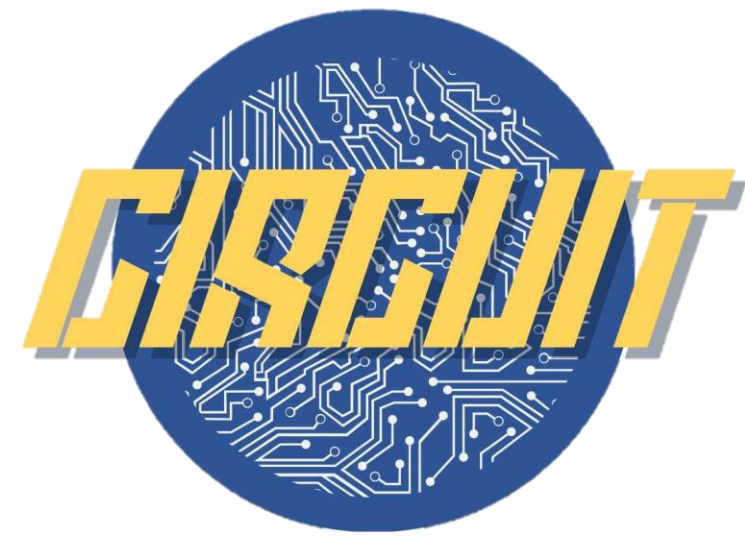


Circuit & Electronic Group9



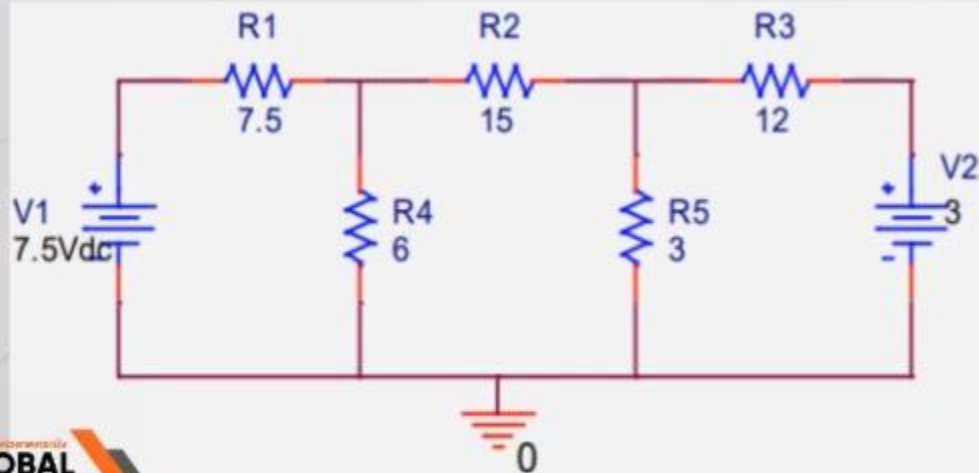
63010895 นายวีรภัทร อุ่มอาษา

63010918 นายศิวักร น้อยสันโดษ

63010921 นายศุภกร ทองบ่อ

ปัญหาที่ 1 การแก้ปัญหาคircuitวิเคราะห์ไฟฟ้า 2

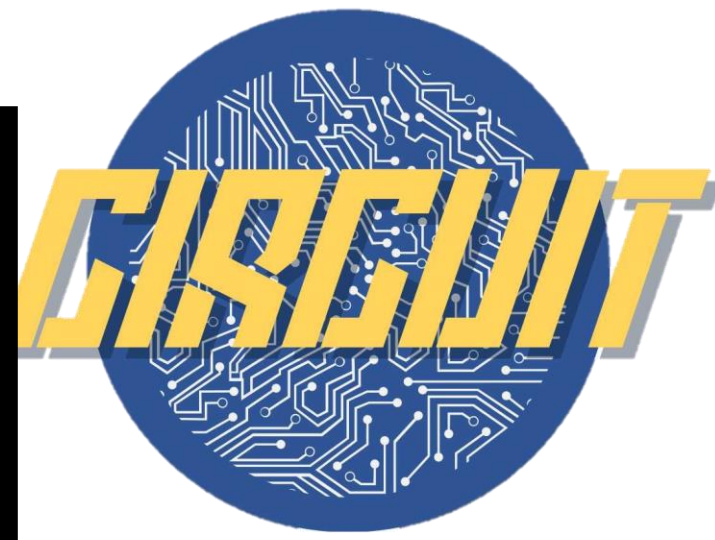
โจทย์



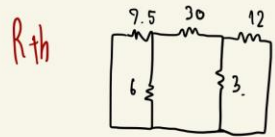
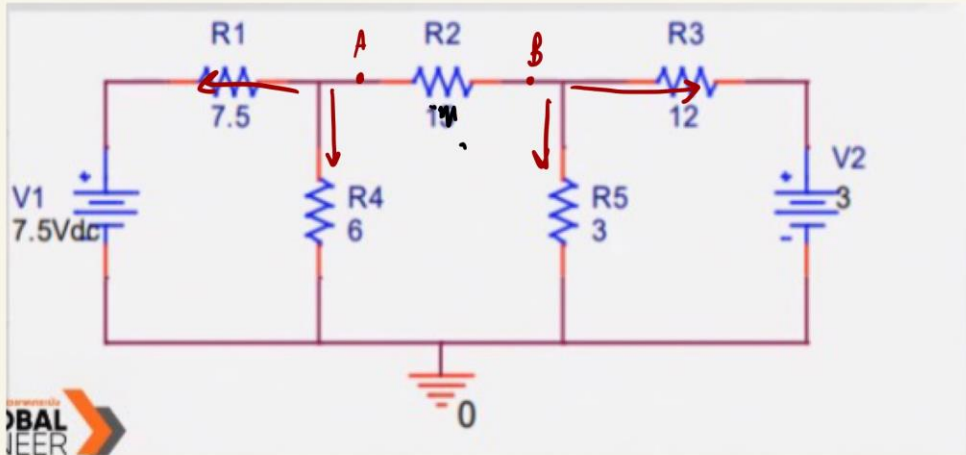
จากรูปที่ 1 วงจร ให้หา IR_2

$$R_2 = 30 \text{ Ohm}$$





Thevenin



$$R_{th} = 12 // 3 + 7.5 // 6 = \frac{86}{15} = 5.73 \Omega$$

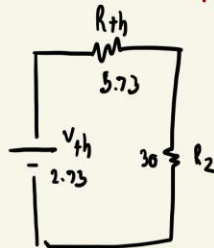
V_{th}

Ⓐ $\frac{V_A - 7.5}{7.5} + \frac{V_A}{6} = 0$ $V_{th} = |V_A - V_B| = \frac{49}{15} = 2.93 V$

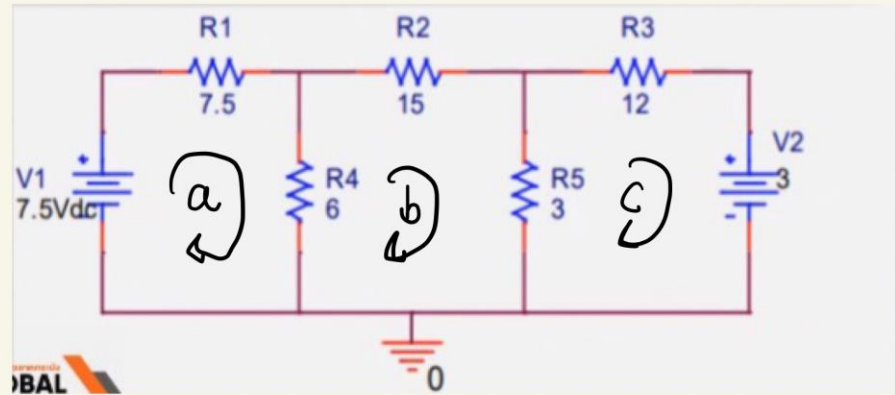
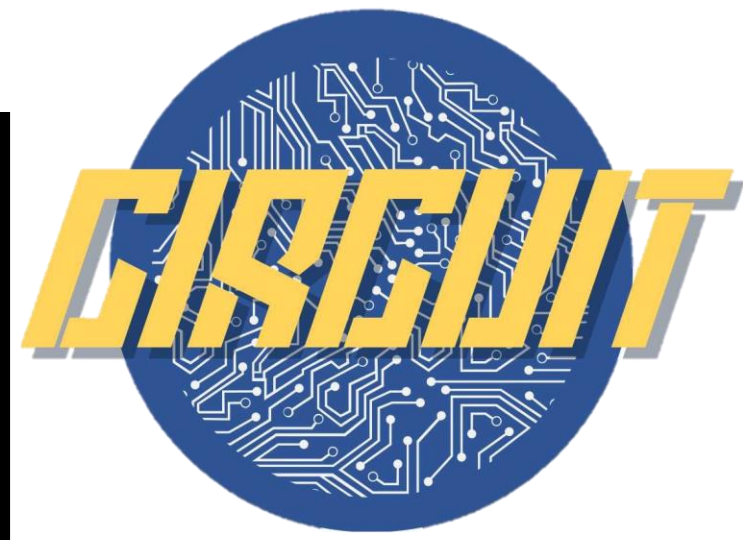
$$V_A = \frac{19}{3}$$

Ⓑ $\frac{V_B - 3}{12} + \frac{V_B}{3} = 0$

$$V_B = \frac{3}{5}$$



$$I_{R_2} = \frac{V_{th}}{R_{th} + R_2} = \frac{2.93}{5.73 + 30} = 76.40 \text{ mA}$$



Loop A $(R_1 + R_4)I_a + (-R_4)I_b$.

Loop B $(-R_4)I_a + (R_2 + R_4 + R_5)I_b + I_c(-R_5)$.

Loop C $(-R_5)I_b + (R_3 + R_5)I_c$.

$$\begin{bmatrix} R_1 + R_4 & -R_4 & 0 \\ -R_4 & R_2 + R_4 + R_5 & -R_5 \\ 0 & -R_5 & R_3 + R_5 \end{bmatrix} \begin{bmatrix} V_1 \\ 0 \\ -V_2 \end{bmatrix} = \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix}$$

$$I_a = 0.6191$$

$$I_b = 0.1318$$

$$I_c = -0.1936$$

$$I_2 = I_b = 0.1318 \text{ A}$$

ตรวจสอบด้วย mesh

```

Editor - C:\Users\Billy\Documents\MATLAB\bruh.m
Untitled.m x Untitled2.m x lab.m x Untitled3.m x bruh.m x +
1 v1 = input("V1 : ");
2 v2 = input("V2 : ");
3 r1 = input("R1 : ");
4 r2 = input("R2 : ");
5 r3 = input("R3 : ");
6 r4 = input("R4 : ");
7 r5 = input("R5 : ");
8
9 I1=v1/r1;
10 I2=v2/r3;
11 d=[1/r1+1/r4 0; 0 1/r3+1/r5]
12 a=[I1 0; I2 1/r3+1/r5]
13 b=[1/r1+1/r4 I1; 0 I2]
14 va=det(a)/det(d)
15 vb=det(b)/det(d)
16 Vth=va-vb
17 Rth=1/((r3+r5)/(r3*r5))+1/((r1+r4)/(r1*r4))
18 Ir2=Vth/(Rth+r2)
19

```

Command Window

```

vb =

    0.6000

Vth =

    2.7333

Rth =

    5.7333

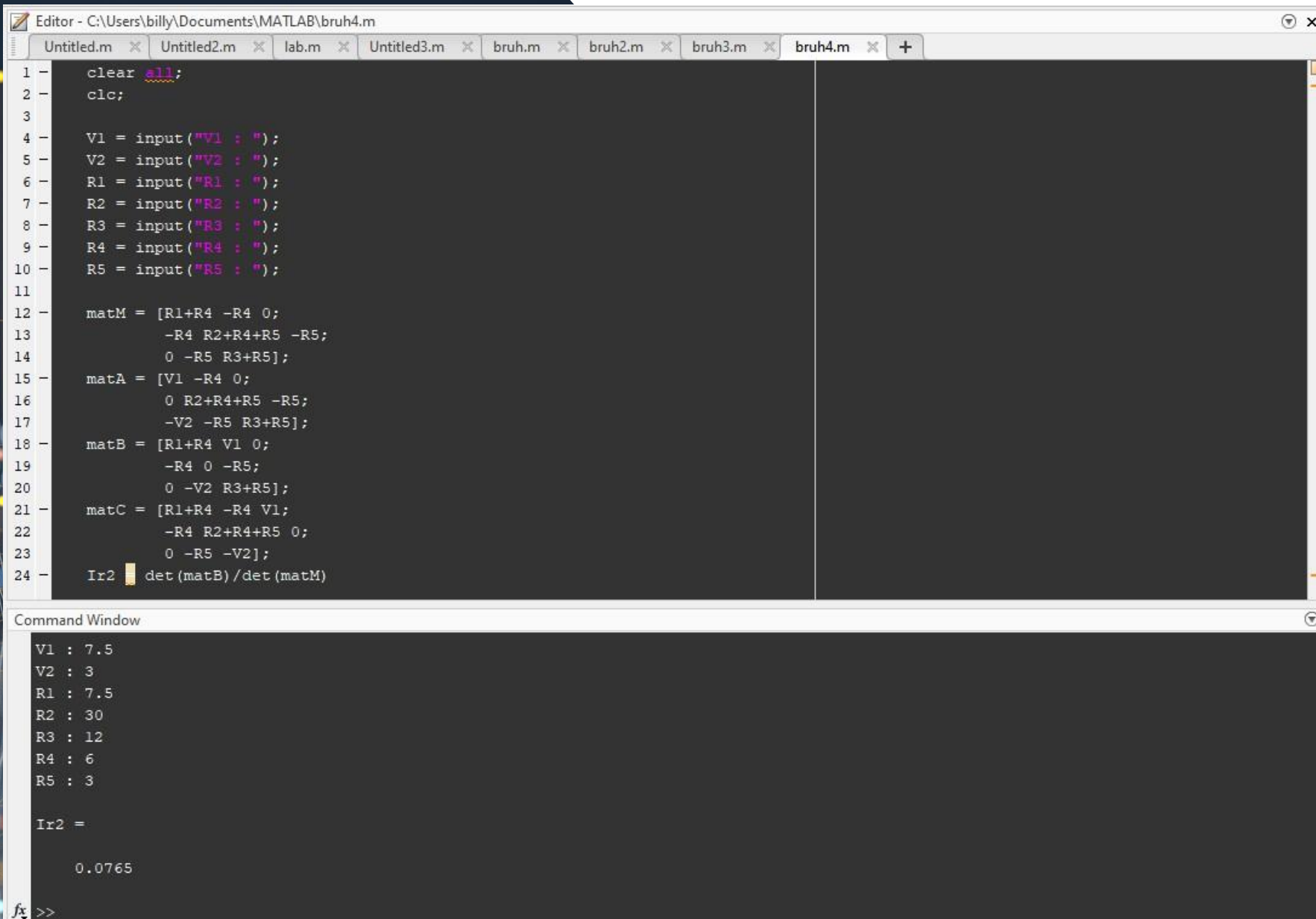
Ir2 =

    0.0765

```

f1 >>

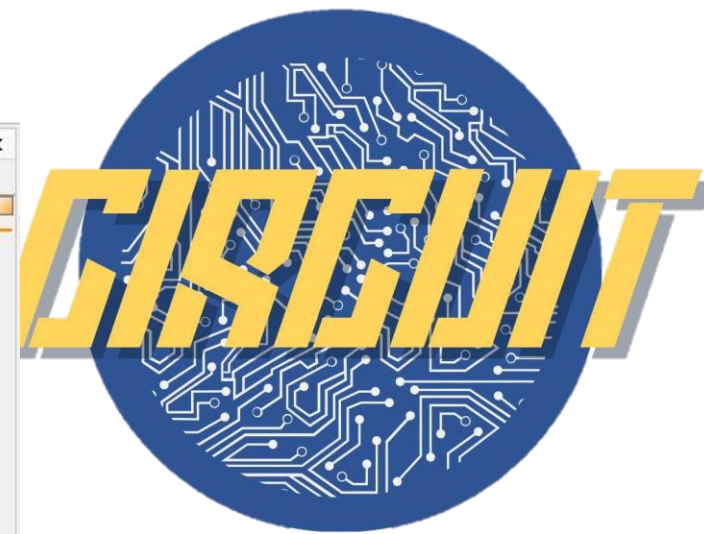


The image shows a MATLAB environment with an Editor window and a Command Window. The Editor window contains a script named 'bru4.m' with 24 lines of MATLAB code. The code defines input variables V1, V2, R1, R2, R3, R4, and R5, then constructs three matrices: matM, matA, and matB. It also calculates the determinant of matB divided by the determinant of matM, storing the result in Ir2. The Command Window shows the execution of the script, displaying the values of the input variables and the final result for Ir2, which is 0.0765.

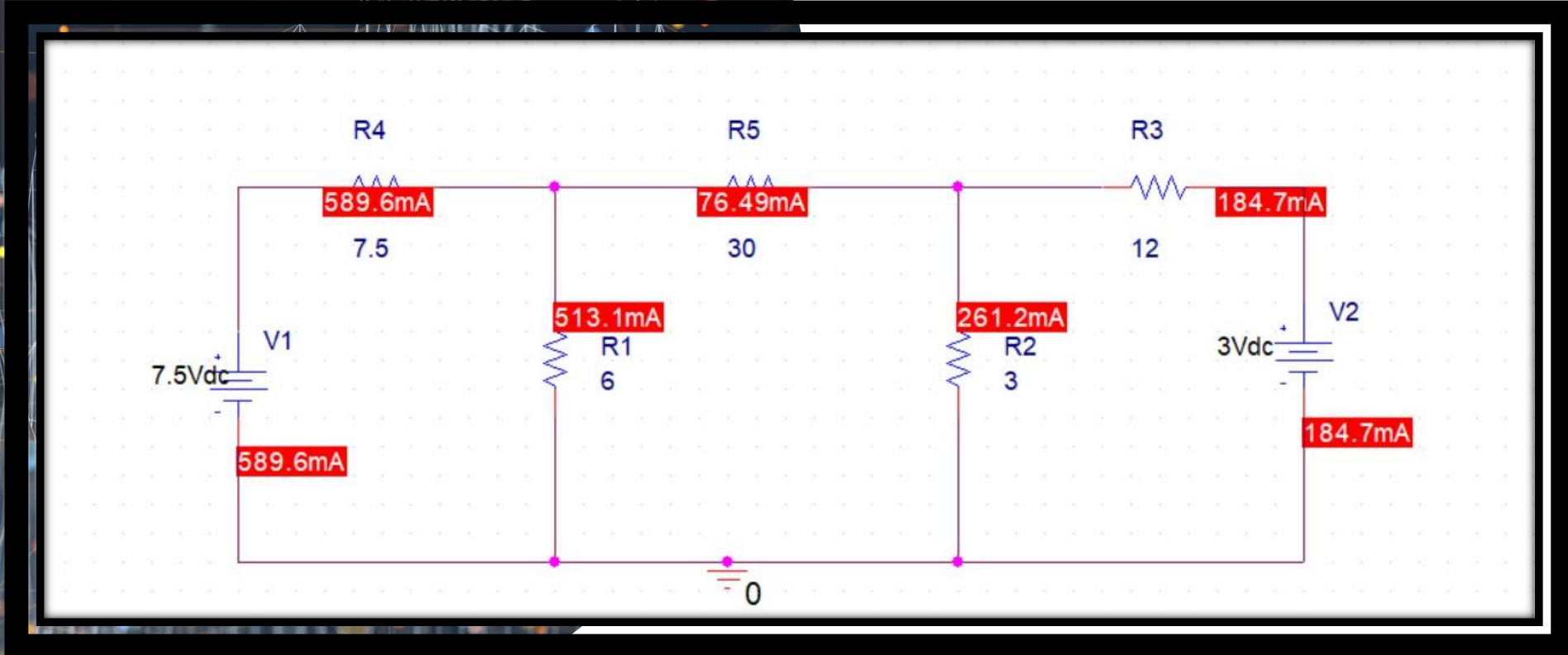
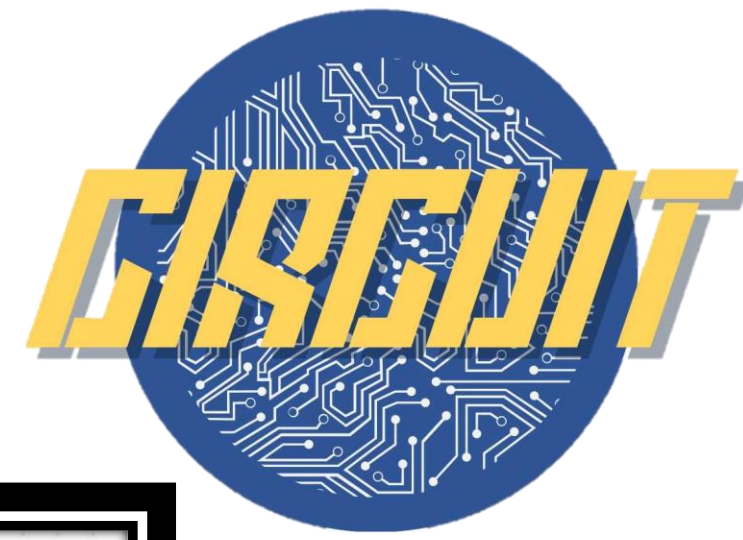
```
1 clear all;  
2 clc;  
3  
4 V1 = input("V1 : ");  
5 V2 = input("V2 : ");  
6 R1 = input("R1 : ");  
7 R2 = input("R2 : ");  
8 R3 = input("R3 : ");  
9 R4 = input("R4 : ");  
10 R5 = input("R5 : ");  
11  
12 matM = [R1+R4 -R4 0;  
13         -R4 R2+R4+R5 -R5;  
14         0 -R5 R3+R5];  
15 matA = [V1 -R4 0;  
16         0 R2+R4+R5 -R5;  
17         -V2 -R5 R3+R5];  
18 matB = [R1+R4 V1 0;  
19         -R4 0 -R5;  
20         0 -V2 R3+R5];  
21 matC = [R1+R4 -R4 V1;  
22         -R4 R2+R4+R5 0;  
23         0 -R5 -V2];  
24 Ir2 = det(matB)/det(matM)
```

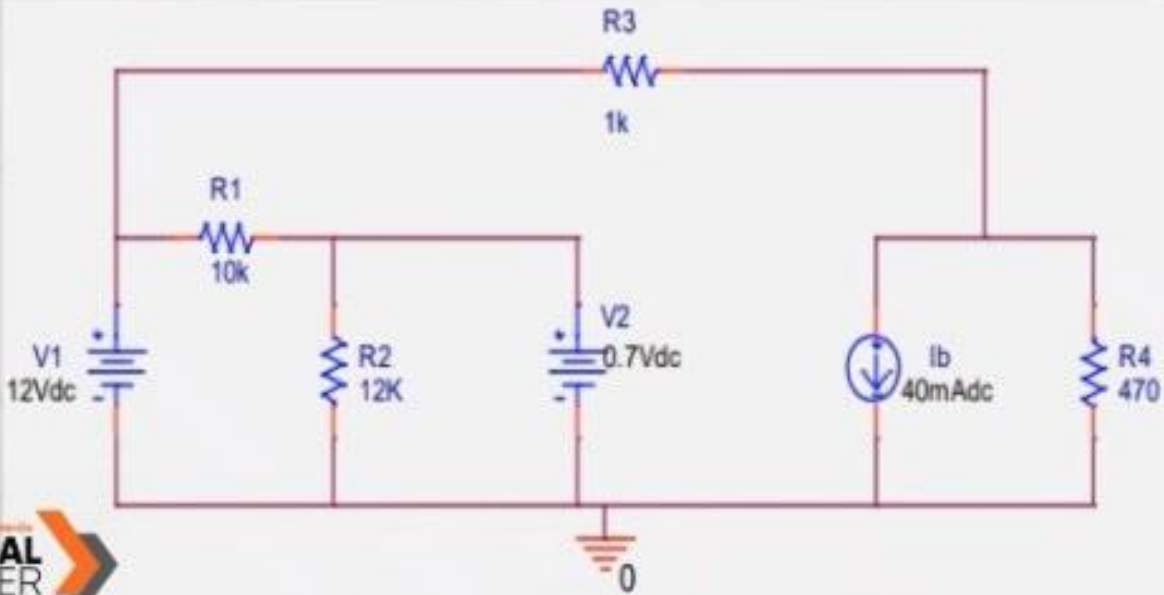
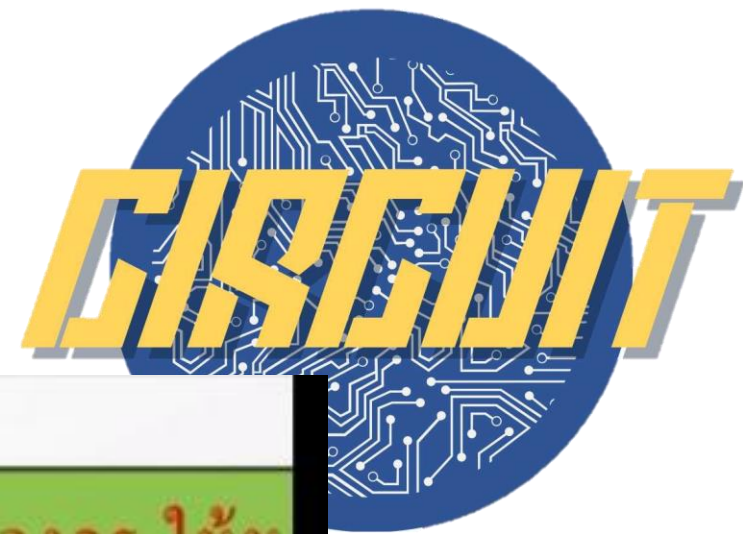
Command Window

```
V1 : 7.5  
V2 : 3  
R1 : 7.5  
R2 : 30  
R3 : 12  
R4 : 6  
R5 : 3  
  
Ir2 =  
  
0.0765  
  
fx >>
```



ตรวจสอบด้วยmesh



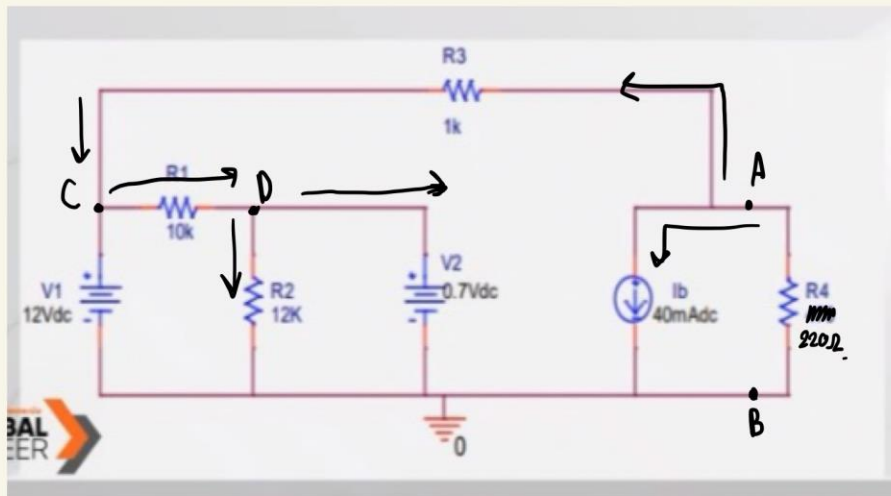


จากรูปที่ 2 วงจร ให้ห
VR4

$R4=220$

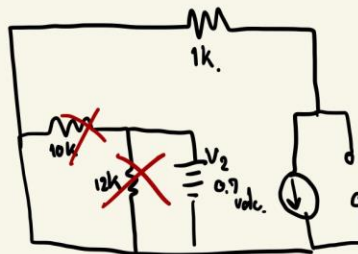
GLOBAL
ENGINEER





find V_{th} .

$$R_{th} = R_3 = 1000\Omega.$$



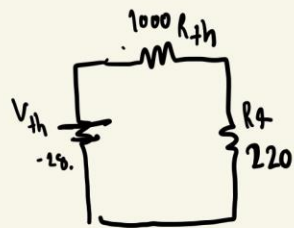
$$V_{th} \text{ (A). } \frac{V_A - V_C}{1k} + 40m = 0. \quad \left(\frac{1}{1k}\right)V_A + \left(-\frac{1}{1k}\right)V_C = 0.04$$

$$\text{(C)} \quad (V_C - 12) + \left(\frac{V_C - V_P}{10k}\right) + \frac{V_C - V_A}{1k} = 0. \quad \left(-\frac{1}{1k}\right)V_A + \left(1 + \frac{1}{10k} + \frac{1}{1k}\right)V_C + \left(-\frac{1}{10k}\right)V_P = 12$$

$$\text{(D)} \quad \frac{V_P - V_C}{10k} + \frac{V_P}{12k} - V_P - 0.7 = 0. \quad \left(-\frac{1}{10k}\right)V_C + \left(\frac{1}{10k} + \frac{1}{12k} + 1\right)V_P = 0.7 \quad \text{--- (E)}$$

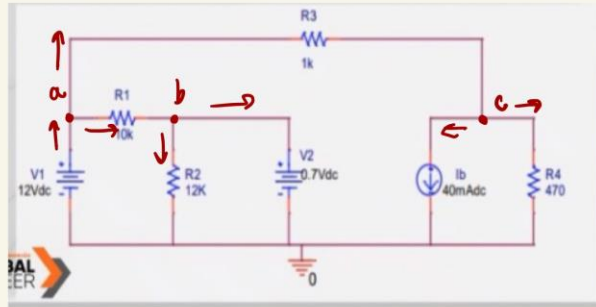
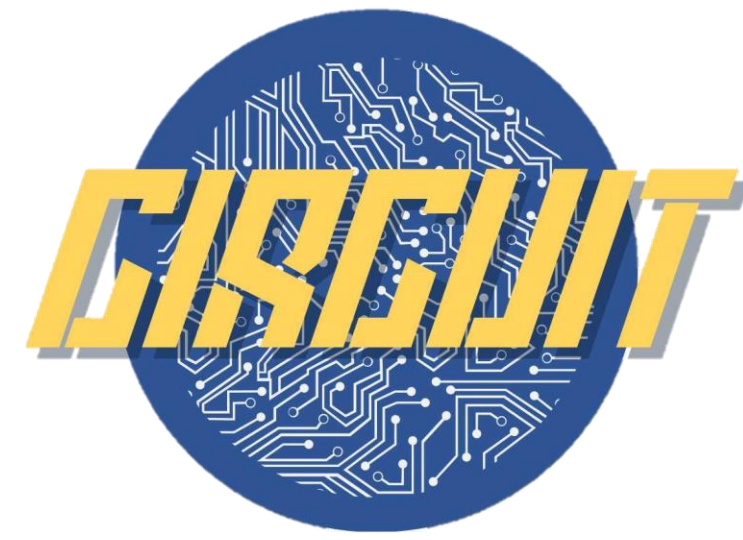
$$\begin{bmatrix} \frac{1}{1k} & -\frac{1}{1k} & 0 \\ -\frac{1}{1k} & 1 + \frac{1}{10k} + \frac{1}{1k} & -\frac{1}{10k} \\ 0 & -\frac{1}{10k} & 1 + \frac{1}{10k} + \frac{1}{12k} \end{bmatrix} \begin{bmatrix} V_A \\ V_C \\ V_P \end{bmatrix} = \begin{bmatrix} 0.04 \\ 12 \\ 0.7 \end{bmatrix}$$

$$V_A = -28V.$$



$$V_{R4} = I_{R4} R_4 = \left(\frac{-28}{1000 + 220}\right) 220$$

$$= -5.099V.$$



Node A.

$$\left(1 + \frac{1}{R_1} + \frac{1}{R_3}\right) V_A + \left(-\frac{1}{R_1}\right) V_B + \left(-\frac{1}{R_3}\right) V_C = V_1.$$

Node B.

$$\left(-\frac{1}{R_1}\right) V_A + \left(1 + \frac{1}{R_1} + \frac{1}{R_2}\right) V_B = V_2.$$

Node C.

$$\left(-\frac{1}{R_3}\right) V_A + \left(\frac{1}{R_3} + \frac{1}{R_4}\right) V_C = -I_b.$$

$$\begin{bmatrix} 1 + \frac{1}{R_1} + \frac{1}{R_3} & -\frac{1}{R_1} & -\frac{1}{R_3} \\ -\frac{1}{R_1} & 1 + \frac{1}{R_1} + \frac{1}{R_2} & 0 \\ -\frac{1}{R_3} & 0 & \frac{1}{R_3} + \frac{1}{R_4} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ -I_b \end{bmatrix} = \begin{bmatrix} V_A \\ V_B \\ V_C \end{bmatrix}$$

$$V_C = -8.9590.$$

ตรวจสอบโดยใช้node

Editor - C:\Users\billy\Documents\MATLAB\bruh3.m

Untitled.m x Untitled2.m x lab.m x Untitled3.m x bruh.m x bruh2.m x bruh3.m x +

```
1 - clear all;  
2 - clc;  
3 -  
4 - R1=10000;  
5 - R2=12000;  
6 - R3=1000;  
7 - R4=220;  
8 - V1=12;  
9 - V2=0.7;  
10 - Ib=0.04;  
11 -  
12 - Rth=R3;  
13 - Vth=-28;  
14 - V4=(R4/(R4+Rth))*Vth
```

Command Window

```
V4 =  
  
-5.0492
```

fx >>

VIT


```
Editor - C:\Users\bill\Documents\MATLAB\bruh2.m
Untitled.m x Untitled2.m x lab.m x Untitled3.m x bruh.m x bruh2.m x bruh3.m x +

1 clear all,
2
3 clc;
4
5 R1=10000;
6 R2=12000;
7 R3=1000;
8 R4=220;
9 V1=12;
10 V2=0.7;
11 Ib=0.04;
12
13 d=[1+1/R1+1/R3 -1/R1 -1/R3;-1/R1 1+1/R1+1/R2 0;-1/R3 0 1/R3+1/R4]
14 a=[V1 -1/R1 -1/R3;V2 1+1/R1+1/R2 0;-Ib 0 1/R3+1/R4]
15 b=[1+1/R1+1/R3 V1 -1/R3;-1/R1 V2 0;-1/3 -Ib 1/R3+1/R4]
16 c=[1+1/R1+1/R3 -1/R1 V1;-1/R1 1+1/R1+1/R2 V2;-1/R3 0 -Ib]
17
18 Va=det(a)/det(d)
19 Vb=det(b)/det(d)
20 Vc=det(c)/det(d)

Command Window

1.0011    -0.0001    12.0000
-0.0001     1.0002     0.7000
-0.0010         0    -0.0400

Va =

11.9818

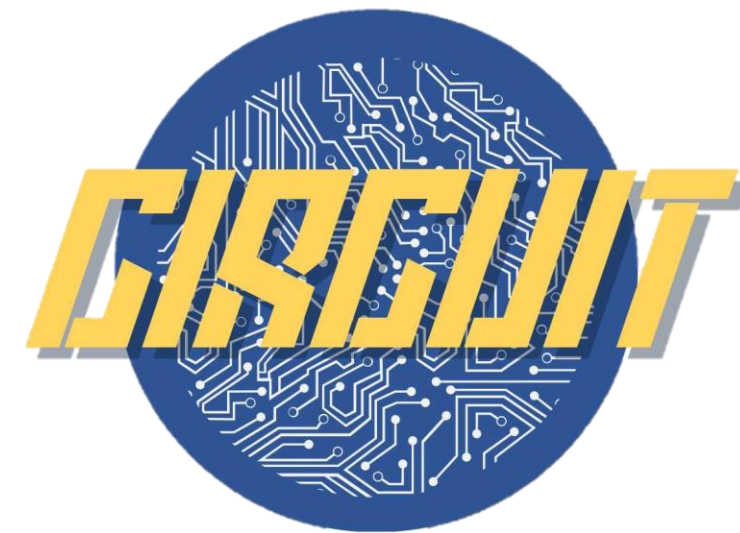
Vb =

0.6592

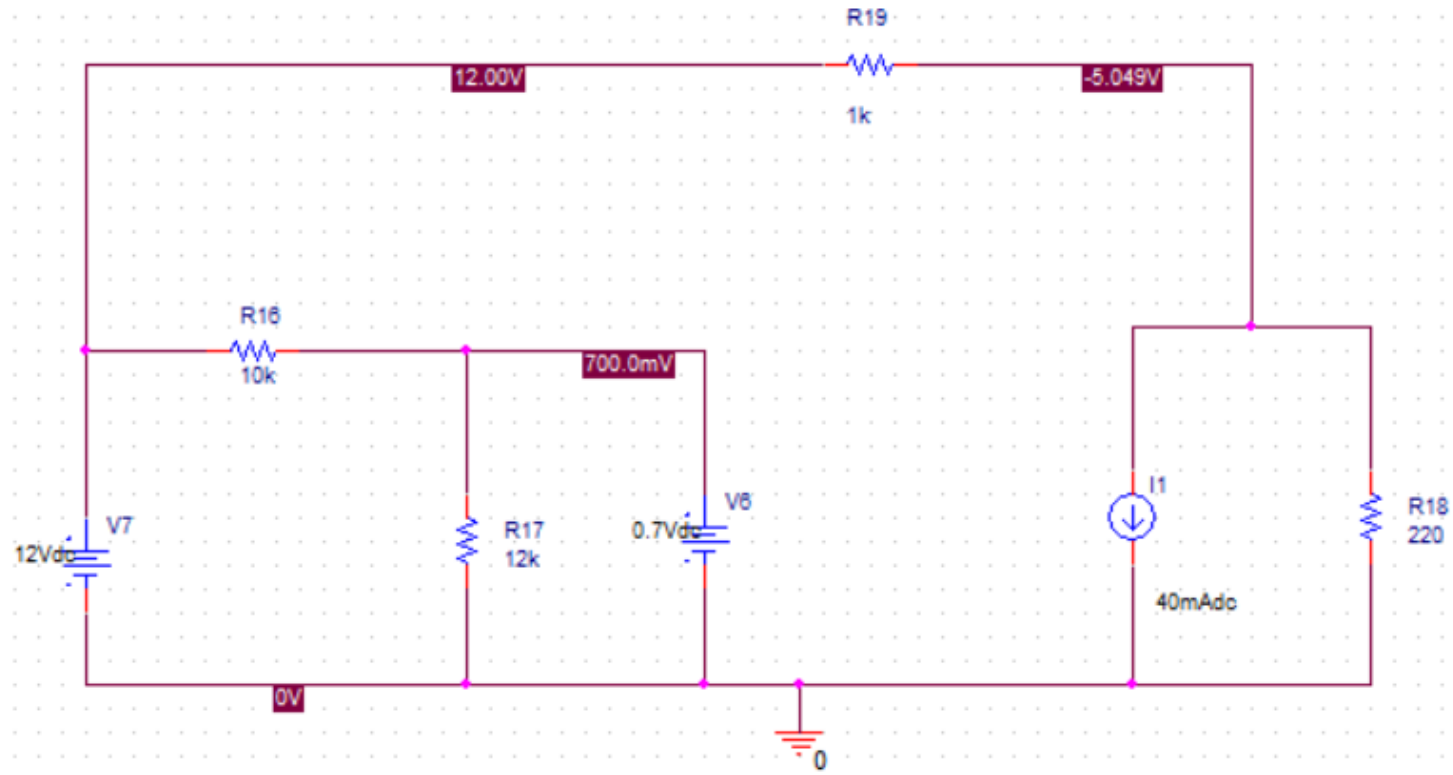
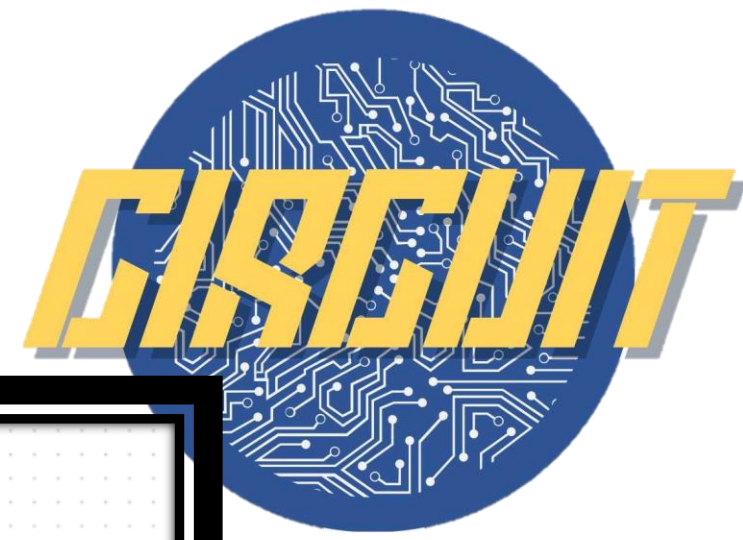
Vc =

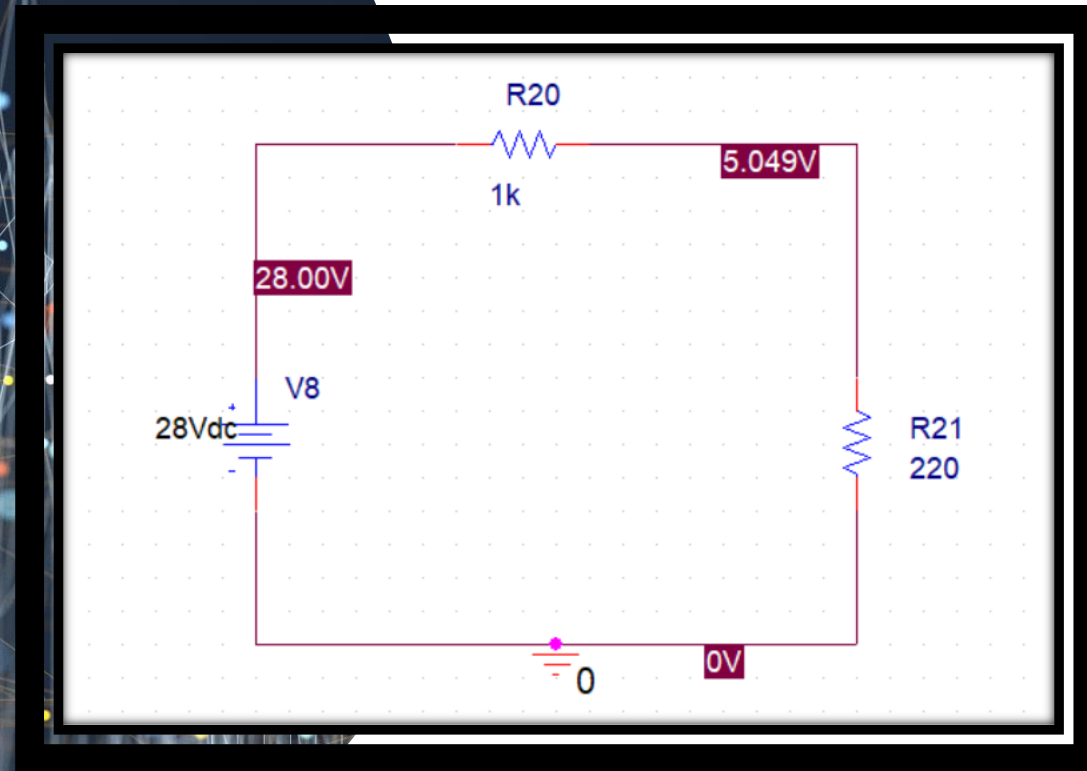
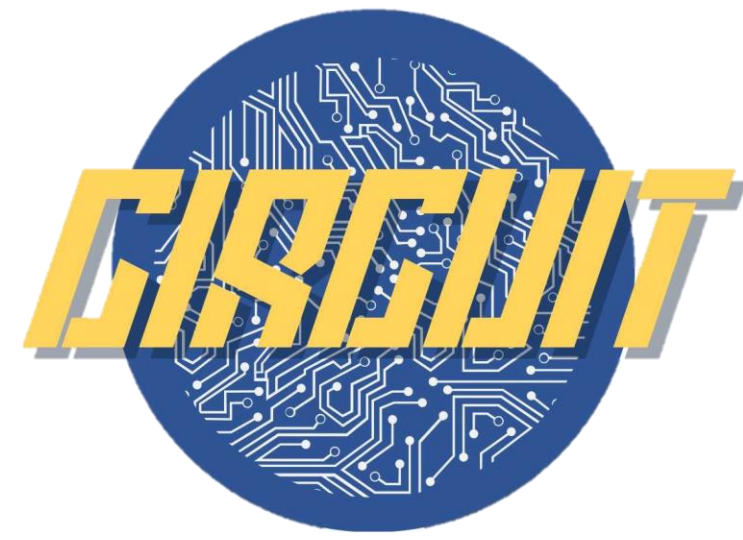
-5.0525

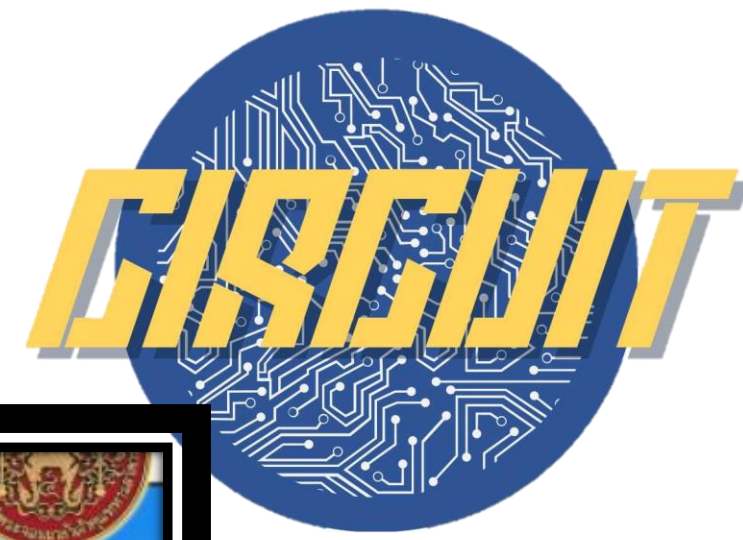
fx >>
```



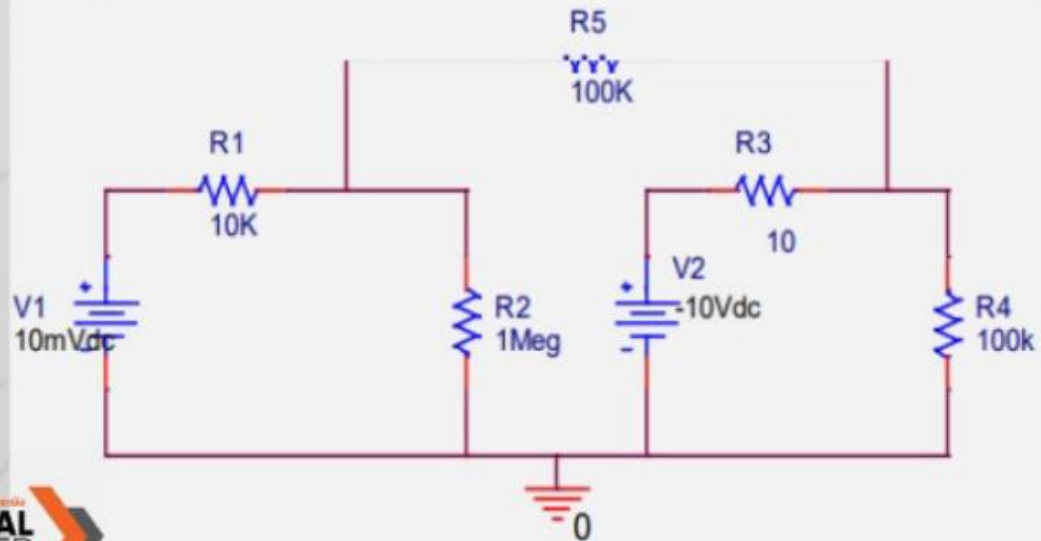
ตรวจสอบโดยใช้node







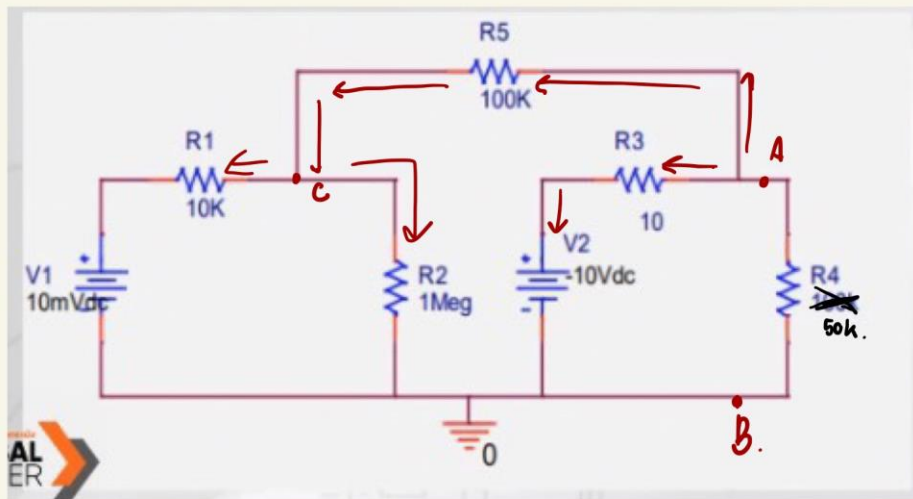
ปัญหาที่ 3 การแก้ปัญหาคำวิเคราะห์ไฟฟ้า 2



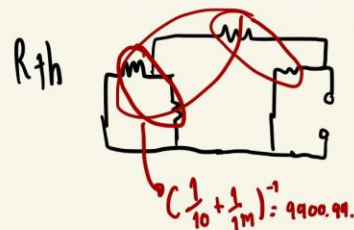
จากรูปที่ ๖ จงหาค่า
PR4

$R4 = 50k$





ur P_{R4} .



$$9900.99 + 100K = 109900.99$$

$$(\frac{1}{10} + \frac{1}{109900.99}) = 10\Omega$$

V_{th} [A] $\frac{V_A - V_C}{100K} + \frac{V_A - (-10)}{10} = 0$

$$C(\frac{1}{100K} + \frac{1}{10})V_A + (-\frac{1}{100K})V_C = -1$$

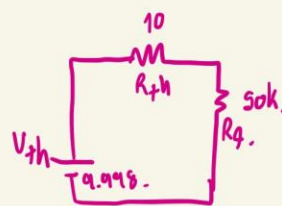
[C] $\frac{V_C - 10}{10K} + \frac{V_C - V_A}{100K} + \frac{V_C}{1M} = 0$

$$(-\frac{1}{100K})V_A + (\frac{1}{10K} + \frac{1}{1M})V_C = \frac{1}{1K}$$

$$\begin{bmatrix} \frac{1}{100K} + \frac{1}{10} & -\frac{1}{100K} \\ -\frac{1}{100K} & \frac{1}{10K} + \frac{1}{1M} \end{bmatrix} \begin{bmatrix} V_A \\ V_C \end{bmatrix} = \begin{bmatrix} -1 \\ \frac{1}{1K} \end{bmatrix}$$

$$V_A = -9.998V$$

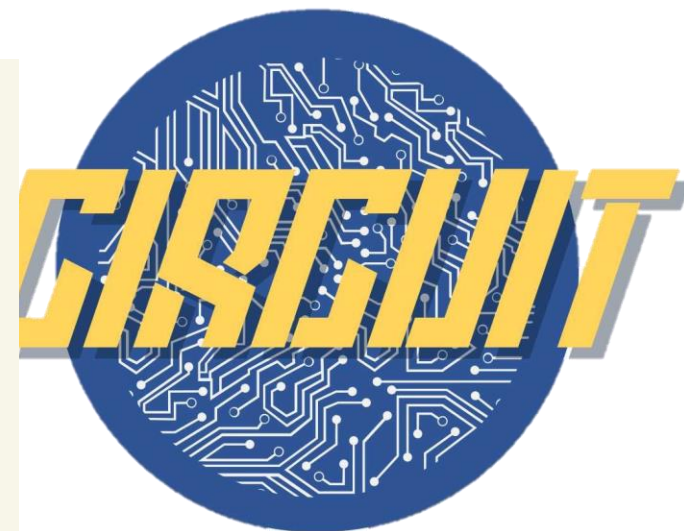
$$V_{th} = |V_A - V_B| = 9.998V$$

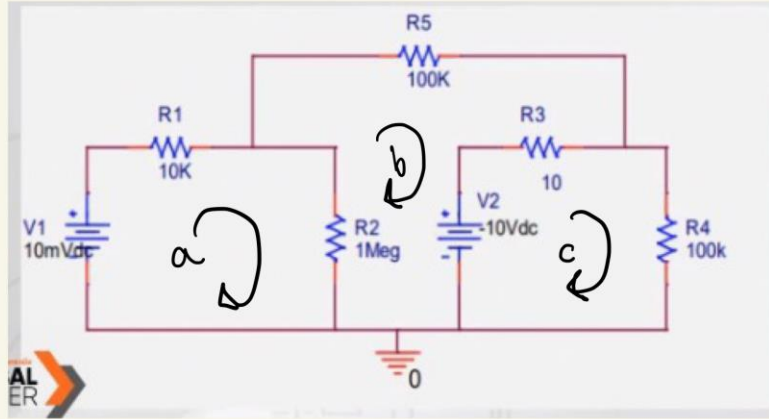
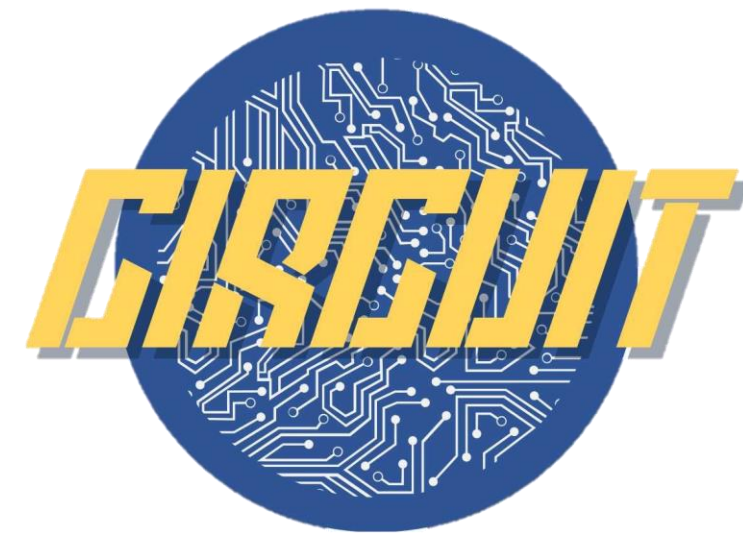


$$P_{R4} = IV = \frac{V^2}{R} = \frac{(9.998)^2}{(10 + 50,000)}$$

$$= 1.999mW$$

$$\approx 2mW$$





Loop a

$$V_1 = I_a(R_1 + R_2) + I_b(-R_2).$$

Loop b

$$-V_2 = I_a(-R_2) + I_b(R_2 + R_3 + R_5) + I_c(R_3).$$

Loop c

$$V_2 = I_b(-R_3) + I_c(R_3 + R_4).$$

$$\begin{bmatrix} R_1 + R_2 & -R_2 & 0 \\ -R_2 & R_2 + R_3 + R_5 & R_3 \\ 0 & -R_3 & R_3 + R_4 \end{bmatrix} \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} V_1 \\ -V_2 \\ V_2 \end{bmatrix}$$

$$\text{or } I_c = 1.999 \times 10^{-4}.$$

$$P_{R4} = I^2 \cdot 50k = (1.999 \cdot 10^{-4})^2 \cdot 50k = 1.9999 \cdot 10^{-4}.$$

ตรวจสอบด้วยmesh


```
Editor - C:\Users\billy\Documents\MATLAB\bruh5.m
Untitled.m x Untitled2.m x lab.m x Untitled3.m x bruh.m x bruh2.m x bruh3.m x bruh4.m x bruh5.m x +

1 - clear all;
2 - clc;
3
4
5 - R1 = input("R1 : ");
6 - R2 = input("R2 : ");
7 - R3 = input("R3 : ");
8 - R4 = input("R4 : ");
9 - R5 = input("R5 : ");
10 - V1 = input("V1 : ");
11 - V2 = input("V2 : ");
12
13 - Rth = 1/(1/(1/(1/R1+1/R2)+R5)+1/R3);
14 - matM = [1/R1+1/R2+1/R5 -1/R5;
15 -         -1/R5 1/R3+1/R5];
16 - matA = [V1/R1 -1/R5;
17 -         V2/R3 1/R3+1/R5];
18 - matB = [1/R1+1/R2+1/R5 V1/R1;
19 -         -1/R5 V2/R3];
20
21 - Va = det(matA)/det(matM);
22 - Vb = det(matB)/det(matM);
23 - Vth = -Vb;
24
25 - PR4 = Vth^2/(Rth+R4)

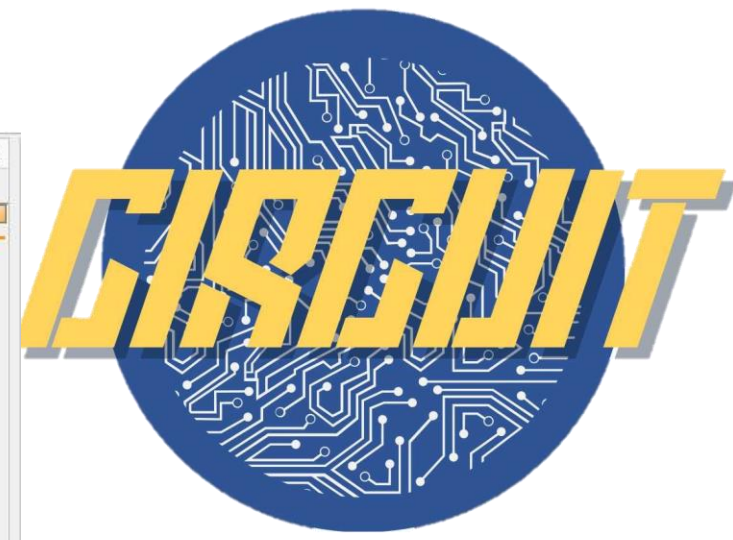
Command Window

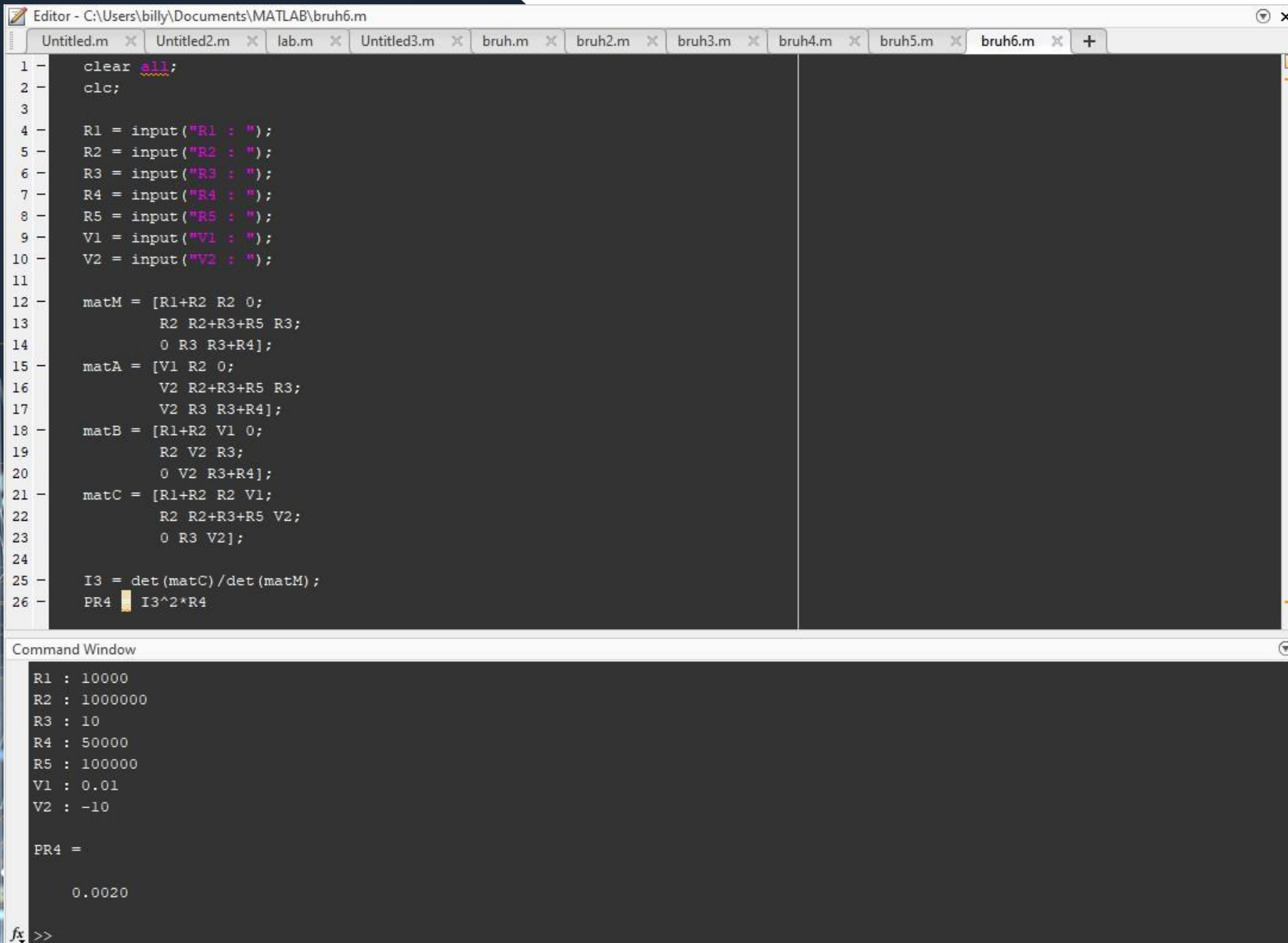
R1 : 10000
R2 : 1000000
R3 : 10
R4 : 50000
R5 : 100000
V1 : 0.01
V2 : 10

PR4 =

    0.0020

fx >>
```





```
Editor - C:\Users\billy\Documents\MATLAB\bruh6.m
Untitled.m x Untitled2.m x lab.m x Untitled3.m x bruh.m x bruh2.m x bruh3.m x bruh4.m x bruh5.m x bruh6.m x +

1 - clear all;
2 - clc;
3
4 - R1 = input("R1 : ");
5 - R2 = input("R2 : ");
6 - R3 = input("R3 : ");
7 - R4 = input("R4 : ");
8 - R5 = input("R5 : ");
9 - V1 = input("V1 : ");
10 - V2 = input("V2 : ");
11
12 - matM = [R1+R2 R2 0;
13           R2 R2+R3+R5 R3;
14           0 R3 R3+R4];
15 - matA = [V1 R2 0;
16           V2 R2+R3+R5 R3;
17           V2 R3 R3+R4];
18 - matB = [R1+R2 V1 0;
19           R2 V2 R3;
20           0 V2 R3+R4];
21 - matC = [R1+R2 R2 V1;
22           R2 R2+R3+R5 V2;
23           0 R3 V2];
24
25 - I3 = det(matC)/det(matM);
26 - PR4 = I3^2*R4

Command Window
R1 : 10000
R2 : 1000000
R3 : 10
R4 : 50000
R5 : 100000
V1 : 0.01
V2 : -10

PR4 =

0.0020

fx >>
```



ตรวจสอบด้วยmesh

