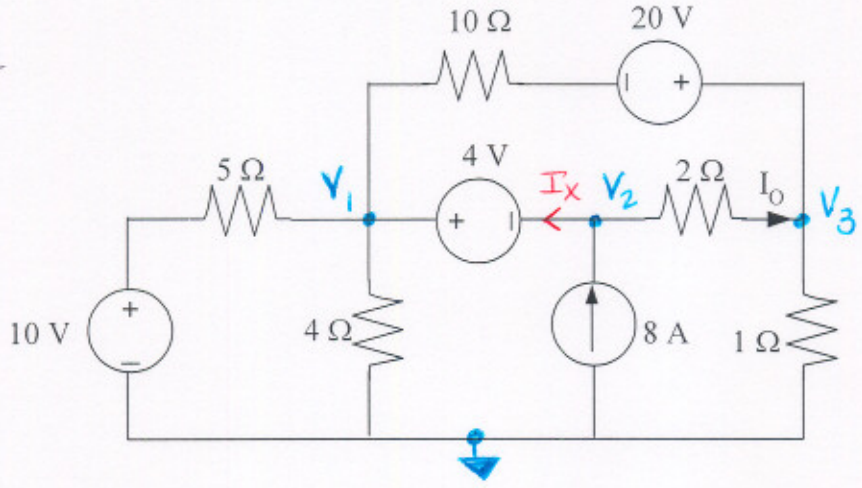
Nodal Analysis Examples – Solutions

1. Use nodal analysis to solve for the current I_o and the power delivered by the 4 V source.

note: I labeled I_x.



we know:

$I_o = \frac{V_2 - V_3}{2}$

$P_{4V} = 4 I_x$

$V_1 - V_2 = 4$

(N1) $\frac{V_1 - 10}{5} + \frac{V_1}{4} + \frac{V_1 + 20 - V_3}{10} - I_x = 0$

(N2) $I_x - 8 + \frac{V_2 - V_3}{2} = 0$

(N3) $\frac{V_3 - V_2}{2} + \frac{V_3 - 20 - V_1}{10} + \frac{V_3}{1} = 0$

simplify

(N1) $.55V_1 - .1V_3 - I_x = 0$

(N2) $.5V_2 - .5V_3 + I_x = 8$

(N3) $-.1V_1 - .5V_2 + 1.6V_3 = 2$

know $V_1 - V_2 = 4$

solve

$V_1 = 12.12\,V$ $V_3 = 4.55V$

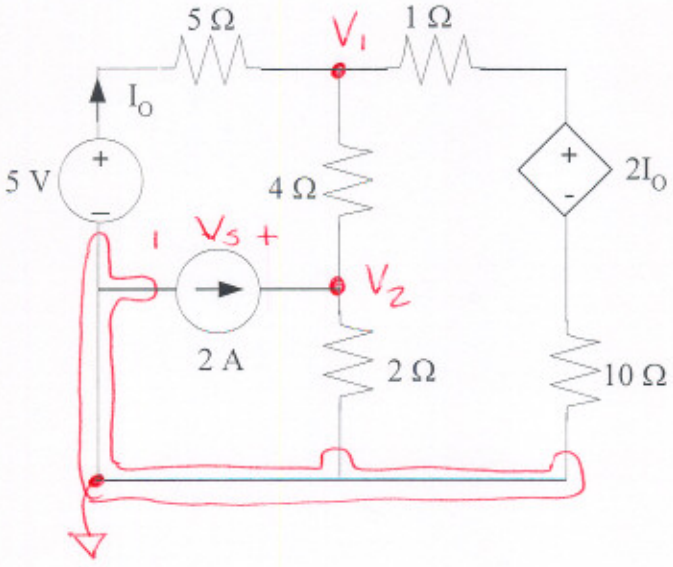
$V_2 = 8.12\,V$ $I_x = 6.21\,A$

so

$I_o = 1.79\,A$

$P_{4V} = 24.84\,W$, del

2. Use Nodal Analysis to find I_O and the power delivered by the 2A source.



Know:

$I_O = \frac{5 - V_1}{5}$

$V_S = V_2$

$P_{2A} = V_S \cdot 2$

$= 2V_2$

note: I labeled V_S.

(N1) $\frac{V_1 - 5}{5} + \frac{V_1 - V_2}{4} + \frac{V_1 - 2I_O}{11} = 0$

(N2) $\frac{V_2}{2} + \frac{V_2 - V_1}{4} + (-2) = 0$

Simplify (remember $I_O = \frac{5 - V_1}{5}$)

(N1) $V_1(.577) + V_2(-.25) = 1.18$

(N2) $V_1(-.25) + V_2(.75) = 2$

Solve

$V_1 = 3.74\,V$

$V_2 = 3.91\,V$

$\Rightarrow$

So

$I_O = 0.25A$

$P_{2A} = 7.82\,W$, del