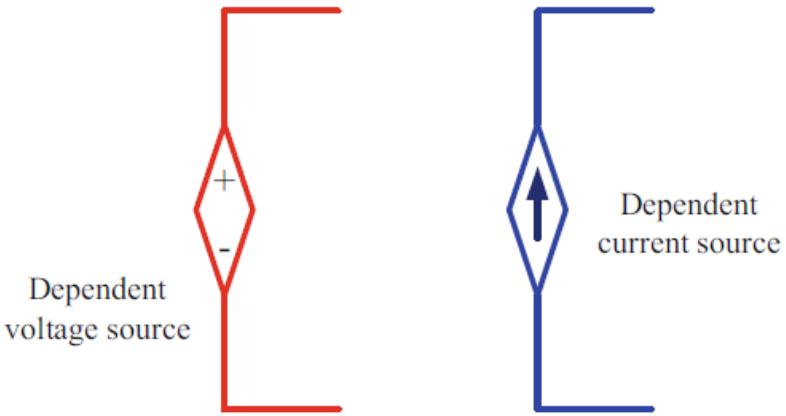
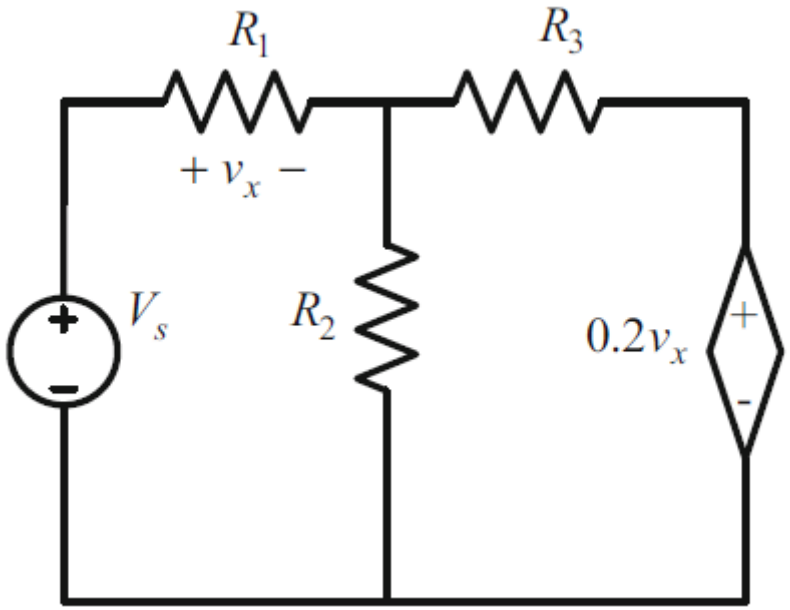
Fig. 1.12 Independent sources

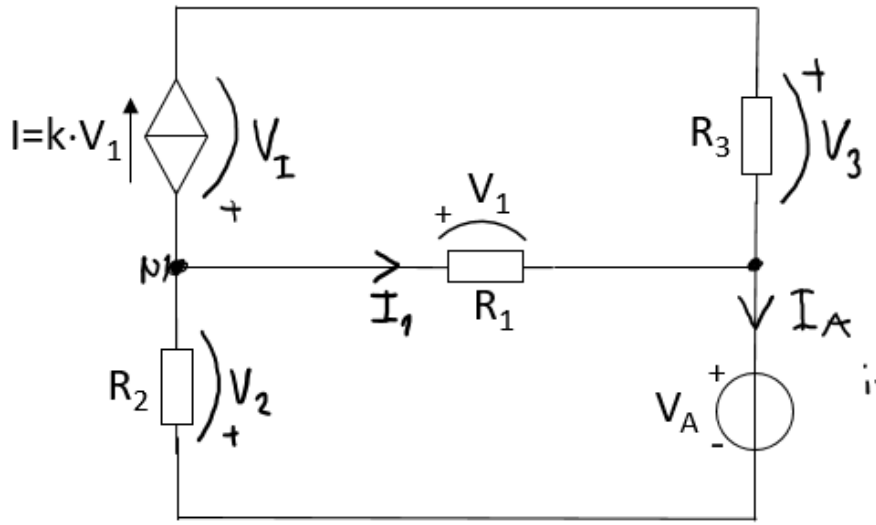




(1) Voltage-controlled voltage source (VCVS)
(2) Voltage-controlled current source (VCCS)
(3) Current-controlled voltage source (CCVS)
(4) Current-controlled current source (CCCS)



Analyze circuits with dependent sources



R_1=2 kΩ, R_2=6 kΩ, R_3=10 kΩ, V_A=18 V

$k = \frac{1}{3}\ mA/V$

$V_I, V_1, V_2, V_3, I_1, I_A, I$

$V_3 = R_3 \cdot k \cdot V_1$

KCL in N1: $\frac{V_1}{R_1} + kV_1 = \frac{V_2}{R_2}$ (1)

KVL in lower loop: $V_A + V_1 + V_2 = 0 \Rightarrow V_2 = -V_A - V_1$ (2)

(2) in (1) $\Rightarrow \frac{V_1}{R_1} + kV_1 = \frac{-V_A - V_1}{R_2} \Rightarrow V_1\left[\frac{1}{R_1} + k + \frac{1}{R_2}\right] = \frac{-V_A}{R_2} \Rightarrow V_1 = \frac{-V_A}{\frac{R_2}{R_1} + kR_2 + 1} = \frac{-18}{\frac{6}{2} + \frac{6}{3} + 1} = -3\ V$

$V_3 = 10 \cdot \frac{1}{3} \cdot (-3) = -10\ V$

$I = k \cdot V_1 = \frac{1}{3} \cdot (-3) = -1\ mA$

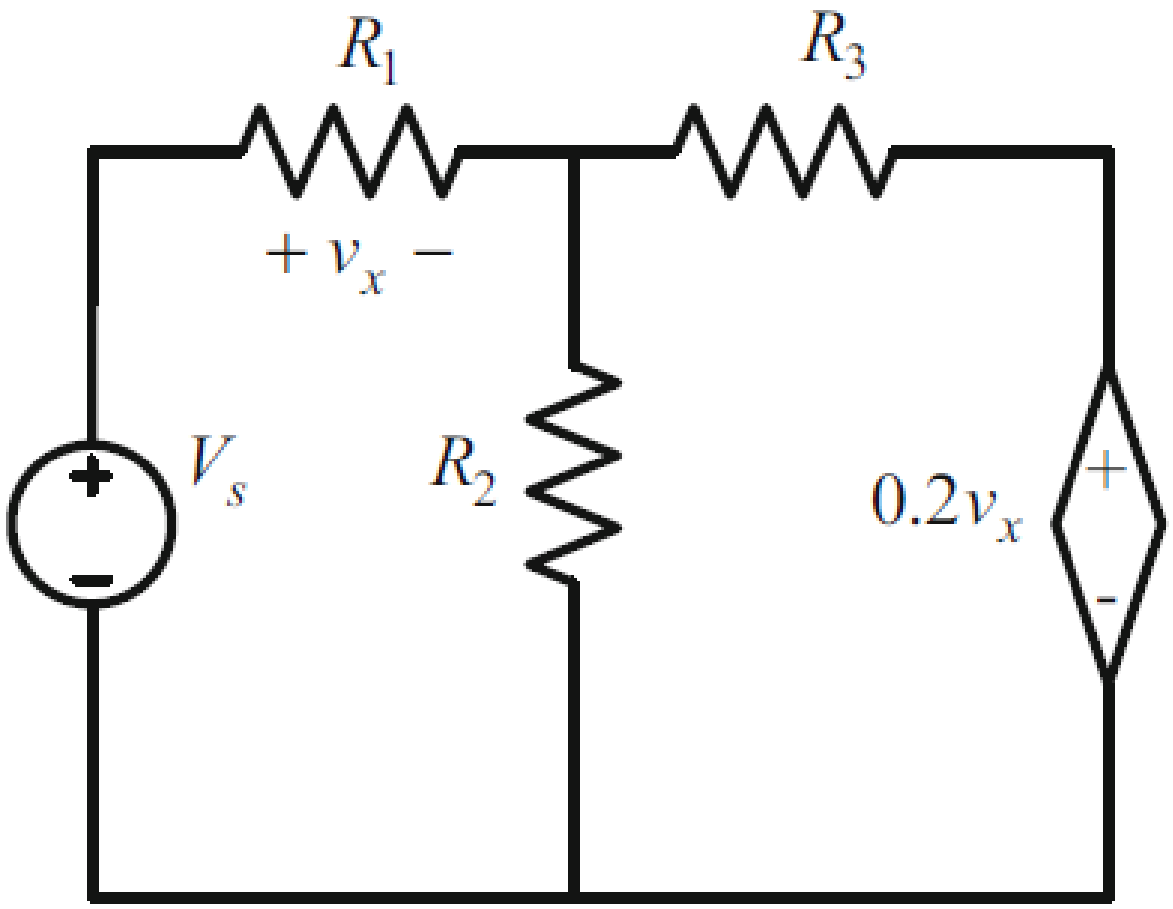
$V_2 = -V_A - V_1 = -18 - (-3) = -15\ V$

$V_1 - V_I - V_3 = 0 \Rightarrow V_I = V_1 - V_3 = -3 - (-10) = 7\ V$

$I_1 = \frac{V_1}{R_1} = \frac{-3}{2} = -1{,}5\ mA$

$I_1 + I = I_A \Rightarrow I_A = -1{,}5 + (-1) = -2{,}5\ mA$

Circuit Element	V[V]	I[mA]	P[mW]
R_1	-3	-1,5	4,5
R_2	-15	-2,5	37,5
R_3	-10	-1	10
I	7	-1	-7
V_A	18	-2,5	-45



R_1=2 kΩ
R_2=2 kΩ
R_3=2 kΩ
V_S=10 V

Determine v_x

Send me an email (pereh@kth.se) with your answer and I give you feedback on your answer.