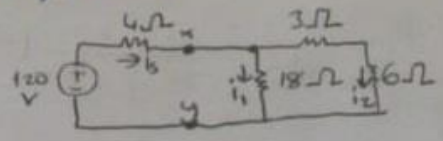
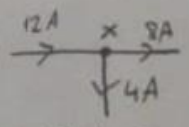
3.1) (PSPICE)



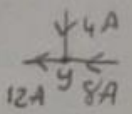
$R_{eq} = 4 + \frac{(3+6)\cdot 18}{(3+6)+18} = 10\Omega$

$i_s = \frac{120}{10} = 12$ $\quad i_1 = 4A$

$i_2 = 8A$

a) 

$12A - 8A - 4A = 0$



$8A + 4A - 12A = 0$

b) Left loop

$-120V + 12.4V + 4.18V = 0$

Right loop

$-18.4V + 3.8V + 6.8V = 0$

Outer loop

$-120V + 12.4V + 3.8V + 6.8V = 0$

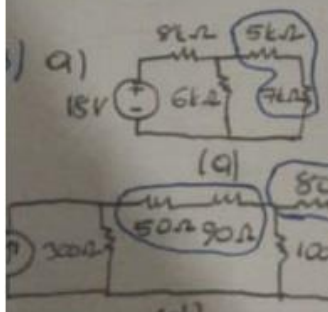
.2) (PSPICE)

a) $P_{4\Omega} = 12^2 \cdot 4 = 576W$ | $P_{3\Omega} = 8^2 \cdot 3 = 192W$ | $P_{18\Omega} = 4^2 \cdot 18 = 288W$ | $P_{6\Omega} = 8^2 \cdot 6 = 384W$

b) $P_{120V} = 120 \cdot 12 = 1440W$

c) $P_{120V} = P_{4\Omega} + P_{3\Omega} + P_{18\Omega} + P_{6\Omega} = 1440W$

) a)

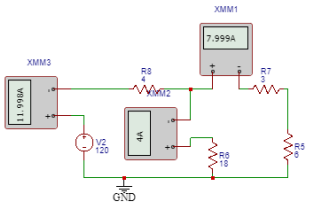


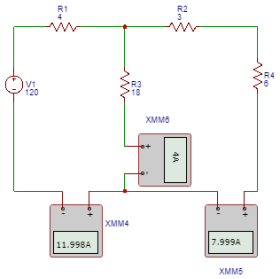
3.5) a) $\left(\frac{12.6}{12+6}\right) + 8 = 12k\Omega$ (a)

$\frac{500 \cdot 1000}{500+1000} + 500 = 900\Omega$ (b)

$\frac{75 \cdot 50}{75+50} = 30\Omega$ (c)

$\frac{\left(\left(\frac{150 \cdot 100}{150+100}\right) + 140\right) \cdot 300}{\left(\frac{150 \cdot 100}{150+100}\right) + 140 + 300} = 120\Omega$ (d)





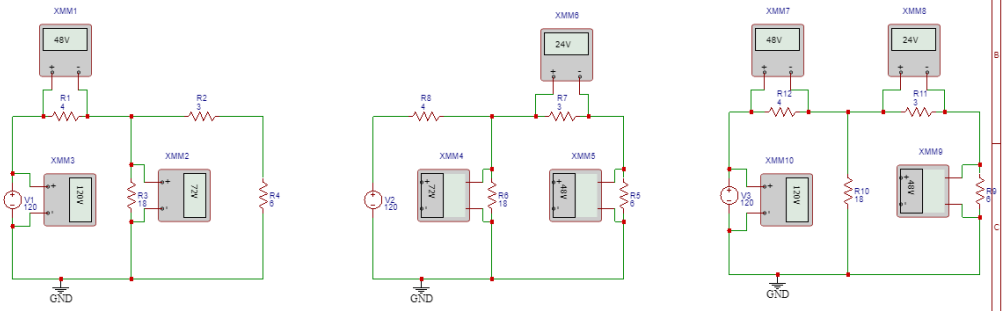
3.1-A

.tran 10m

LEFT LOOP:

RIGHT LOOP:

OUTER LOOP:

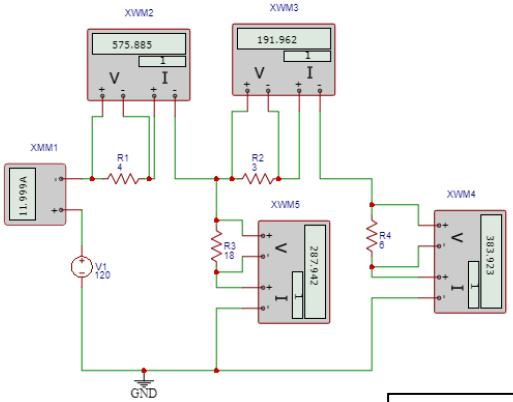


3.1-B

.tran 10m

TITLE: Sheet_1 REV: 1.0
Company: Your Company Sheet: 1/1
Date: 2020-11-04 Drawn By: gokbeykeskin_4066

*12*120 = 1440W*
576+192+288+384=1440W



.tran 110m

3.2

TITLE: Sheet_1 REV: 1.0
Company: Your Company Sheet: 1/1

3.5) b) $18 = i \cdot 12000\Omega$ $P_a = 18 \cdot 0.005 = 27mW$ (a)

$i = 15mA$

$27 = i \cdot 900\Omega$ $P_b = 27 \cdot 0.03 = 810mW$ (b)

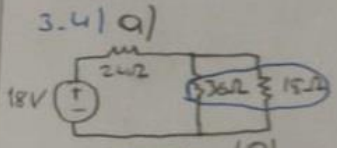
$i = 30mA$

$90 = i \cdot 30\Omega$ $P_c = 90 \cdot 3 = 270W$ (c)

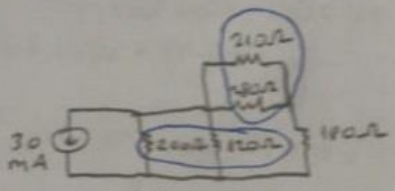
$i = 3A$

$(0.03)^2 \cdot 120 = 108mW$ (d)

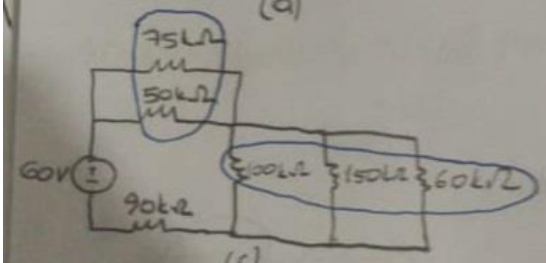
3.4) a)



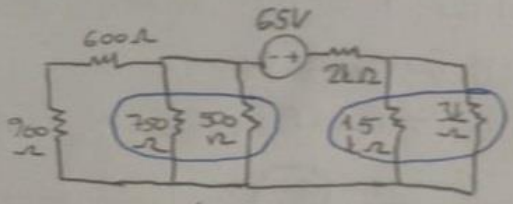
(a)



(b)

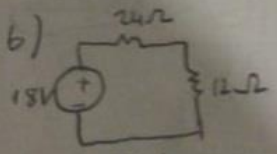


(c)



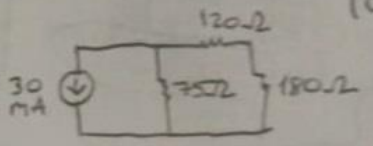
(d)

b)



$Req = \frac{36 \cdot 18}{36+18} = 12\Omega$

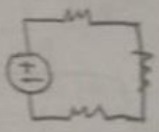
(a)



$Req_1 = \frac{210 \cdot 280}{210+280} = 120\Omega$

$Req_2 = \frac{200 \cdot 120}{200+120} = 75\Omega$

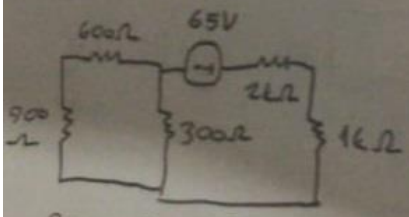
(b)



$Req_1 = \frac{75 \cdot 50}{75+150} = 30k\Omega$

$Req_2 = \frac{1}{\frac{1}{150}+\frac{1}{100}+\frac{1}{60}} = 30\Omega$

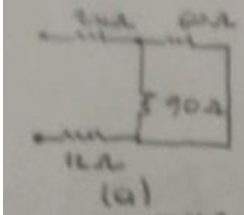
(c)



$Req_1 = \frac{750 \cdot 500}{750+500} = 300\Omega$

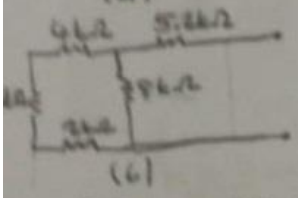
$Req_2 = \frac{1,5 \cdot 3}{1,5+3} = 1k\Omega$

3.8) (PSPICE)



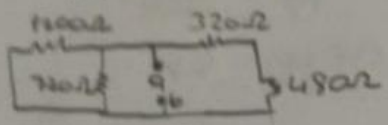
(a)

$$R_{eq} = \frac{6 \cdot 9}{6+9} + 2 + 1 = 7.2\,\Omega$$



(b)

$$\left(\frac{(6+4+2)\cdot 8}{(6+4+2)+8}\right) + 5.2 = 10\,\Omega$$

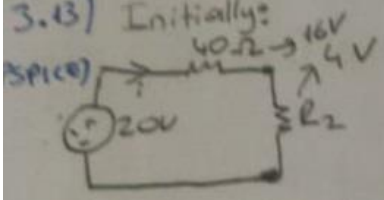


(c)

$$\frac{(320+480)\cdot\frac{1200\cdot 720}{1200+720}}{(320+480)+\frac{1200\cdot 720}{1200+720}} = 288\,\Omega$$

3.13) Initially:

(SPICE)

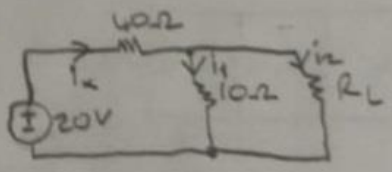


$$-20 + 40i + 4 = 0$$

$$i = \frac{16}{40} = 0{,}4\,A$$

$$V_o = i \cdot R_2 =$$

$$4 = 0{,}4 \cdot R_2 \Rightarrow R_2 = 10\,\Omega$$



$$V_{10\Omega} = V_{R_L} = 3V$$

$$V_{10\Omega} = 10\,\Omega \cdot i_1$$

$$i_1 = 0{,}3A$$

For left loop:

$$-20V + 40 \cdot i_x + 10 \cdot 0{,}3 = 0$$

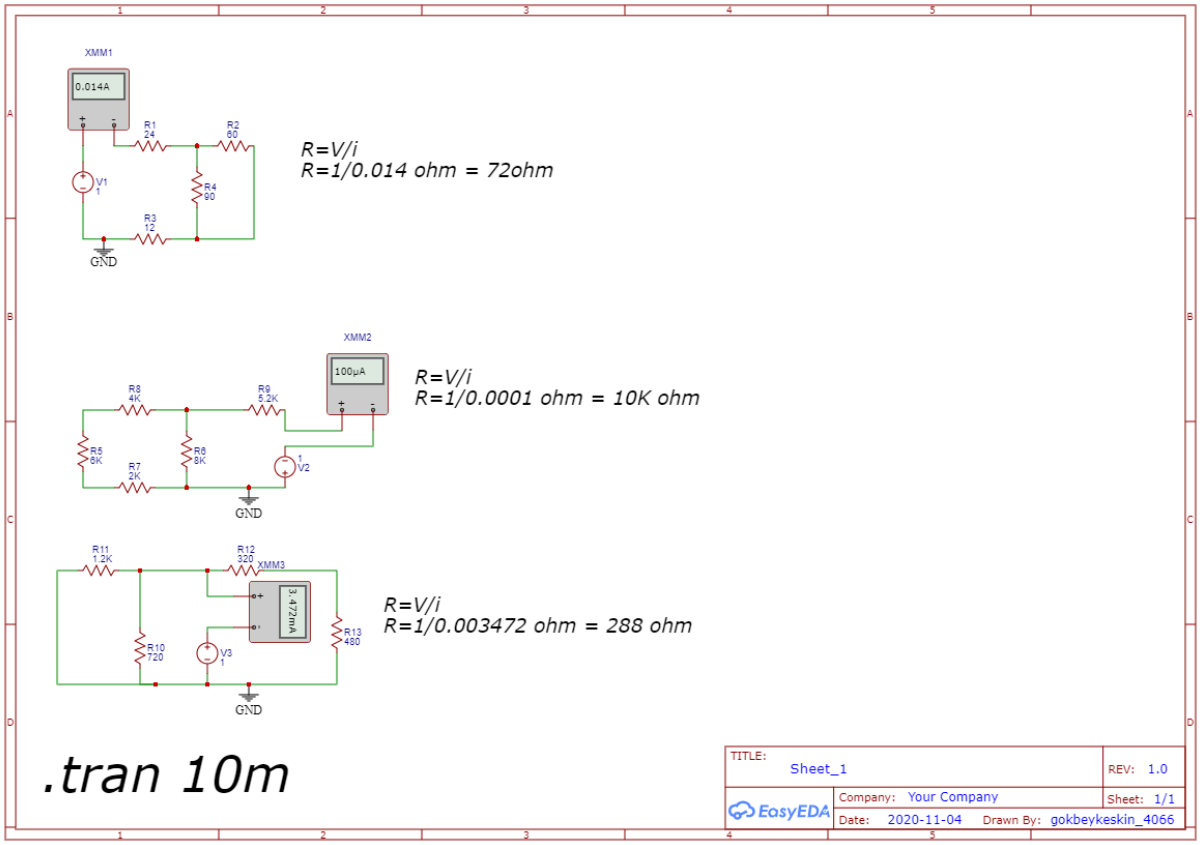
$$i_x = \frac{17}{40}\,A = 0{,}425\,A$$

$$i_x = i_1 + i_2$$

$$0{,}425 = 0{,}3 + i_2 \Rightarrow i_2 = 0{,}125$$

$$V_{R_L} = R_L \cdot i_2$$

$$3 = R_L \cdot 0{,}125 \Rightarrow \underline{R_L = 24\,\Omega}$$


XMM1
0.014A
R1
24
R2
60
R4
90
R3
12
V1
1
GND
R=V/i
R=1/0.014 ohm = 72ohm
XMM2
100µA
R8
4K
R9
5.2K
R5
6K
R6
6K
R7
2K
V2
1
GND
R=V/i
R=1/0.0001 ohm = 10K ohm
R11
1.2K
R12
320
XMM3
3.472mA
R10
720
V3
1
R13
480
GND
R=V/i
R=1/0.003472 ohm = 288 ohm
.tran 10m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
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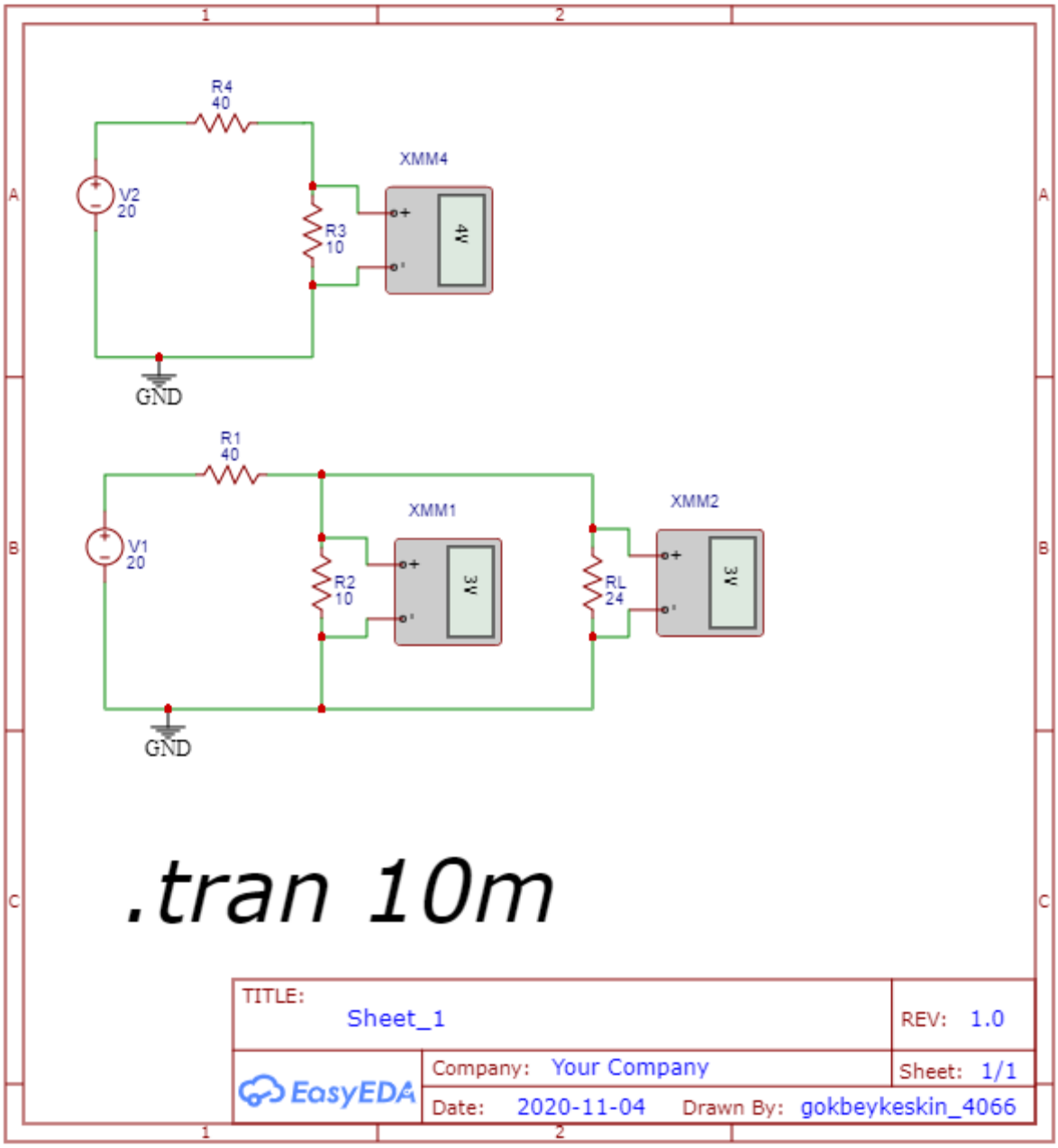
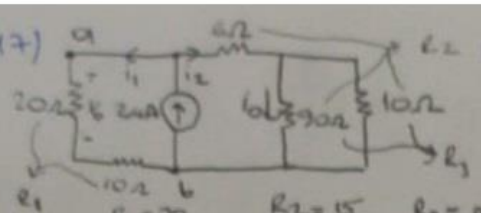
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.8

3.13


R4
40
V2
20
R3
10
XMM4
4V
GND
R1
40
V1
20
R2
10
XMM1
3V
RL
24
XMM2
3V
GND
.tran 10m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
Sheet: 1/1
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.17) 

$$R_{eq} = \frac{(20+10).\left(\frac{90.10}{90+10}+6\right)}{20+10+\frac{90.10}{90.10}+6} = 10\Omega$$

$V = i.R$

$P = V.i = i^2R$

$i_1 = \frac{2,4.10}{30} = 0,8A \quad i_2 = \frac{2,4.10}{\frac{15}{3}} = 1,6A$

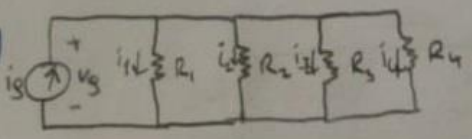
a) $i_0 = \frac{1,6.9}{90} = 0,16A$

$V_0 = 0,8.20 = 16V$

b) $(1,6)^2.6 = 15,36W$

c) $V_{2,4A} = V_{ab} = 0,8.30 = 24V$

$P_{2,4A} = 24.2,4 = 57,6W$

3.18) 

$i_g = 50mA \quad V_g = 25V \quad i_1 = 0,6i_2 \quad i_3 = 2i$

$i_4 = 4i_1$

$i_1 + i_2 + i_3 + i_4 = 50mA$

$0,6i_2 + i_2 + 2i_2 + 2,4i_2 = 50mA \Rightarrow i_2 = 8.\overline{3}$

$i_1 = 5mA \quad i_3 = 16.67mA \quad i_4 = 20mA$

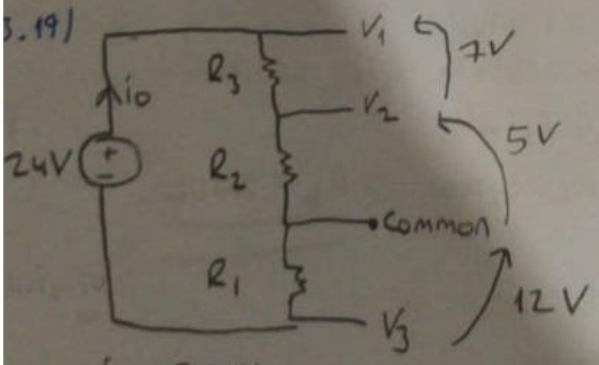
$V = i.R$

$25 = 0,005.R_2 \Rightarrow R_2 = 5k\Omega$

$25 = 0,0833.R_2 \Rightarrow R_2 = 3k\Omega$

$25 = 0,01667.R_3 \Rightarrow R_3 = 1,49k\Omega$

$25 = 0,020.R_4 \Rightarrow 24 = 1,25k\Omega$

3.19) 

$V = i.R$

$7 = 3,\overline{3}.R_3 \Rightarrow R_3 = 2,1\Omega$

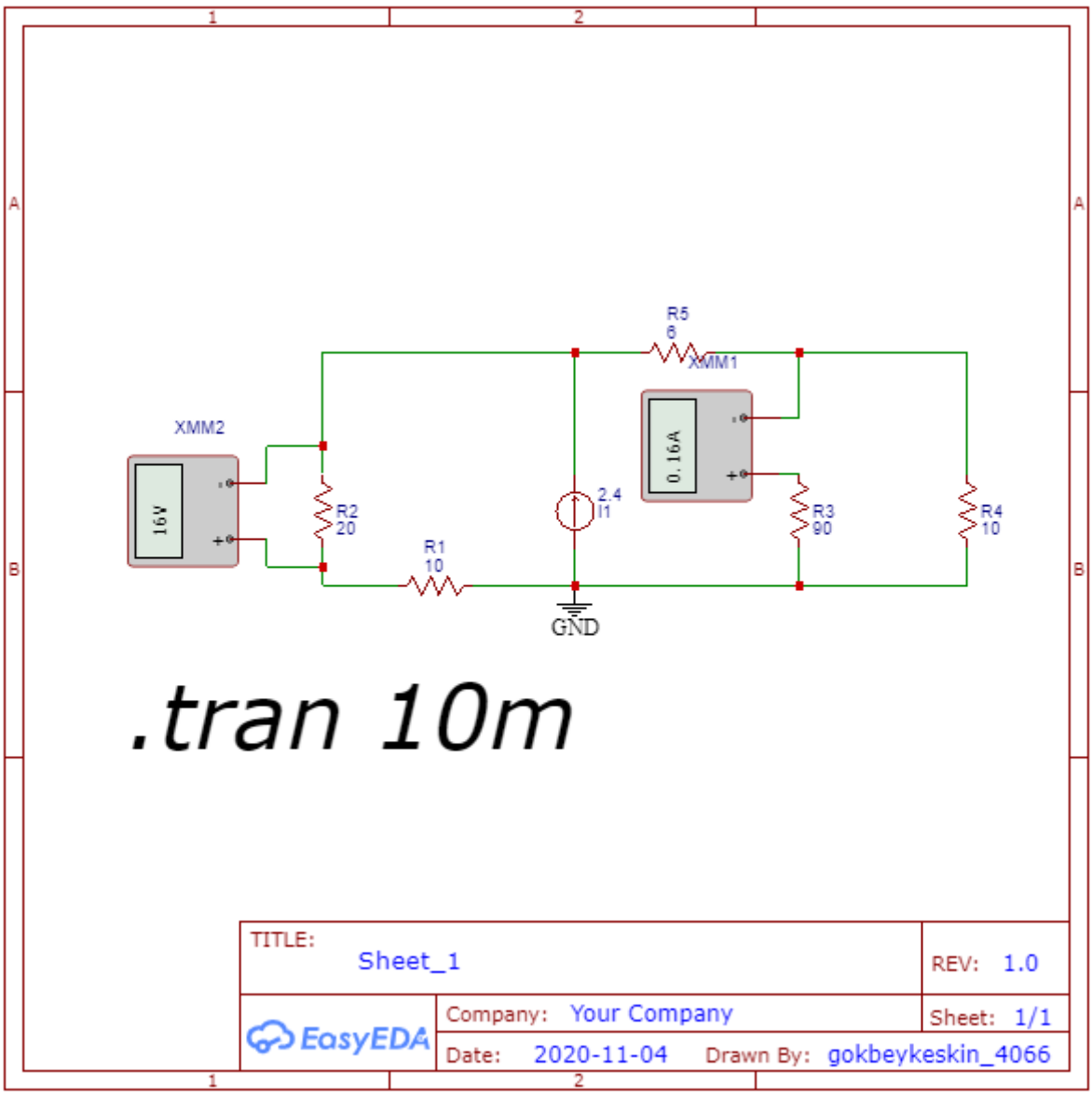
$5 = 3,\overline{3}.R_2 \Rightarrow R_2 = 1,5\Omega$

$12 = 3,\overline{3}.R_1 \Rightarrow R_1 = 3,6\Omega$

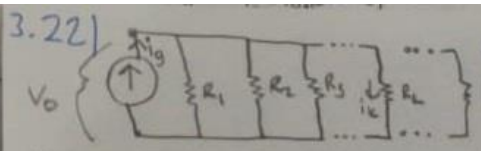
$24.i_0 = 80W$

$i_0 = 3.\overline{3}A$

3.17


1
2
A
B
R5
6
XMM1
XMM2
16V
0.16A
R2
20
R1
10
2.4
I1
R3
90
R4
10
GND
.tran 10m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
Sheet: 1/1
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.22) (PSPICE)



a) $i_L = V_o \cdot \frac{1}{R_L} = V_o G_L$

$i_g = i_1 + i_2 + i_3 \cdots i_N$

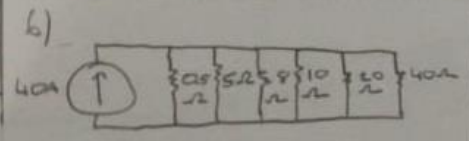
$i_g = V_o G_1 + V_o G_2 \cdots V_o G_N = V_o (G_1 + G_2 \cdots G_N)$

$\Rightarrow V_o = \frac{i_g}{(G_1 + G_2 \cdots G_N)} \Rightarrow V_o \cdot G_L = \frac{i_g \cdot G_L}{(G_1 + G_2 \cdots G_N)}$

($V_o \cdot G_L = i_L$)

$$i_L = \frac{i_g \cdot G_L}{(G_1 + G_2 \cdots G_N)}$$

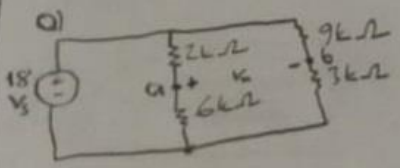
b)



$$i_{5\Omega} = \frac{40 \cdot \frac{1}{5}}{2 + \frac{1}{5} + \frac{1}{8} + \frac{1}{10} + \frac{1}{20} + \frac{1}{40}} = 32A$$

3.28) (PSPICE)

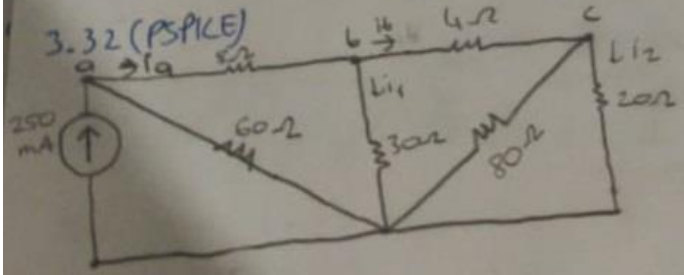
a)



$V_x = V_{ab} = \frac{18.6}{(6+2)} - \frac{18.3}{(9+3)} = 9V$

b) $V_x = \frac{V_s \cdot 6}{8} - \frac{V_s \cdot 3}{12} = \frac{V_s}{2}$

3.32 (PSPICE)



$i_1 = ?$ $i_2 = ?$

a)

$R_{cd} = \frac{20 \cdot 80}{20 + 80} = 16\Omega$

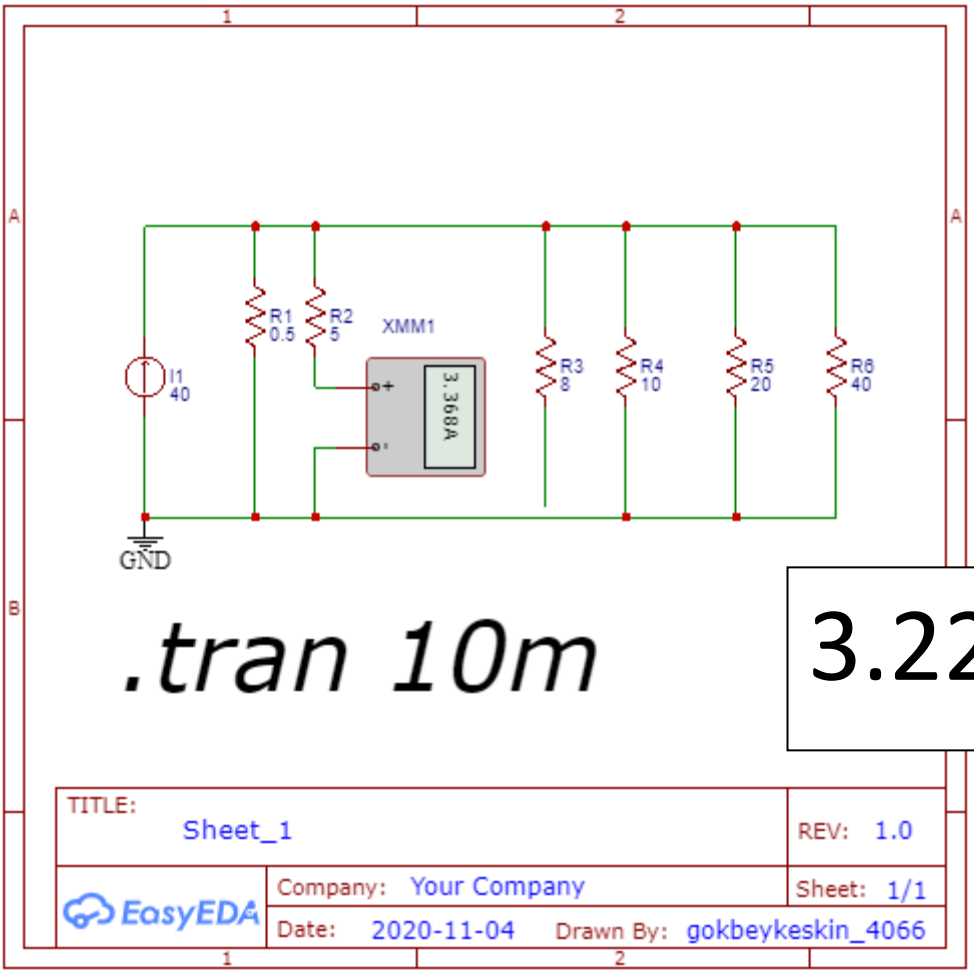
$R_{bd} = \frac{(16+4) \cdot 30}{(16+4) + 30} = 12\Omega$

$i_a = \frac{250 \cdot 60}{12 + 8 + 100} = 187.5mA$ (80Ω ∥ 20Ω + 4Ω)

$i_1 = \frac{187,5 \cdot 20}{30 + 20} = 75mA$

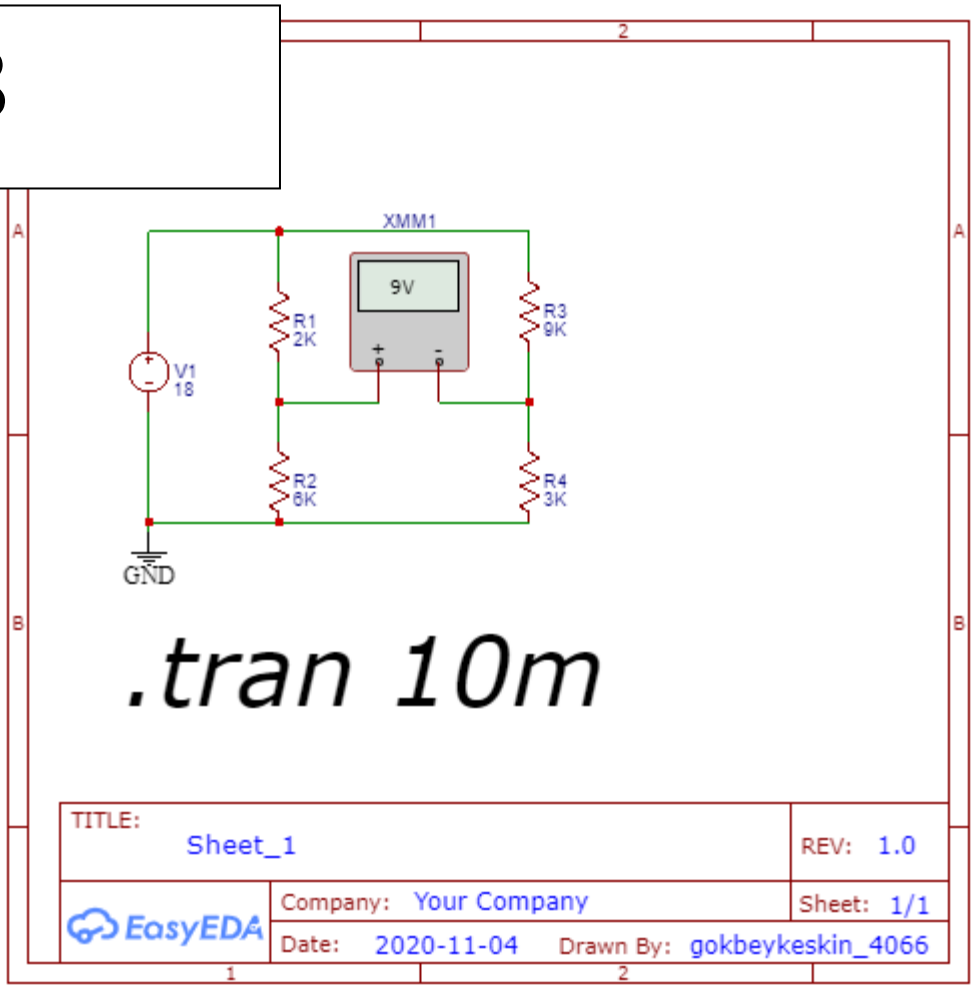
$i_2 = \frac{172.5 \cdot 80}{80 + 20} = 90mA$

$i_L = 187.5mA - 75mA = 112.5mA$

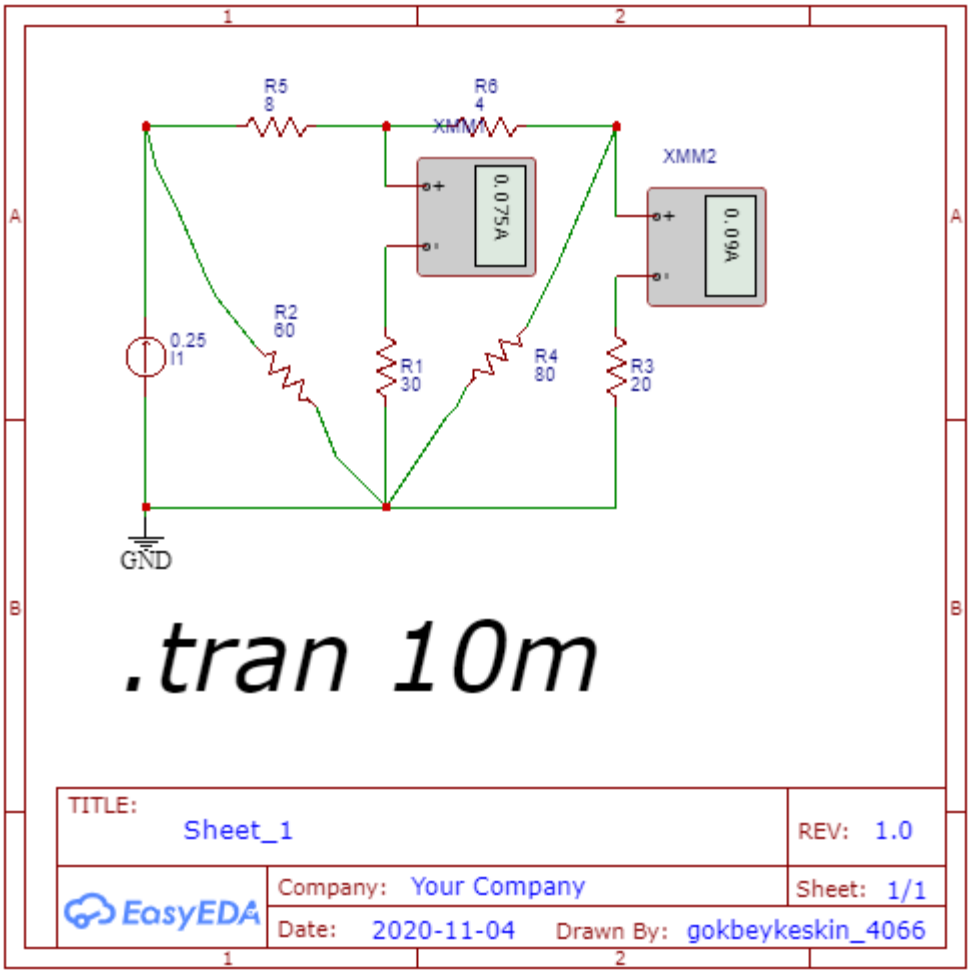

1
2
A
B
R1
0.5
R2
5
XMM1
3.368A
I1
40
R3
8
R4
10
R5
20
R6
40
GND
.tran 10m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
Sheet: 1/1
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.22

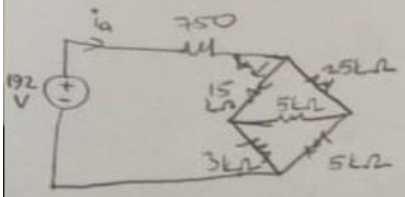
3.28


1
2
A
B
XMM1
9V
R1
2K
R3
9K
V1
18
R2
6K
R4
3K
GND
.tran 10m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
Sheet: 1/1
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.32


R5
8
R6
4
XMM1
XMM2
0.075A
0.09A
0.25
I1
R2
60
R1
30
R4
80
R3
20
GND
.tran 10m
TITLE:
Sheet_1
REV: 1.0
Company: Your Company
Sheet: 1/1
EasyEDA
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.52) (PSPICE)



$P_{3k\Omega} = ?$

Circuit is balanced because

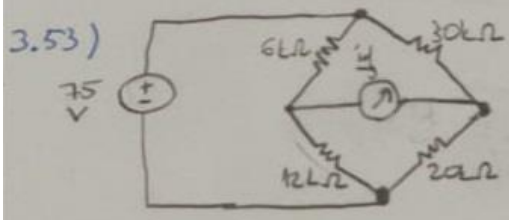
$15 \cdot 5 = 25 \cdot 3 = 75$ so, there is no current in 5Ω resistor.

$$R_{eq} = \frac{(15+3)\cdot(25+5)}{(15+3)+(25+5)} + 0{,}75 = 12k\Omega$$

$$i_a = \frac{192V}{12k\Omega} = 16mA \qquad i_x = \frac{16 \cdot 3}{48} = 1mA$$

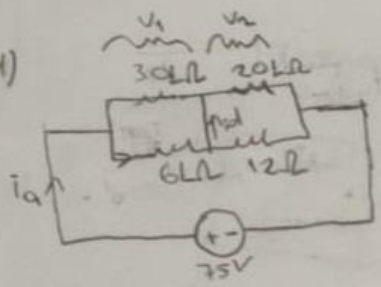
$$P_{3k\Omega} = 10^2 \cdot 3 = 300mA$$

3.53)



(unbalanced)

$i_d = ?$



$$R_{eq} = \frac{30 \cdot 6}{30+6} + \frac{20 \cdot 12}{20+12} = 12{,}5k\Omega$$

$5k\Omega$ $\quad 7{,}5k\Omega$

$$i_a = \frac{75V}{12{,}5k\Omega} = 6mA$$

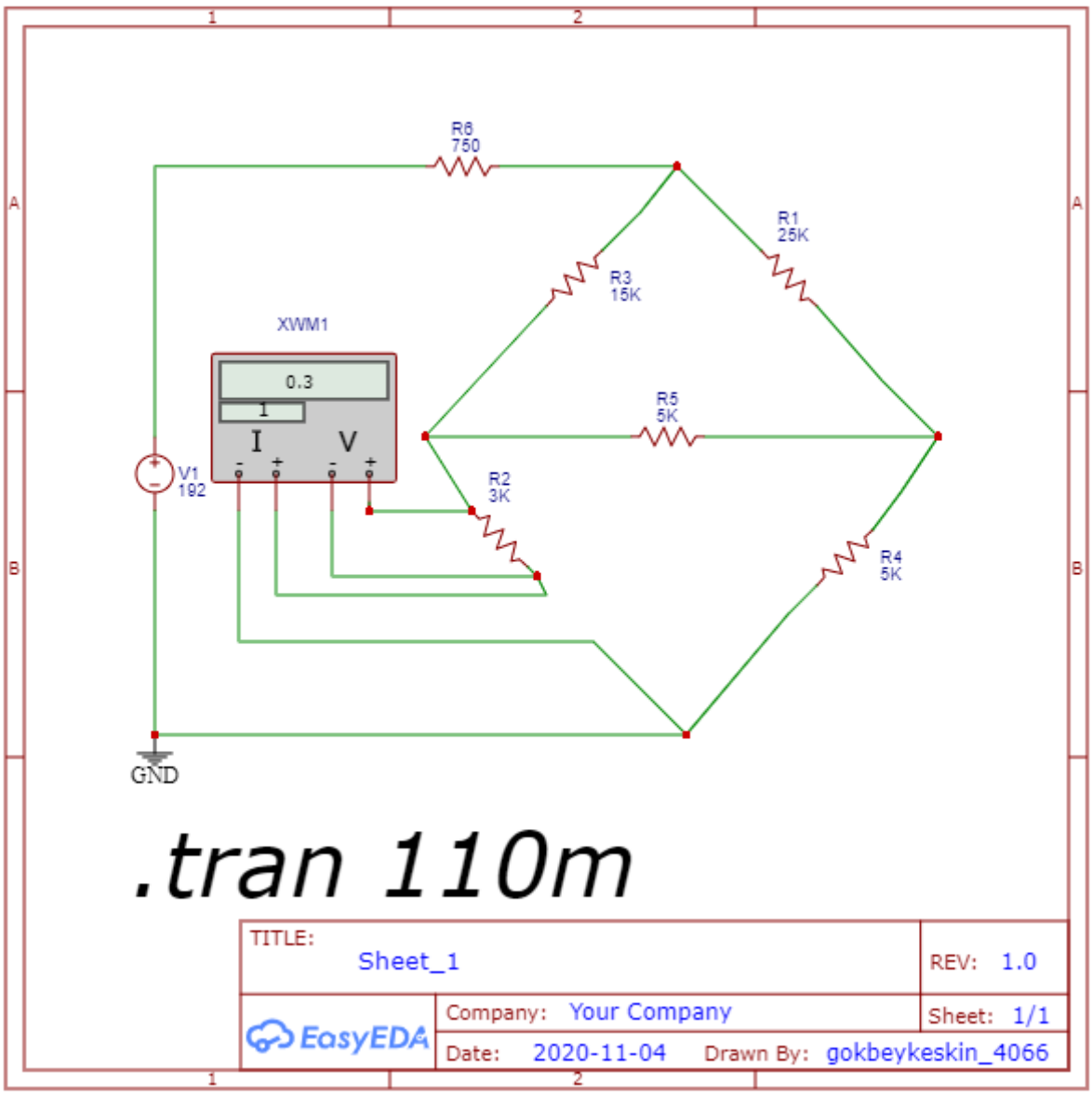
$$V_1 = 6mA \cdot 5k\Omega = 30V$$

$$V_2 = 6mA \cdot 7{,}5k\Omega = 45V$$

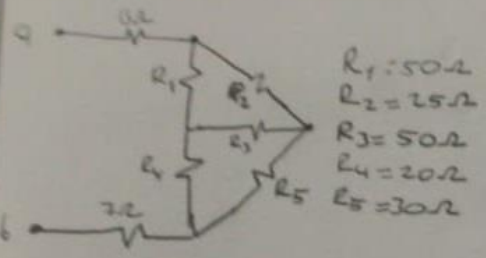
$$i_d = i_{6k\Omega} - i_{12k\Omega}$$

$$i_d = \frac{30V}{6k\Omega} - \frac{45V}{12k\Omega} = 1{,}25mA$$

3.52

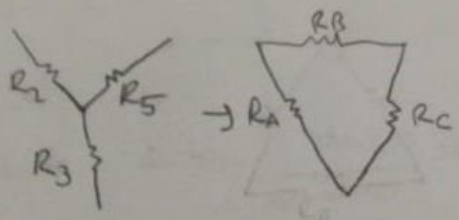

R6
750
R1
25K
R3
15K
XWM1
0.3
1
I
V
R5
5K
V1
192
R2
3K
R4
5K
GND
.tran 110m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
Sheet: 1/1
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.58/ (PSPICE)



$R_1 = 50\Omega$
$R_2 = 25\Omega$
$R_3 = 50\Omega$
$R_4 = 20\Omega$
$R_5 = 30\Omega$

a)



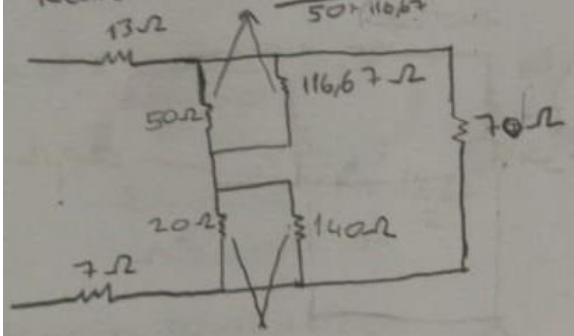
$$R_A = \frac{R_2 \cdot R_3 + R_2 \cdot R_5 + R_3 \cdot R_5}{R_5} = 116{,}67\Omega$$

$$R_B = \frac{R_2 \cdot R_3 + R_2 \cdot R_5 + R_3 \cdot R_5}{R_3} = 70\Omega$$

$$R_C = \frac{R_2 \cdot R_3 + R_2 \cdot R_5 + R_3 R_5}{R_2} = 140\Omega$$

Redraw:

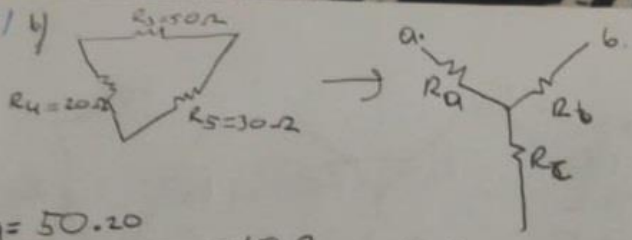
$\frac{50 \cdot 116{,}67}{50 + 116{,}67} = 35\Omega$



$\frac{20 \cdot 140}{20 + 140} = 17{,}5\Omega$

$R_{eq} = \frac{70 \cdot (35 + 17{,}5)}{70 + (35 + 17{,}5)} + 13 + 7 = 50\Omega$

3.58 / b)

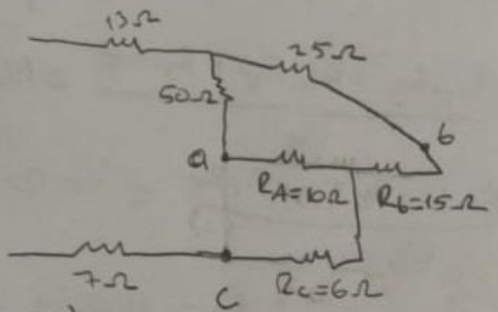


$R_a = \frac{50.20}{50+20+30} = 10\Omega$

$R_b = \frac{50.30}{50+20+30} = 15\Omega$

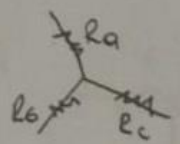
$R_c = \frac{20.30}{50+20+30} = 6\Omega$

Redraw



$R_{eq} = 13 + 7 + 6 + \frac{(15+25).(50+10)}{15+25+50+10} = 50\Omega$

c) ① $R_1 = 50\Omega$, $R_2 = 25\Omega$, $R_3 = 50\Omega$

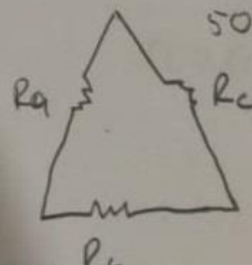


$R_a = \frac{50.25}{50+50+25} = 10\Omega$

$R_b = \frac{50.50}{50+50+25} = 20\Omega$

$R_c = R_a = 10\Omega$

② $R_1 = 50\Omega$, $R_3 = 50\Omega$, $R_4 = 20\Omega$



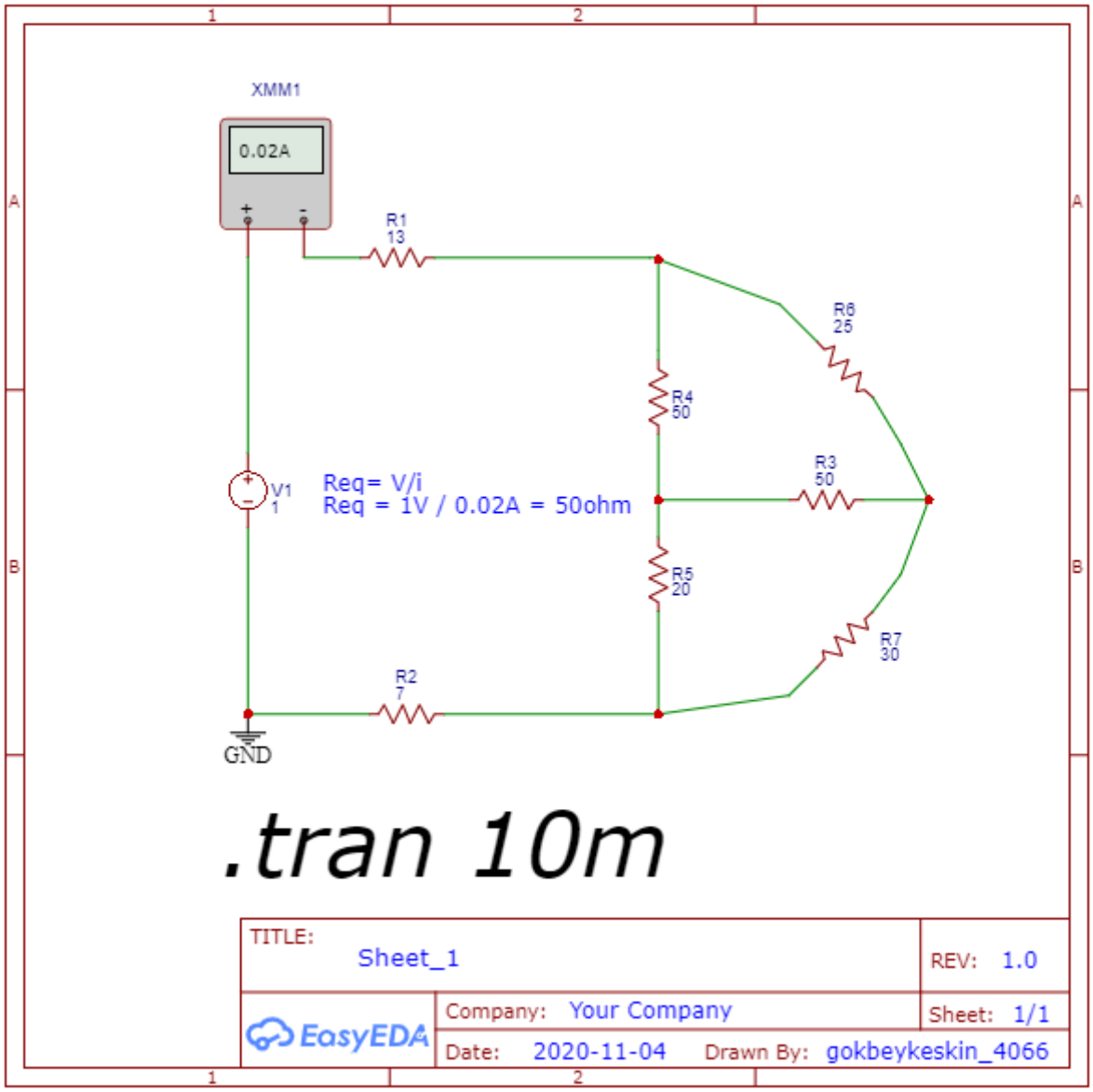
$50.50 + 50.20 + 50.20 = 4500$

$R_a = \frac{4500}{50} = 90\Omega$

$R_b = \frac{4500}{50} = 90\Omega$

$R_c = \frac{4500}{20} = 225\Omega$

3.58


XMM1
0.02A
R1
13
R6
25
R4
50
R3
50
V1
1
Req= V/i
Req = 1V / 0.02A = 50ohm
R5
20
R7
30
R2
7
GND
.tran 10m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
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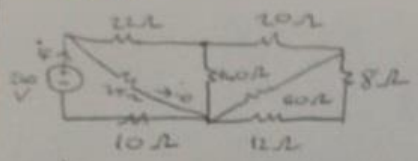
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.62) (ASPICE)



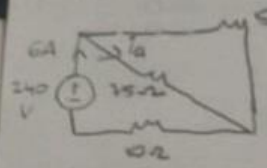
$i_o = ?$ $P_{140\Omega} = ?$

$\frac{(12+8)\cdot 60}{20+60} + 20 = 35\Omega + \frac{35 \cdot 140}{35+140} = 28\Omega$

$\rightarrow 28 + 22 = 50\Omega + \frac{50 \cdot 75}{50+75} + 10 = 40\Omega$

$R_{eq} = 40\Omega$

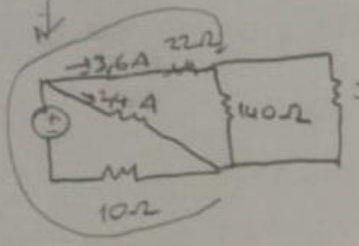
$i_c = \frac{240V}{40\Omega} = 6A$



kVL for left loop:

$-240 + i_a \cdot 75 + 6 \cdot 10 = 0$

$\Rightarrow i_a = 2,4A$

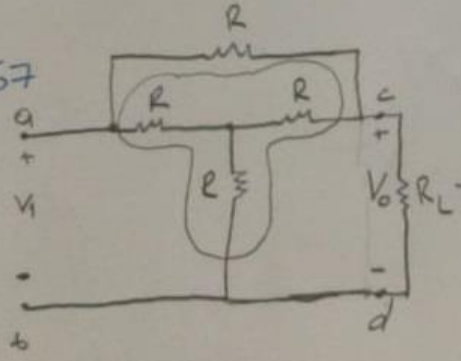


kVL: $-240 + 3,6 \cdot 22 + 140 \cdot i_{140\Omega} + 6 \cdot 10 = 0$

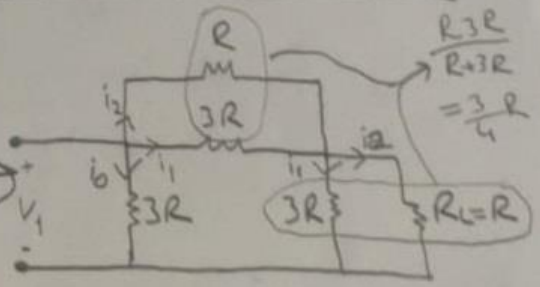
$\Rightarrow i_{140\Omega} = 0,72A$

$P_{140\Omega} = 0,72^2 \cdot 140 = 72,576W$

3.67



a)



$R_{eq} = \frac{\left(\frac{3}{4}R + \frac{3}{4}R\right) \cdot 3R}{\frac{3}{4}R + \frac{3}{4}R + 3R} = R$

b)

$-V_1 + 3R \cdot \frac{2}{3} i_2 = 0$

$\Rightarrow V_1 = 2R i_2$

$\Rightarrow \frac{V_1}{2} = V_o \Rightarrow \frac{V_o}{V_1} = 0,5$

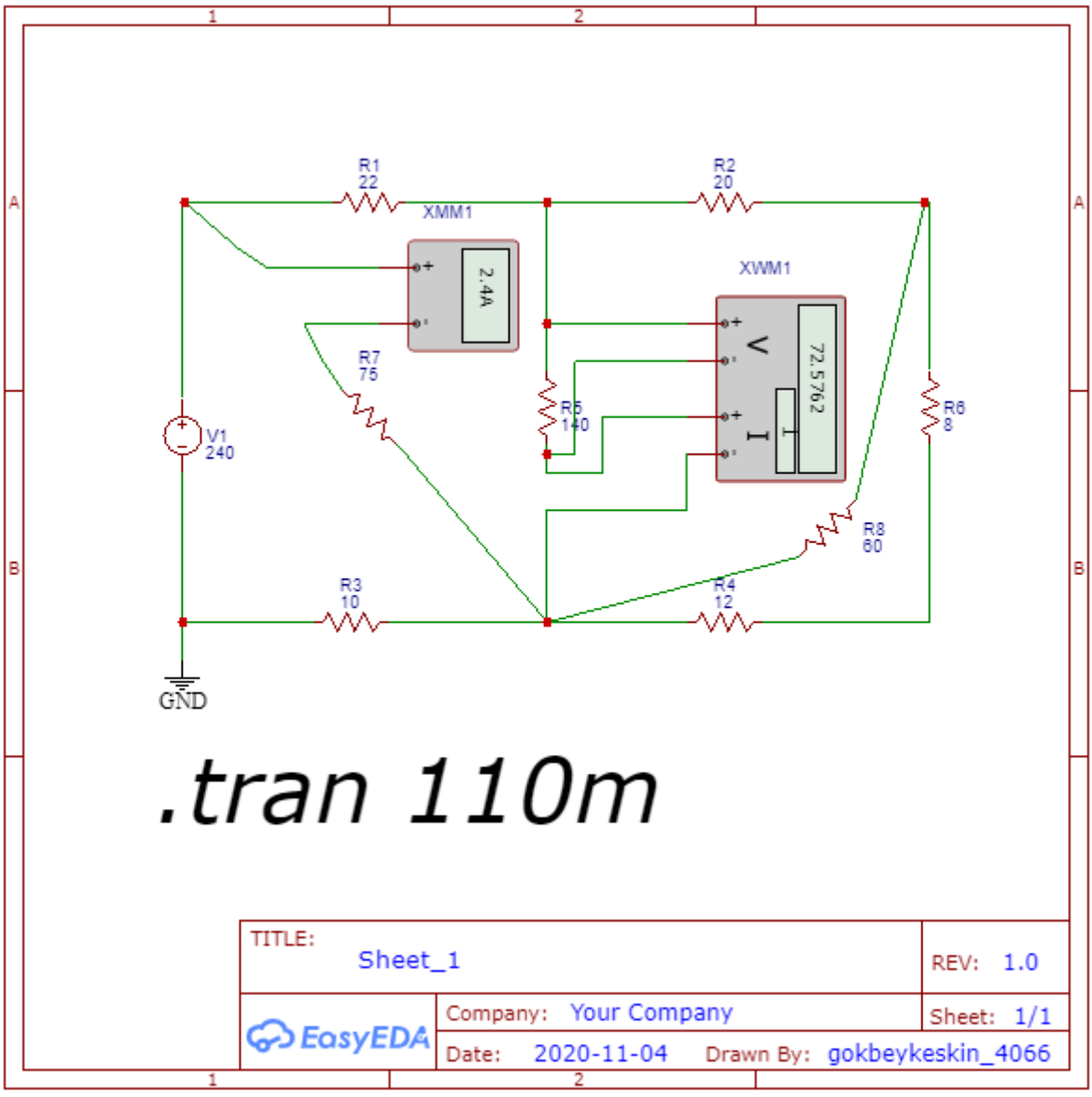
kVL: $-V_1 + 3R \cdot i_o = 0$

$-V_1 + 3R i_1 + 3R i_1 = 0 \} 2i_1 = i_o$

$-V_1 + 3R i_1 + R i_2 = 0 \} 3i_1 = i_2$

$\} i_o = \frac{2}{3} i_2$

3.62


R1
22
R2
20
XMM1
2.4A
XWM1
V
72.5762
I
R7
75
R5
140
R6
8
V1
240
R8
60
R3
10
R4
12
GND
.tran 110m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
Sheet: 1/1
Date: 2020-11-04
Drawn By: gokbeykeskin_4066

3.73) (PSPICE)

a) $V_x = \alpha . V_s$

$1V = \alpha . 5V \Rightarrow \alpha = 0,2$

b) $V_y = \beta . V_s$

$3,75V = \beta . 5 = \beta = 0,75$

b) $x = (1-\alpha) . P_x = 0,8 . 480 = 384$

$y = (1-\beta) . P_y = 0,25 . 800 = 200$

3.74) (PSPICE)

$x = (1-\alpha) . P_x$

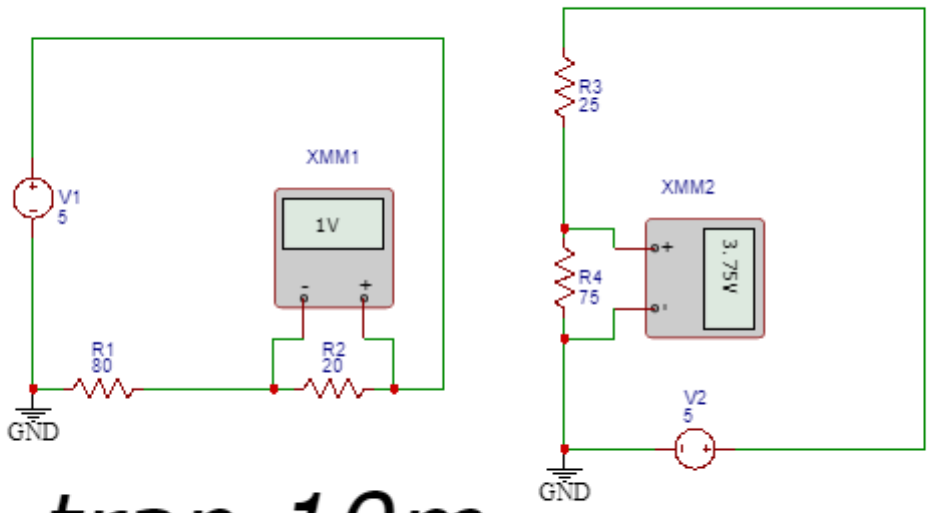
$480 = (1-\alpha) . 640 \Rightarrow \alpha = 0,25$

$V_x = \alpha . V_s = 0,25 . 8V = 2V$

$y = (1-\beta) . P_y$

$192 = (1-\beta) . 1024 \Rightarrow \beta = 0,8125$

$V_y = \beta . V_s = 0,8125 . 8V = 6.5V$



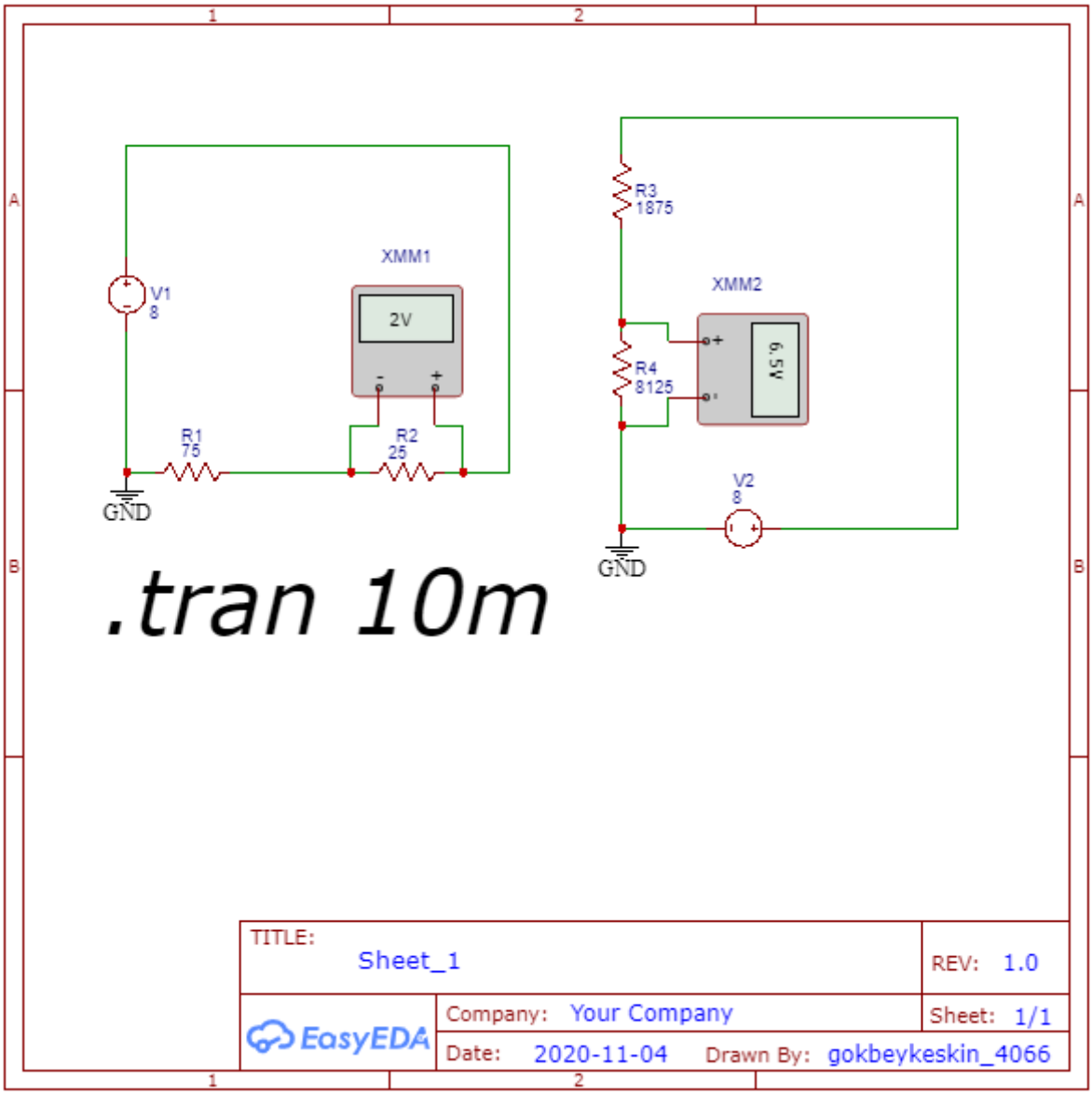
.tran 10m

3.73

TITLE: Sheet_1		REV: 1.0
EasyEDA	Company: Your Company	Sheet: 1/1
	Date: 2020-11-04	Drawn By: gokbeykeskin_4066

3.74

S


1
2
A
B
V1
8
XMM1
2V
R1
75
R2
25
GND
R3
1875
XMM2
R4
8125
6.5V
V2
8
GND
.tran 10m
TITLE:
Sheet_1
REV: 1.0
EasyEDA
Company: Your Company
Sheet: 1/1
Date: 2020-11-04
Drawn By: gokbeykeskin_4066