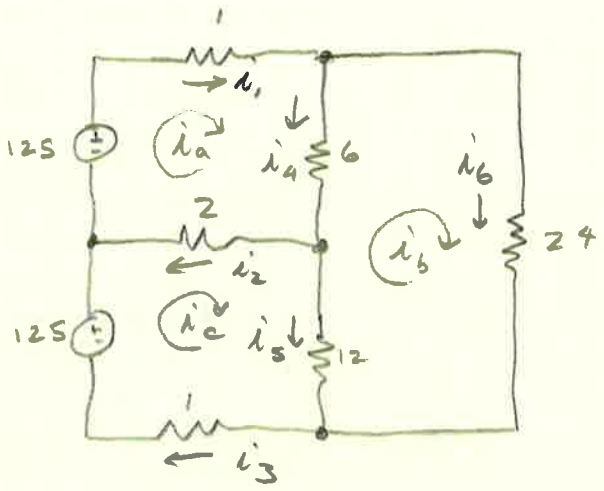
a) Solve for all currents using mesh analysis.



i_a: $-125 + 1(i_a) + 6(i_a - i_b) + 2(i_a - i_c) = 0$

i_b: $24(i_b) + 12(i_b - i_c) + 6(i_b - i_a) = 0$

i_c: $-125 + 2(i_c - i_a) + 12(i_c - i_b) + 1 i_c = 0$

Standard Form:

$$\begin{aligned} 9 i_a - 6 i_b - 2 i_c &= 125 \\ -6 i_a + 42 i_b - 12 i_c &= 0 \\ -2 i_a - 12 i_b + 15 i_c &= 125 \end{aligned}$$

Solving: $i_a = 23.76\,A$, $i_b = 8.66\,A$, $i_c = 18.43\,A$

So
$i_1 = i_a = 23.76\,A$
$i_2 = i_a - i_c = 5.34\,A$
$i_3 = i_c = 18.43\,A$
$i_4 = i_a - i_b = 15.10\,A$
$i_5 = i_c - i_b = 9.77\,A$
$i_6 = i_b = 8.66\,A$

b) Show that Power developed = Power dissipated

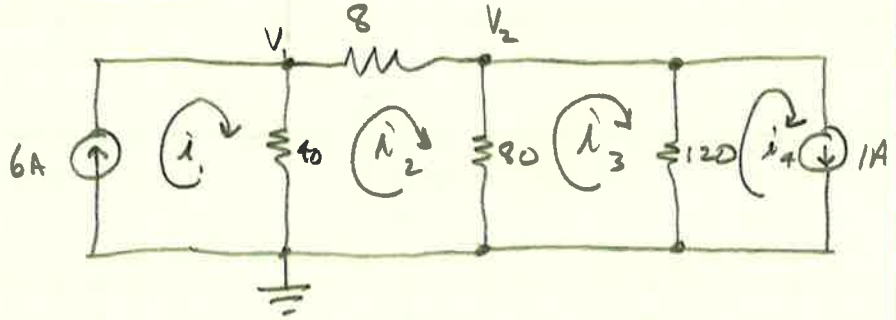
$P_{125+} = (125)(-23.76) = -2970\,W$
$P_{125_B} = (125)(-18.43) = -2303.75\,W$
$\Big\} -5274\,W$

$P_1 = (23.76)^2 1 = 564.54\,W$
$P_6 = (15.10)^2 6 = 1368.1\,W$
$P_2 = (5.34)^2 2 = 57.03\,W$
$P_{12} = (9.77)^2 12 = 1145.4\,W$
$P_1 = (18.43)^2 1 = 339.7\,W$
$P_{24} = (8.66)^2 24 = 1800\,W$

$5275\,W$

Find v_1 and v_2 using the mesh current method.

1) Pick Reference
2) assign mesh currents
3) Solve



$i_1 = 6A$

① mesh i_2: $40(i_2 - i_1) + 8i_2 + 80(i_2 - i_3) = 0$

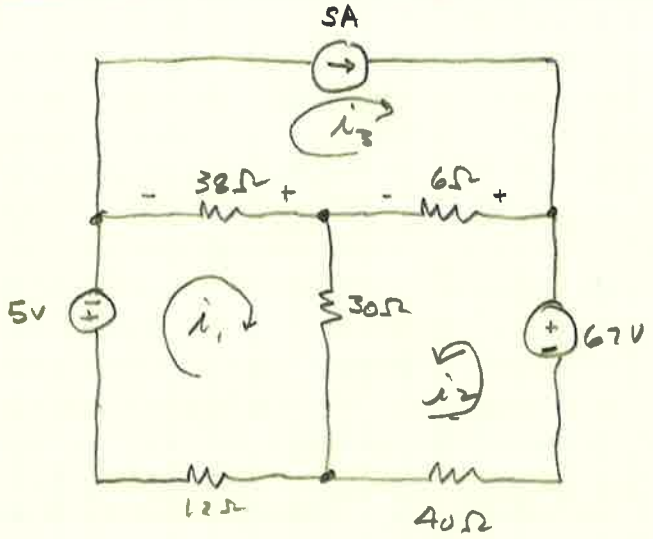
② mesh i_3: $80(i_3 - i_2) + 120(i_3 - i_4) = 0$

$i_4 = 1A$

Solving ① + ②: $\boxed{\begin{array}{l} i_2 = 3A \\ i_3 = 1.8A \end{array}}$

$v_1 = 40(i_1 - i_2) = 40(6-3) = \underline{\underline{120\,V}}$

$v_2 = v_1 - 8i_2 = \underline{\underline{96\,V}}$



a) use mesh-current method to find P_{5A}.

mesh i_1:
$$5 + 38(i_1 - i_3) + 30(i_1 + i_2) + 12 i_1 = 0$$

mesh i_2:
$$-67 + 6(i_2 + i_3) + 30(i_2 + i_1) + 40 i_2 = 0$$

mesh i_3:
$$i_3 = 5A$$

Solving: $i_1 = 2.5A$, $i_2 = -0.5A$, $i_3 = 5A$

$$P_{5A} = VI = (V_{38} + V_6)5A = [38(i_1 - i_3) + 6(i_3 + i_2)]5 = (-122)(5) = -610W$$

5A source is delivering 610W

b) $P_{5V} = 5(2.5) = 12.5W$
$P_{67} = .5(67) = 33.5W$

Total power delivered = 610W

c) check that power delivered = power absorbed

$P_{38} = (2.5)^2 38 = 237.5W$
$P_6 = (4.5)^2 6 = 121.5W$
$P_{30} = (2)^2 30 = 120W$
$P_{40} = (.5)^2 40 = 10W$
$P_{12} = (2.5)^2 12 = 75W$

$+12.5W$
$33.5W$
$610W$ ✓