

P95 4.6 Apply KVL:

$$\text{mesh 1: } -6 + 14i_1 + 5(i_1 - i_2) + 5(i_1 - i_2) = 0$$

$$\Rightarrow 24i_1 - 10i_2 = 6$$

$$\Rightarrow 12i_1 - 5i_2 = 3 \quad \text{--- ①}$$

$$\text{mesh 2: } (5+5)(i_2 - i_1) + 10i_2 + 5 = 0$$

$$\Rightarrow -2i_1 + 4i_2 = -1 \quad \text{--- ②}$$

$$\text{Solving ① ②, } i_1 = 184.2 \text{ mA, } i_2 = -157.9 \text{ mA}$$

P97 4.8

$$(a) A = 2i_2$$

Apply KVL,

$$\text{mesh 1: } -2 + 2i_1 + 5(i_1 - i_2) + -2i_2 = 0 \quad \text{--- ①}$$

$$\text{mesh 2: } 5(i_2 - i_1) + 3i_2 - 6 + 4i_2 = 0 \quad \text{--- ②}$$

$$\text{solving ① ②, } i_1 = 1.35 \text{ A, } i_2 = \del{1.06} 1.06 \text{ A}$$

$$(b) A = 2v_x$$

Apply KVL,

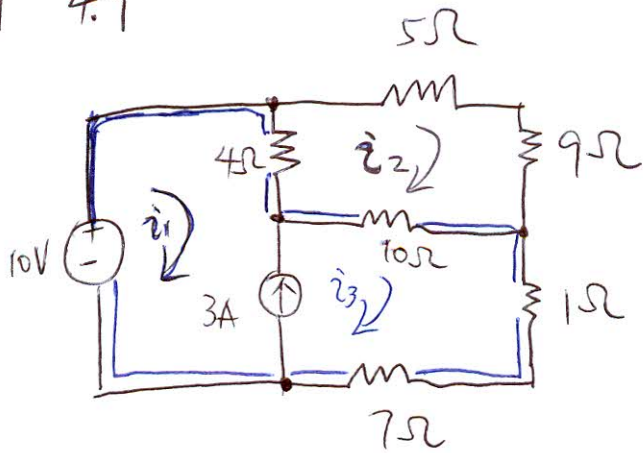
$$\text{mesh 1: } -2 + 2i_1 + v_x + 2v_x = 0 \quad \text{--- ③}$$

$$\text{mesh 2: } -v_x + 3i_2 - 6 + 4i_2 = 0 \quad \text{--- ④}$$

$$\text{and } v_x = 5(i_1 - i_2) \quad \text{--- ⑤}$$

$$\text{solving ③ ④ ⑤, } \Rightarrow i_1 = 546 \text{ mA}$$

P99 4.9



form the supermesh  $i_1-i_3$  with the blue line loop.

Apply KVL,

mesh  $i_1-i_3$ :

$$-10 + 4(i_1 - i_2) + 10(i_3 - i_2) + 1 \cdot i_3 + 7i_3 = 0 \quad (1)$$

or  $4i_1 - 14i_2 + 18i_3 = 10$   
mesh  $i_2$ :

$$4(i_2 - i_1) + 5i_2 + 9i_2 + 10(i_2 - i_3) = 0 \quad (2)$$

or  $-4i_1 + 28i_2 - 10i_3 = 0$

and by inspection,  $i_3 - i_1 = 3 \quad (3)$

or  $-i_1 + 0i_2 + i_3 = 3$

solving (1)(2)(3), see MATLAB code:

$$i_1 = -1.933A, \quad i_2 = 0.105A, \quad i_3 = 1.067A$$

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>> % Practice 4.9
```

```
>> A = [4 -14 18; -4 28 -10; -1 0 1]
```

```
A =
```

```
     4    -14    18
    -4     28   -10
    -1     0     1
```

```
>> B = [10; 0; 3 ]
```

```
B =
```

```
    10
     0
     3
```

```
>> A^-1*B
```

```
ans =
```

```
 -1.9333
  0.1048
  1.0667
```

```
>>
```

P<sub>115</sub> 31. Apply KVL:

$$\text{for mesh 1: } -15 + 9i_1 + 1 \cdot (i_1 - i_2) - 11 = 0 \quad (1)$$

$$\text{for mesh 2: } 9i_2 - 21 + 11 + 1 \cdot (i_2 - i_1) = 0 \quad (2)$$

$$\text{solve (1), (2): } i_1 = \frac{30}{11} \text{ (A)} \quad i_2 = \frac{14}{11} \text{ (A)}$$

P<sub>115</sub> 32. Apply KVL:

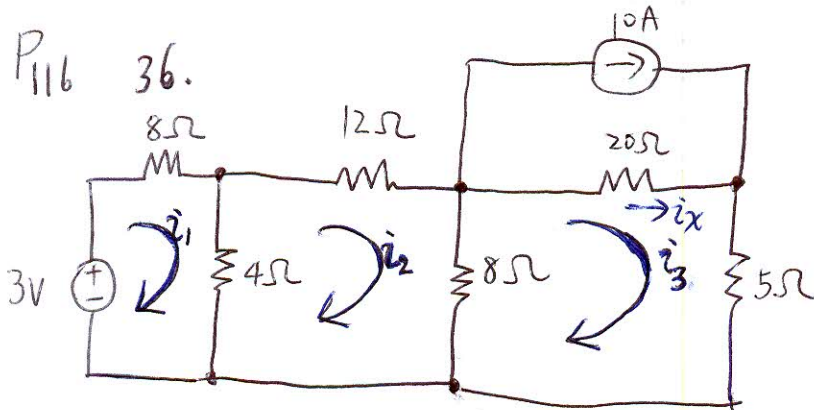
$$\text{for mesh 1: } -2 + 1 \cdot (i_1 - i_2) - 3 + 5(i_1 - i_3) = 0 \quad (1)$$

$$\text{for mesh 2: } 1 \cdot (i_2 - i_1) + 6i_2 + 9(i_2 - i_3) = 0 \quad (2)$$

$$\text{for mesh 3: } 5(i_3 - i_1) + 3 + 9(i_3 - i_2) + 7i_3 = 0 \quad (3)$$

Solve (1), (2), (3):

$$i_1 = 0.9892 \text{ (A)} \quad i_2 = 0.1501 \text{ (A)} \quad i_3 = 0.1570 \text{ (A)}$$



See MATLAB code

Apply KCL:

$$\text{for mesh 1: } -3 + 8i_1 + 4(i_1 - i_2) = 0 \quad (1)$$

$$\text{for mesh 2: } 4(i_2 - i_1) + 12i_2 + 8(i_2 - i_3) = 0 \quad (2)$$

$$\text{for mesh 3: } 8(i_3 - i_2) + 20i_x + 5i_3 = 0 \quad (3)$$

$$\text{obviously, } i_x = i_3 - 10, \text{ then (3) becomes } 8(i_3 - i_2) + 20(i_3 - 10) + 5i_3 = 0 \quad (4)$$

$$\text{solving (1)(2)(4), } i_1 = 1.073/1.026 \text{ (A)}, i_2 = 1.633/1.684 \text{ (A)}, i_3 = 3.406/5.13 \text{ (A)}, \text{ therefore } i_x = i_3 - 10 = -3.3606 \text{ (A)}$$

```
>> % Problem 36
syms i1 i2 i3
equation1 = '-3+8*i1 + 4*(i1-i2)=0'
equation2 = ' 4*(i2-i1)+12*i2+8*(i2-i3)=0'
equation3 = '8*(i3-i2)+20*(i3-10)+5*i3=0'

[i1 i2 i3 ] = solve(equation1,equation2,equation3,i1, i2, i3)
ix = subs(i3)-10

equation1 =

-3+8*i1 + 4*(i1-i2)=0

equation2 =

 4*(i2-i1)+12*i2+8*(i2-i3)=0

equation3 =

8*(i3-i2)+20*(i3-10)+5*i3=0

i1 =

1073/1026

i2 =

1633/684

i3 =

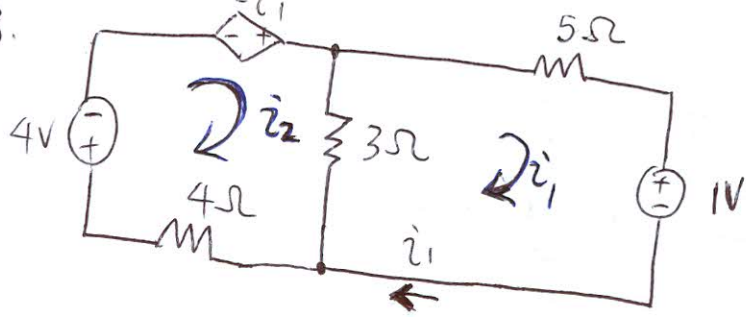
3406/513

ix =

-3.3606

>>
```

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Apply KVL,

for mesh 1 (right mesh):

$$5i_1 + 1 + 3(i_1 - i_2) = 0 \quad (1)$$

for mesh 2 (left mesh):

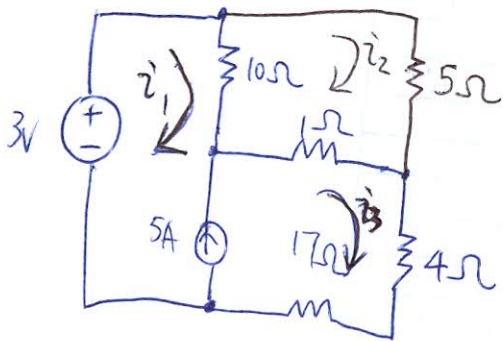
$$4 - 2i_1 + 3(i_2 - i_1) + 4i_2 = 0 \quad (2)$$

solving (1) (2),  $i_1 = -0.4634A$ ,  $i_2 = -0.9024A$

$$\Rightarrow P_{4\Omega} = i_2^2 \cdot R_{4\Omega} = i_2^2 \times 4 = 3.2573W$$

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43.



form a supermesh as the blue line loop,

Apply KVL,

for mesh  $i_1 - i_3$ ,

$$-3 + 10(i_1 - i_2) + 1(i_3 - i_2) + 4i_3 + 17i_3 = 0 \quad (1)$$

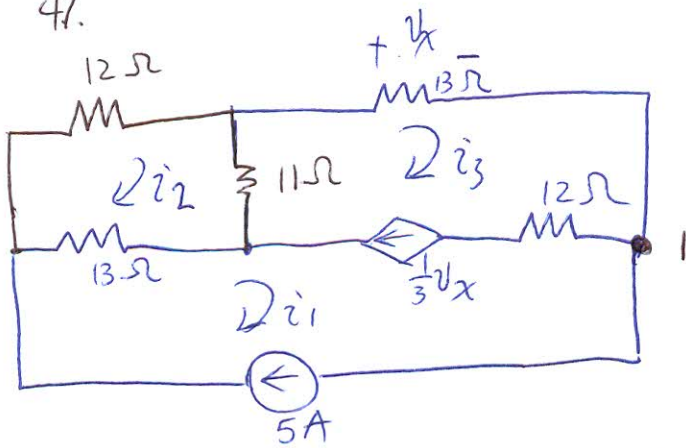
for mesh  $i_2$ ,

$$10(i_2 - i_1) + 5i_2 + (i_2 - i_3) = 0 \quad (2)$$

also from inspection,  $i_3 - i_1 = 5 \quad (3)$

Solving (1) (2) (3),  $i_1 = -4.238A$ ,  $i_2 = -2.606A$ ,  $i_3 = 0.762A$ , hence,  $P_{1\Omega} = (i_2 - i_3)^2 \cdot 1 = 11.310W$

47.



form the supermesh as the blue line loop,

by inspection,  $i_1 = 5A$ ,

Apply KVL for mesh  $i_2$ :  $12i_2 + 11(i_2 - i_3) + 13(i_2 - i_1) = 0$

$$\begin{aligned} i_1 = 5A \\ \Rightarrow \end{aligned}$$

$$12i_2 + 11i_2 - 11i_3 + 13i_2 = 65 \dots \textcircled{1}$$

$$\left. \begin{aligned} \text{for node 1: } i_3 - \frac{1}{3}V_x - 5 = 0 \\ \text{and } V_x = 13i_3 \end{aligned} \right\} \Rightarrow i_3 - \frac{13i_3}{3} - 5 = 0 \Rightarrow i_3 = -1.5A$$

therefore from  $\textcircled{1}$ , we have  $36i_2 = 11i_3 + 65$

$$i_2 = \frac{11i_3 + 65}{36} = 1.347A$$