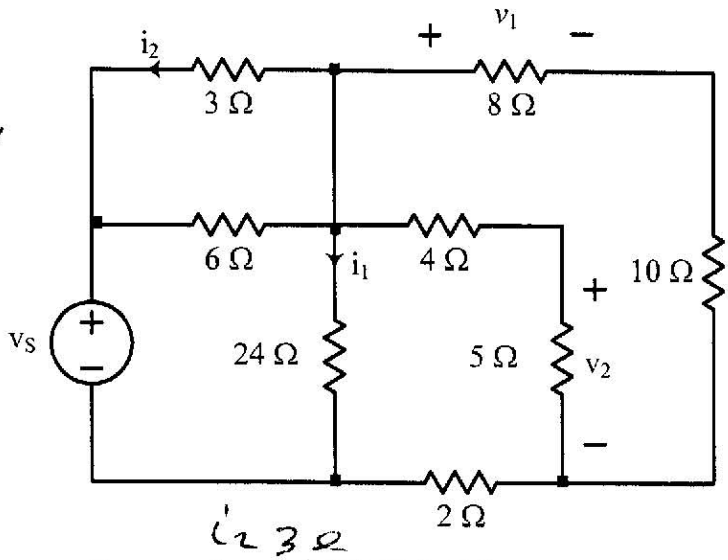
Problem 1.

1. Given that $v_1 = 24$ V in the circuit shown, find v_2, i_1, i_2 and v_S.



$i_3' = \frac{24}{8} = 3$ A

$v_3 = v_1 + 10 i_3' = 24 + 10(3) = 54$ V

VDR ⇒

$v_2 = \frac{v_3(5)}{4+5} = \frac{54(5)}{9} = 30$ V

$i_4' = \frac{54}{6} = 9$ A

$v_4 = 54 + 2 i_4' = 54 + 2(9)$

$= 72$ V

$\Rightarrow i_1' = \frac{72}{24} = 3$ A

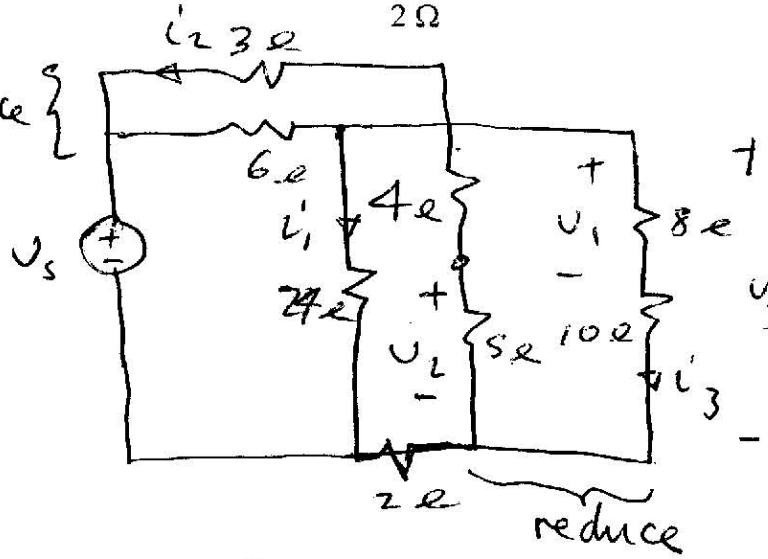
$i_5' = \frac{v_4}{6} = \frac{72}{6} = 12$ A

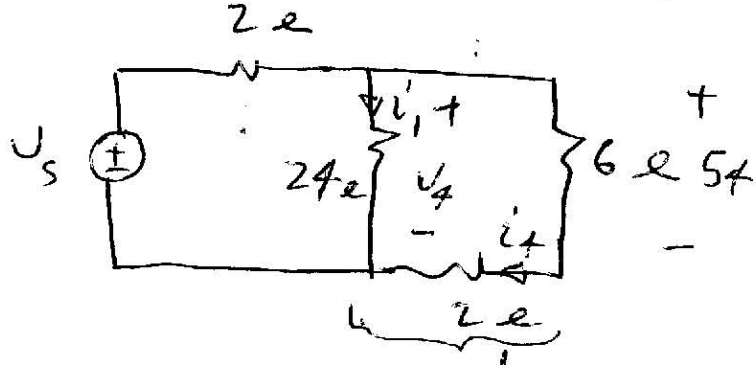
$v_S = (2+6)\, i_5'$

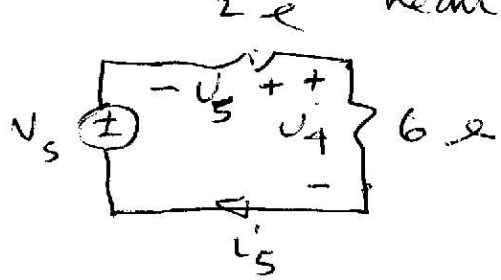
$= 8(12) = 96$ V

$v_5 = -2 i_5' = -24$ V

$i_2' = \frac{-v_S}{3} = \frac{-24}{3} = -8$ A







Problem2:

In the circuit shown, find the power absorbed by the 1.5 Ω resistor $P_{1.5\Omega}$.
(Note: no need to find the power of the other resistors except the 1.5 Ω resistor)

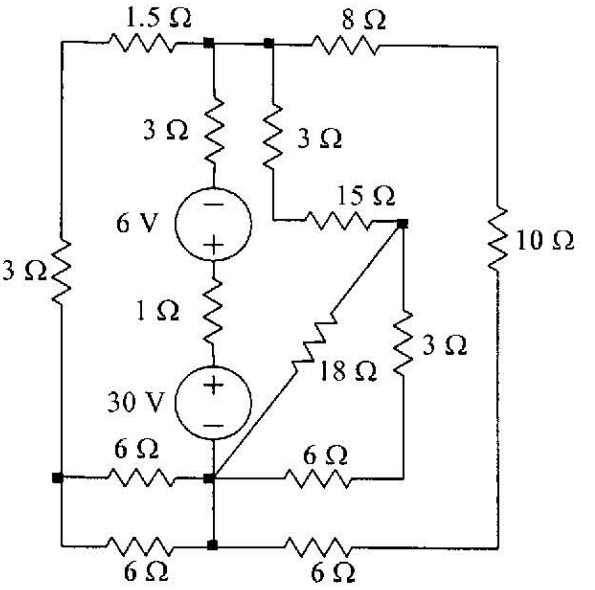
VDR ⇒

$V = 12.858\,V$

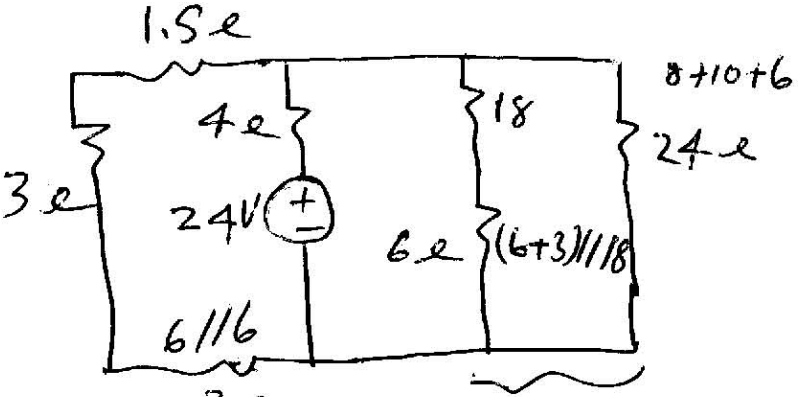
$\Rightarrow i = \frac{V}{7.5} = \frac{12.858}{7.5} = 1.714\,A$

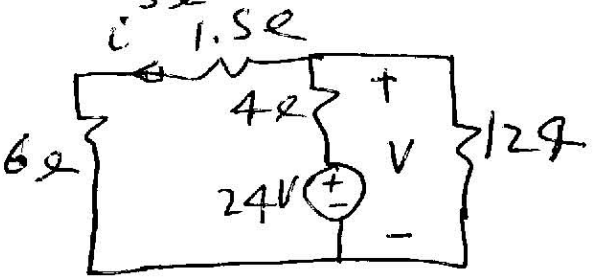
$\Rightarrow P_{1.5\Omega} = i^2(1.5) = (1.714)^2(1.5)$

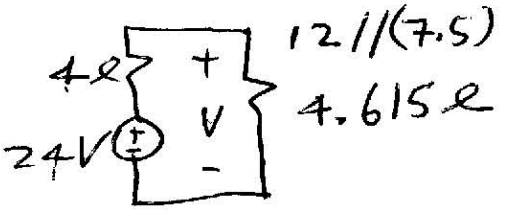
$= 4.41\,W$



reduce ⇓

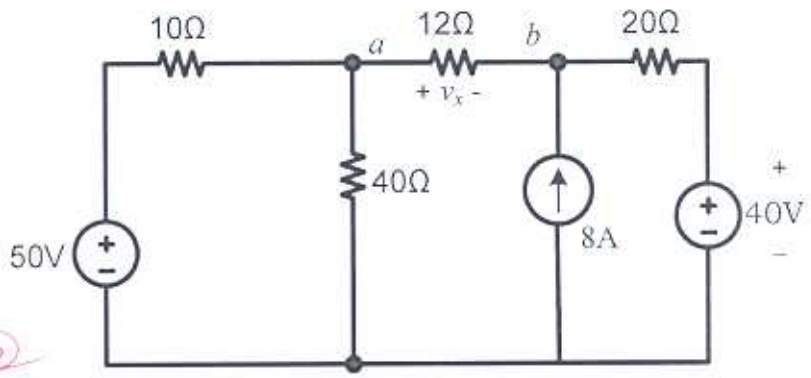


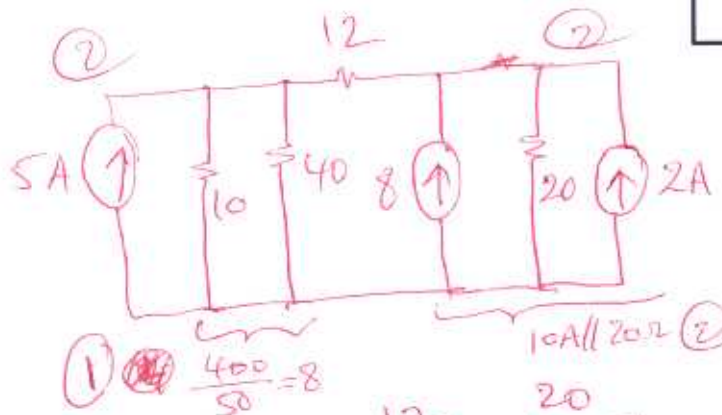




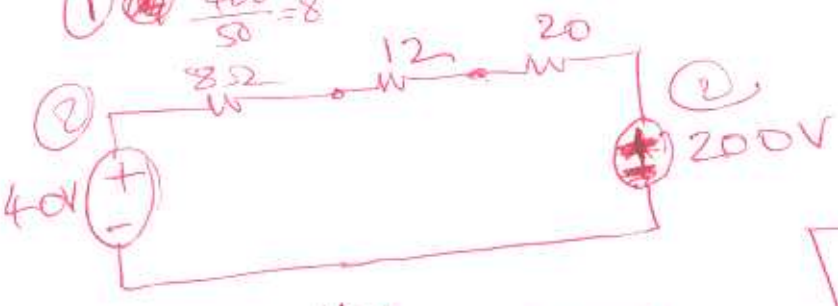
Problem 3:

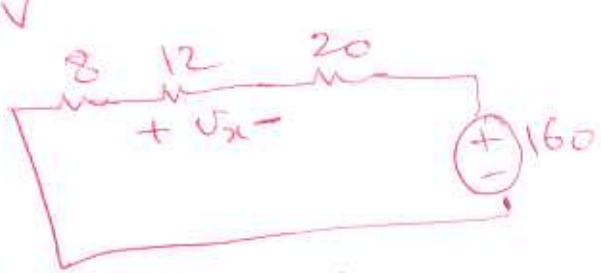
Apply source transformations to reduce the circuit shown to a single loop, then find v_x.

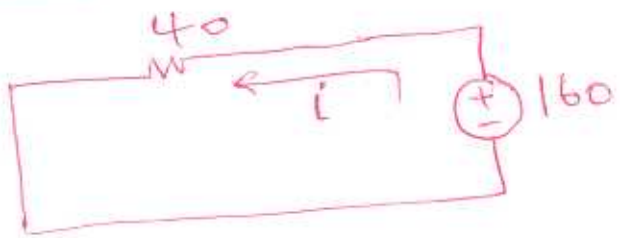




$\frac{400}{50} = 8$







$v_x = -i \times 12$

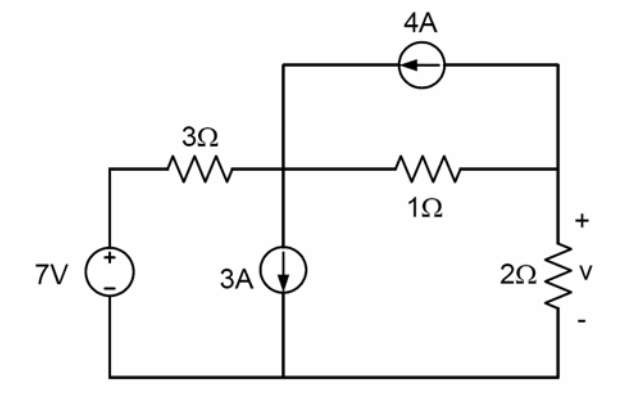
$= -4 \times 12 = -48\ V$

$i = \frac{160}{40} = 4A$

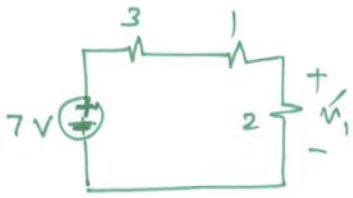
15 points

Problem 4:

Apply the superposition principle to determine the voltage v in the circuit shown.

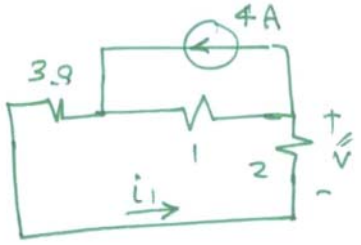


$v_1' = \frac{2}{6} \times 7 = \frac{14}{6}$ Volt



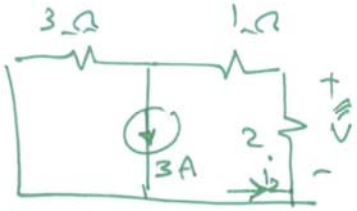
$i_1 = \frac{1}{6} \times 4$ A

$\therefore v'' = -2i_1 = -\frac{8}{6}$ V



$i_2 = \frac{3}{6} \times 3 = \frac{3}{2}$ A

$\therefore v''' = -2i_2 = -3$ V



$\therefore v = v' + v'' + v''' = \frac{14}{6} - \frac{8}{6} - 3$

$= -2$ Volt