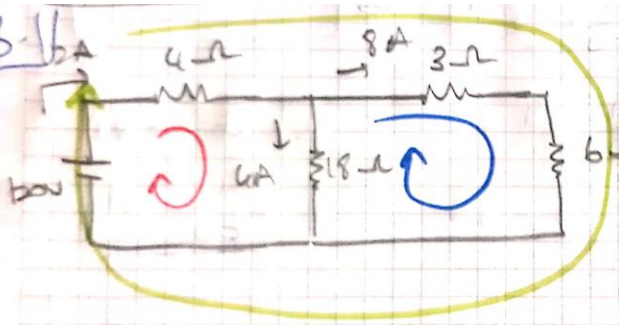
3.1)




loop-1

$120 - 4 \cdot 12 - 4 \cdot 18 = 0$ ✓

loop-2

$-8 \cdot 3 - 6 \cdot 8 + 4 \cdot 18 = 0$ ✓

loop-3

$-12 \cdot 4 - 8 \cdot 3 - 6 \cdot 8 + 120 = 0$ ✓

3.2) $P = I^2 R$

$P_{4\Omega} = 12^2 \cdot 4 = 576W$ $P_{6\Omega} = 4^2 \cdot 18 = 288W$

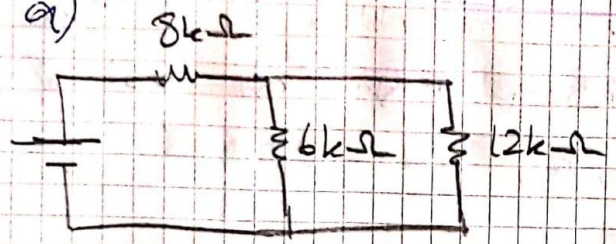
$P_{3\Omega} = 8^2 \cdot 3 = 192W$ $P_{18\Omega} = 8^2 \cdot 6 = 384W$

$P = IV \rightarrow P = 12 \cdot 120 = 1440W$

$576 + 192 + 288 + 384 = 1440$ ✓

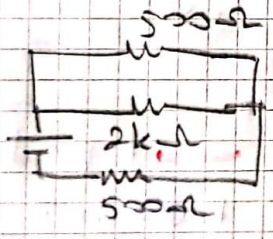
3.5) 5kΩ and 7kΩ resistors are connected in series.

a)




b) 800Ω and 1200Ω resistors are connected in series

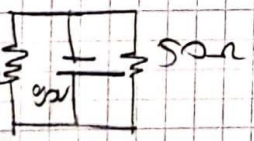
also 200Ω and 300Ω resistors are connected in series

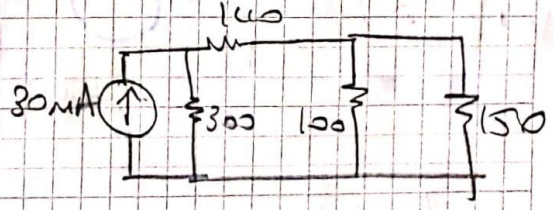



d) (50-90)
(80-70)

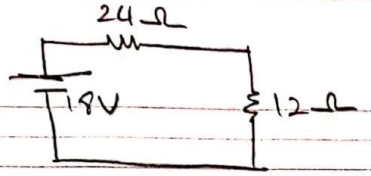
c) (25-15-35)
(10-40)

these resistors are connected in series



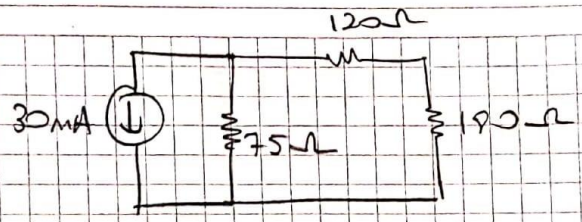



3.4 ] a) (36-18)



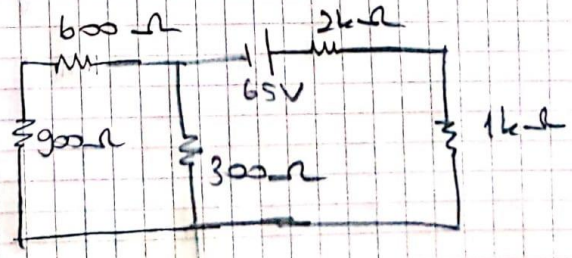

( ) → these are in parallel

b) (210-280)
(200-120)




c) (75kΩ - 50kΩ)
(60kΩ - 150kΩ - 180kΩ)


d) (3kΩ - 15kΩ)
(500Ω - 750Ω)




3.5 ] a) $R_{eq} = 8000 + (7000 + 5000 \| 6000) = 12000 = 12k\Omega$

$P = IV = \frac{V^2}{R}$ $\quad P_a = \frac{18^2}{1200} = 0,027\,W$

b) $R_{eq} = (500 \| (800+1200)) + 300 + 200 = 500 \| 2000 + 500 = 900\Omega$

$P_b = \frac{27^2}{900} = 0,81\,W$

c) $R_{eq} = [(15+25+35) \| (10+40)] = 75 \| 50 = 30\Omega$

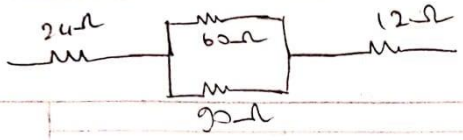
$P_c = \frac{90^2}{30} = 270\,W$

$P = I^2R = (0,03)^2 \cdot 120 = 0,108\,W$

d) $R_{eq} = ((70+80) \| 100 + 50 \| 50) \| 300 = 120\Omega$

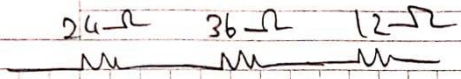
3.8)

a)




$\frac{1}{R} = \frac{1}{160} + \frac{1}{90}$

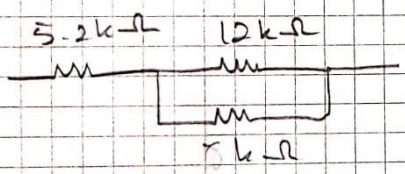
$\Rightarrow R = 36\,\Omega$



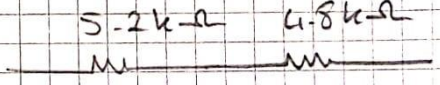

$R_{eq} = 24 + 36 + 12$

$R_{eq} = 72\,\Omega$

b)

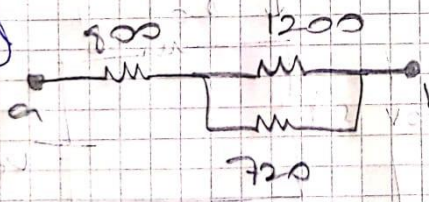



$\Rightarrow$




$R_{eq} = 10k\,\Omega$

~~3.10~~



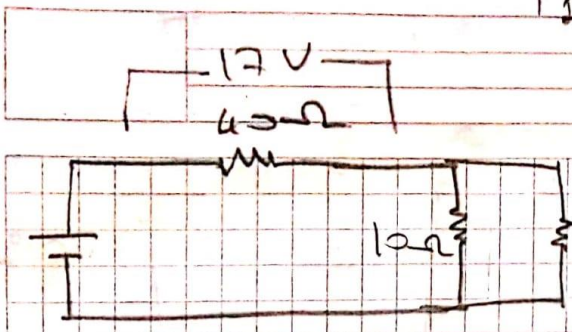

$R_{ab} = 800 \,||\, (1200 + 720)$

$R_{ab} = 288\,\Omega$

3.13) initially: $16 = 40 \cdot i_1$

$i_1 = \frac{4}{10} \Rightarrow 4 = \frac{4}{10} \cdot R_2$

$R_2 = 10\,\Omega$




$17 = 40 \cdot I$

$I = 17/40$

$V = I \cdot R_{eq}$

$20 = \frac{17}{40} R_{eq}$

$R_{eq} = \frac{800}{17}$

$40 + \frac{10 R_L}{10 + R_L} = \frac{800}{17}$

$\Rightarrow R_L = 24\,\Omega$

3-17 $R_{eq} = (10+20) \parallel (6 + (90 \parallel 10)) = 10\,\Omega$

c) $V = (2,4)(10) = 24\,V$

$P = -(2,4)(24) = -57.6\,W$

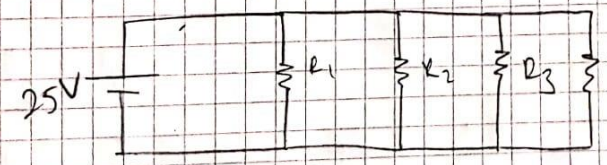
3-18 $i_1 + i_2 + i_3 + i_4 = 0.6 i_2 + i_2 + 2 i_2 + 2.4 i_2$

$\Rightarrow 6 i_2 = 0.05 \Rightarrow i_2 = 0,008333 = 8.33\,mA$

$i_1 = 0,6 i_2 = (0.6)(8,33) = 5\,mA$

$i_3 = 2 i_2 = 2(8,33) = 16,67\,mA$

$i_4 = 4 i_1 = 4(5) = 20\,mA$




$R_1 = \frac{25}{0,005} = 5k\,\Omega$

$R_2 = \frac{25}{0,00833} = 3k\,\Omega$

$R_3 = \frac{25}{0,01667} = 1,5k\,\Omega$

$R_4 = \frac{25}{0,02} = 1,25k\,\Omega$

3-19 $P = \frac{V^2}{R} = \frac{24^2}{R_1+R_2+R_3} = 80 \Rightarrow R_1+R_2+R_3 = 7.2\,\Omega$

$\frac{(R_1+R_2)^2 \cdot 24}{(R_1+R_2+R_3)} = 12 \Rightarrow 2(R_1+R_2) = R_1+R_2+R_3$

$\Rightarrow R_1+R_2 = R_3$

$R_3 = 3.6\,\Omega$

$\frac{R_2 \cdot 24}{(R_1+R_2+R_3)} = 5 \Rightarrow R_2 = 1.5\,\Omega$

$R_1 = 2.1\,\Omega$

3.20 $G = \frac{1}{R}$ (conductivity)

$V = IR$

$V = \frac{1}{G} = I = VG$

3.22 $i_g = i_{R1} + i_{R2} + \cdots + i_{RN}$

$i_g = v_o \cdot G_1 + v_o G_2 + \cdots + v_o G_N$

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

$v_o = \frac{i_g}{G_1 + G_2 + \cdots + G_N}$ $\left(\frac{60}{R_{eq} + 60}\right)(0.25)$

$i_k = v_o \cdot G_k = \frac{i_g G_k}{G_1 + G_2 + \cdots + G_N}$

$i_5 = \frac{40.(0.2)}{2 + 0.2 + 0.125 + 0.1 + 0.05 + 0.025} = 3.2A$

3-28 $V_{6k} = \frac{6}{6+2} \cdot 18 = 13.5V$

$V_{3k} = \frac{3}{3+9} \cdot 18 = 4.5V$

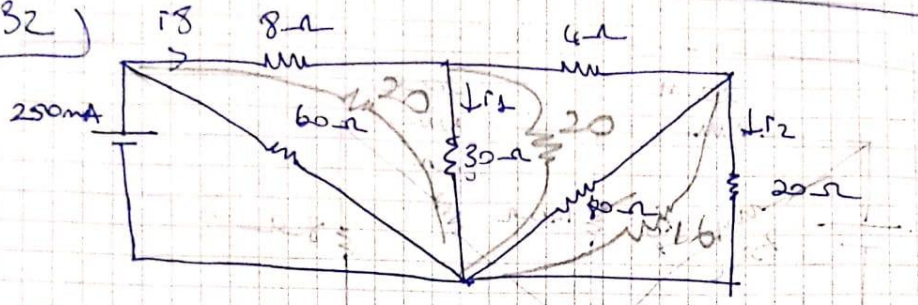
$V_x = V_{6k} - V_{3k} = 13.5V - 4.5V = 9V$

$V_{6k} = \frac{6}{6+2} V_5 = \frac{3}{4} V_5 = 0.75 V_5$

$V_x = 0.5 V_5$

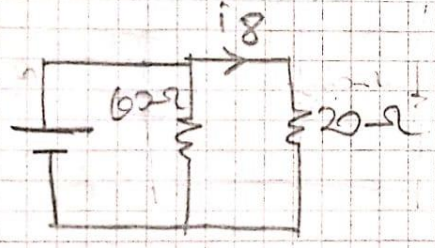
$V_{3k} = \frac{3}{12} V_5 = \frac{V_5}{4} = 0.25 V_5$

3.32)




$R_{eq} = (20 \| 80) + 4 = 20$

$\Rightarrow [(20 \| 30) + 8] = 20$




$i8 = \frac{60}{60+20} \cdot 0,25 = 0,1875$

$= 187,5mA$

$i1 = \frac{30}{30+20} \cdot 187,5$

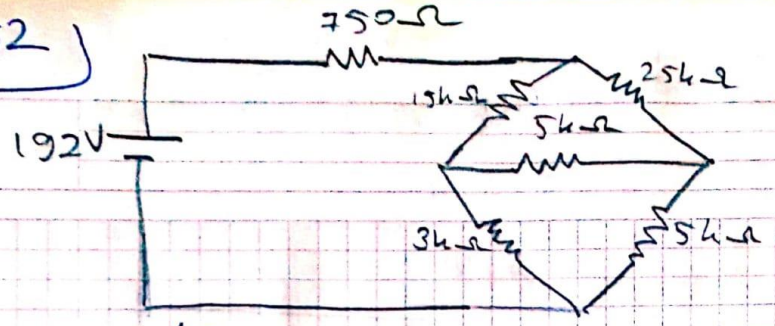
$= 75mA$

$i4 = 187,5 - 75 = 112,5mA$

$i2 = \frac{80}{80+20} \cdot 112,5$

$= 90mA$

3.52




$15 \cdot 5 = 25 \cdot 3$, no current is passing through to the 5kΩ resistor

$R_{eq} = 750 + (15000+300) \,||\, (25000+5000)$

$R_{eq} = 12000 = 12k\Omega$

$I = \frac{V}{R} = \frac{192}{12000} = 0,016 = 16mA$

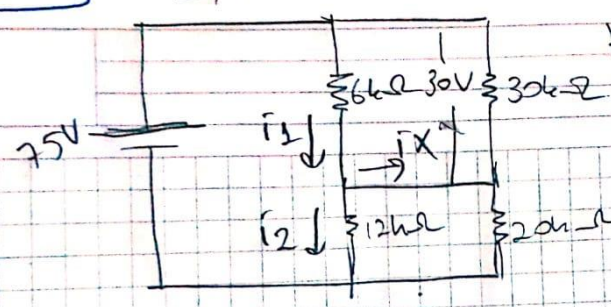
$P = IV = \frac{I^2}{R}$

$i_3 = \frac{11250}{18000}(0,016)$

$i_3 = 10mA$

$P = 3000(0,01)^2 = 0,3W$

-53




$Req = (6 \| 30) + (12 \| 20)$

$Req = 12{,}5\,k\Omega$

$i = \frac{75}{12500}$

$i = 0{,}006 = 6\,mA$

$i_x = i_1 - i_2$

$i_x = i_1$

$30 = i_1 \cdot 6000$

$i_1 = 5\,mA$

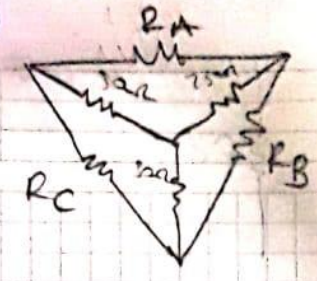
$45 = i_2 \cdot 12000$

$i_2 = 3{,}75\,mA$

$\Rightarrow i_x = 1{,}25\,mA$

3.58)

a)

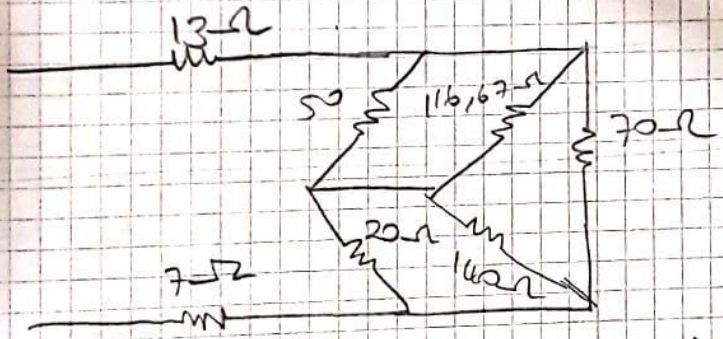



$R_A = \frac{50 \cdot 30 + 25 \cdot 30 + 50 \cdot 25}{30}$

$R_A = \frac{3500}{30} = 116.67\,\Omega$

$R_B = \frac{3500}{50} = 70\,\Omega$

$R_C = \frac{3500}{25} = 140\,\Omega$

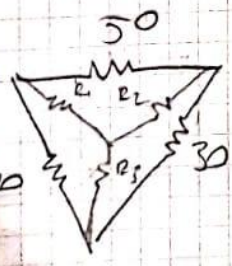



$Req = 70 \,||\, [50 \,||\, 116.67) + (20 \,||\, 140) = 30\,\Omega$

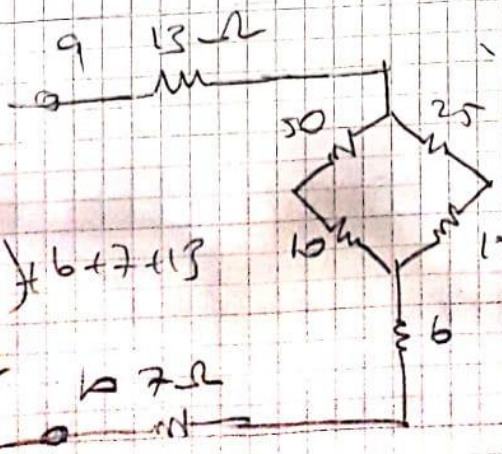
$\rightarrow 30 + 13 + 7 = \boxed{50 = Req}$

↓ with the same formula

b)



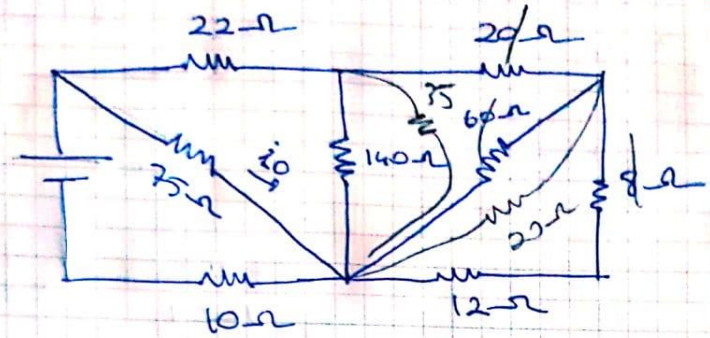

$R_1 = 10\,\Omega$, $R_2 = 15\,\Omega$, $R_3 = 6\,\Omega$




$Rab = (60 \,||\, 30) + 6 + 7 + 13$

$Rab = 50\,\Omega$

3.62)




$[(8+12)\|60]+20=35$

$[(35\|140)+22]\|75+10=\boxed{40\,\Omega=R_{eq}}$

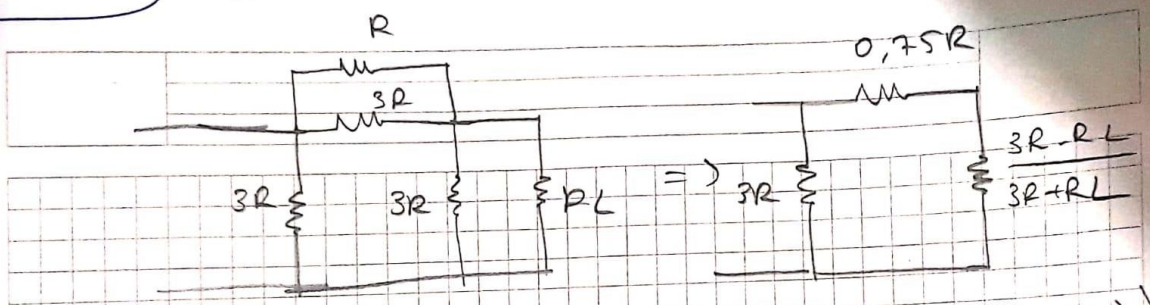
$i=\frac{24}{40}=6A$ $\quad i_0=\frac{50}{125}\cdot i=2.4A$

$P=IV=I^2R$ $\quad i_{140}=\frac{35}{175}(i-i_0)$

$P=(0,72)^2(140)$ $\quad \boxed{i_{140}=0,72A}$

$\boxed{P=72,6\,W}$

3.67) with 4-to-Δ transformation, we get




$\frac{1}{R_{eq}}=\frac{1}{3}+\frac{1}{R_L}$ $\quad R_{eq}=\frac{3R_L}{3+R_L}$

$R_{ab}=3R\|\left(0,75R+\frac{(3RR_L)}{3R+R_L}\right)$

$R_{ab}=\frac{3R_L(8R_L)}{24R_L}$

for $R=R_L \Rightarrow R_{ab}=R_L$

3.73 $V_x = \alpha V_s \Rightarrow \alpha = \frac{V_x}{V_s} = \frac{1}{5} = 0,2$

$V_y = \beta V_s \Rightarrow \beta = \frac{V_y}{V_s} = \frac{3.75}{5} = 0,75$

$x = (1-\alpha)p_x = 0.8 \cdot 480 = 384$

$y = (1-\beta)p_y = 0.25 \cdot 800 = 200$

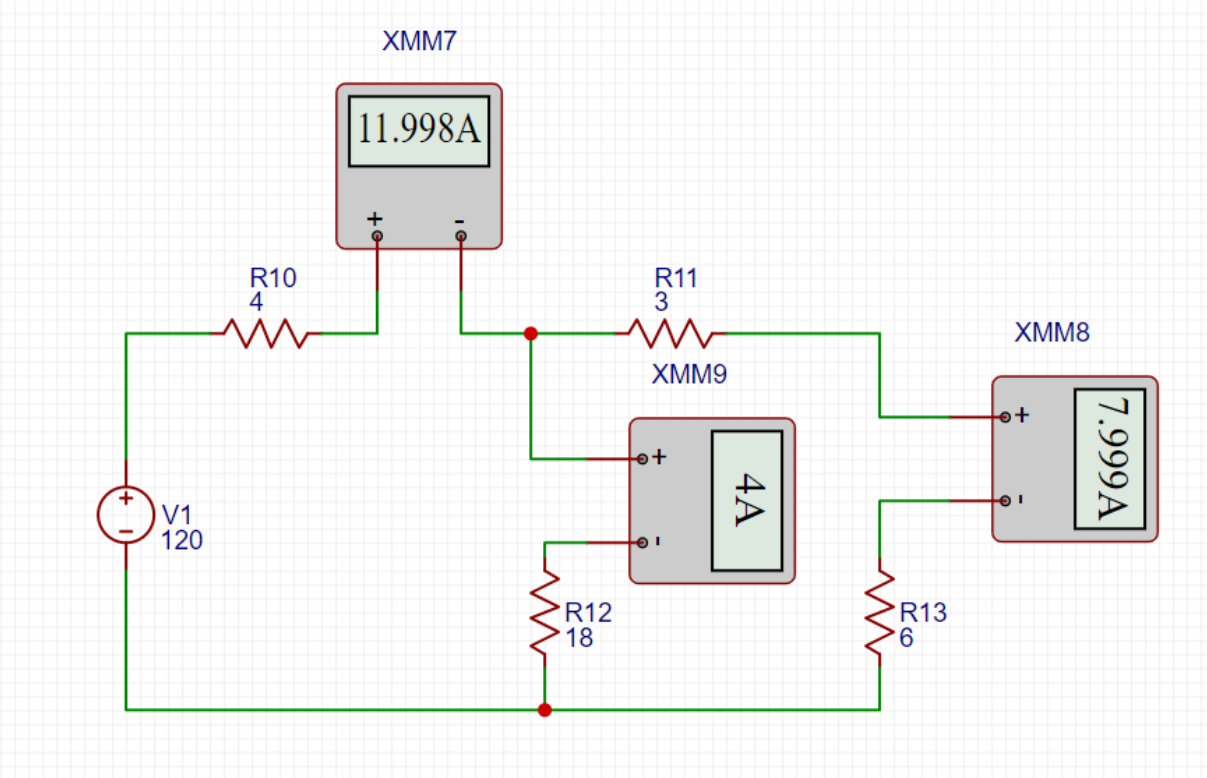
3.74 $x = (1-\alpha)p_x \Rightarrow \alpha = 1 - \frac{x}{p_x} = 1 - \frac{480}{640} = 0.25$

$V_x = \alpha V_s = (0.25)8 = 2V$

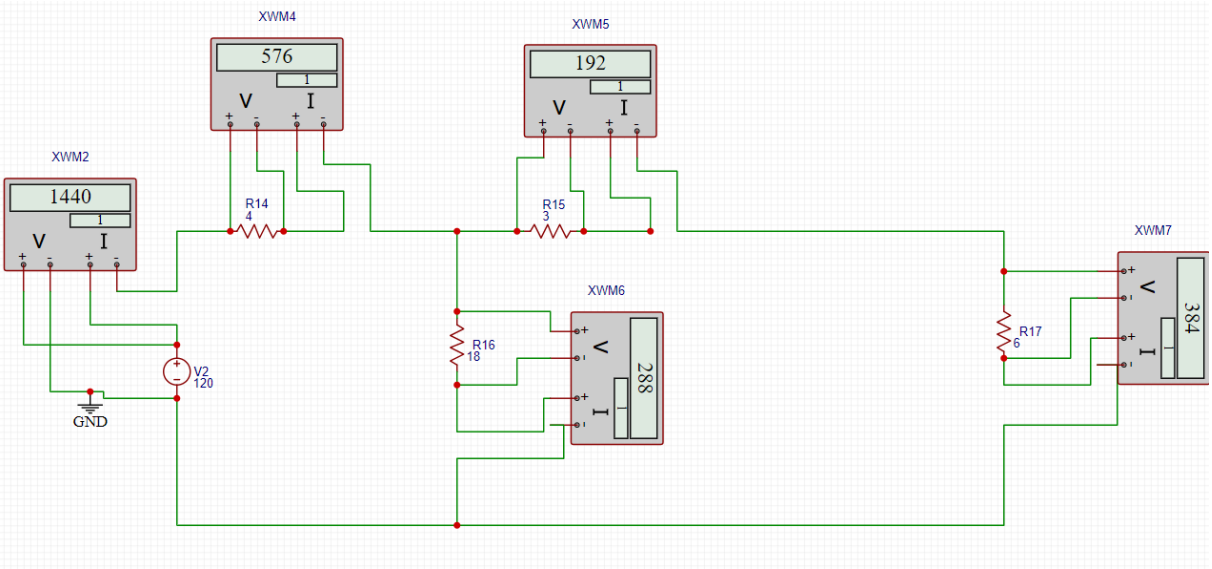
$y = (1-\beta)p_y \Rightarrow \beta = 1 - \frac{y}{p_y} = 1 - \frac{192}{1024} = 0.8125$

$V_y = \beta V_s = (0.8125)8 = 6.5V$

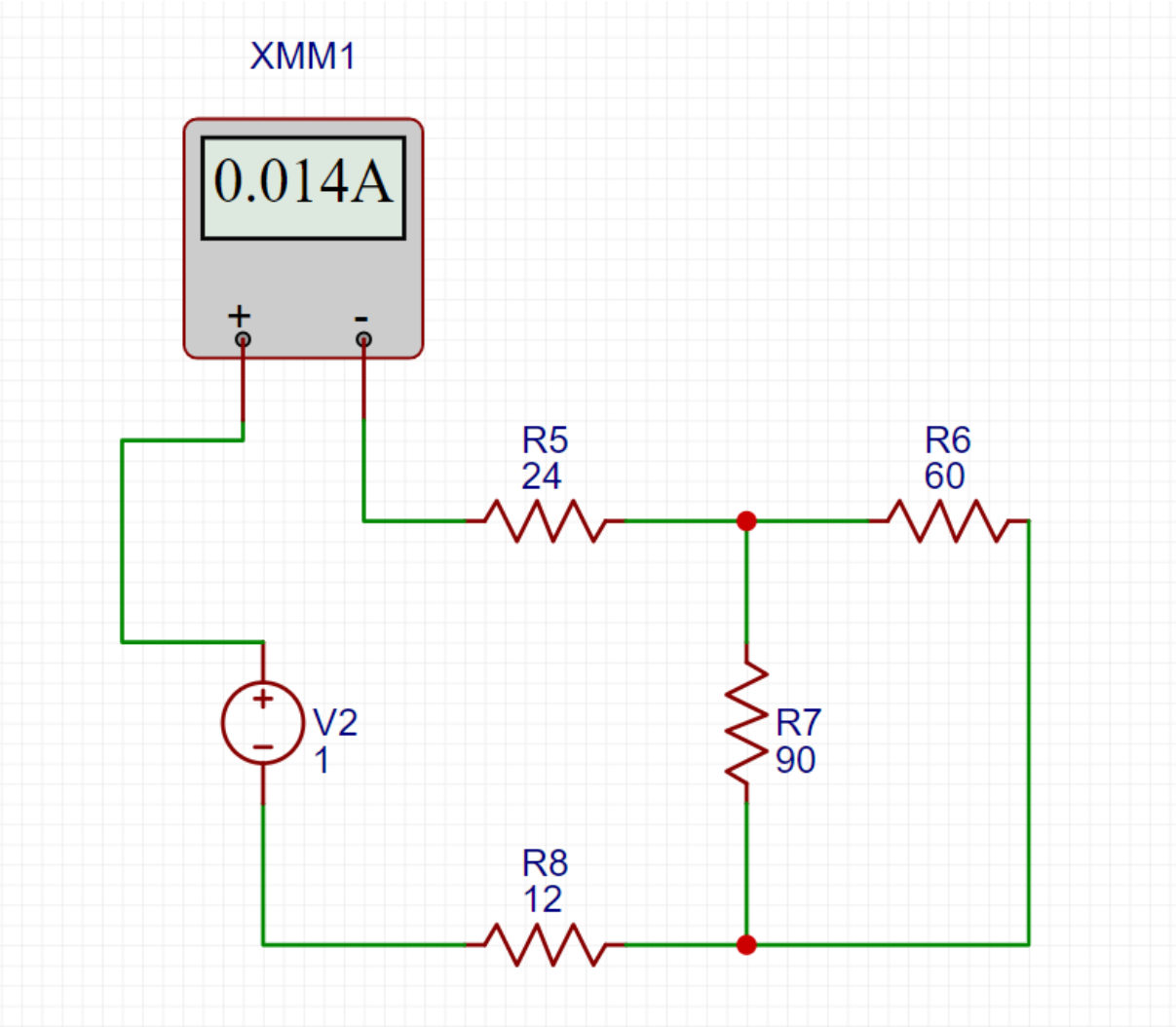
3.1



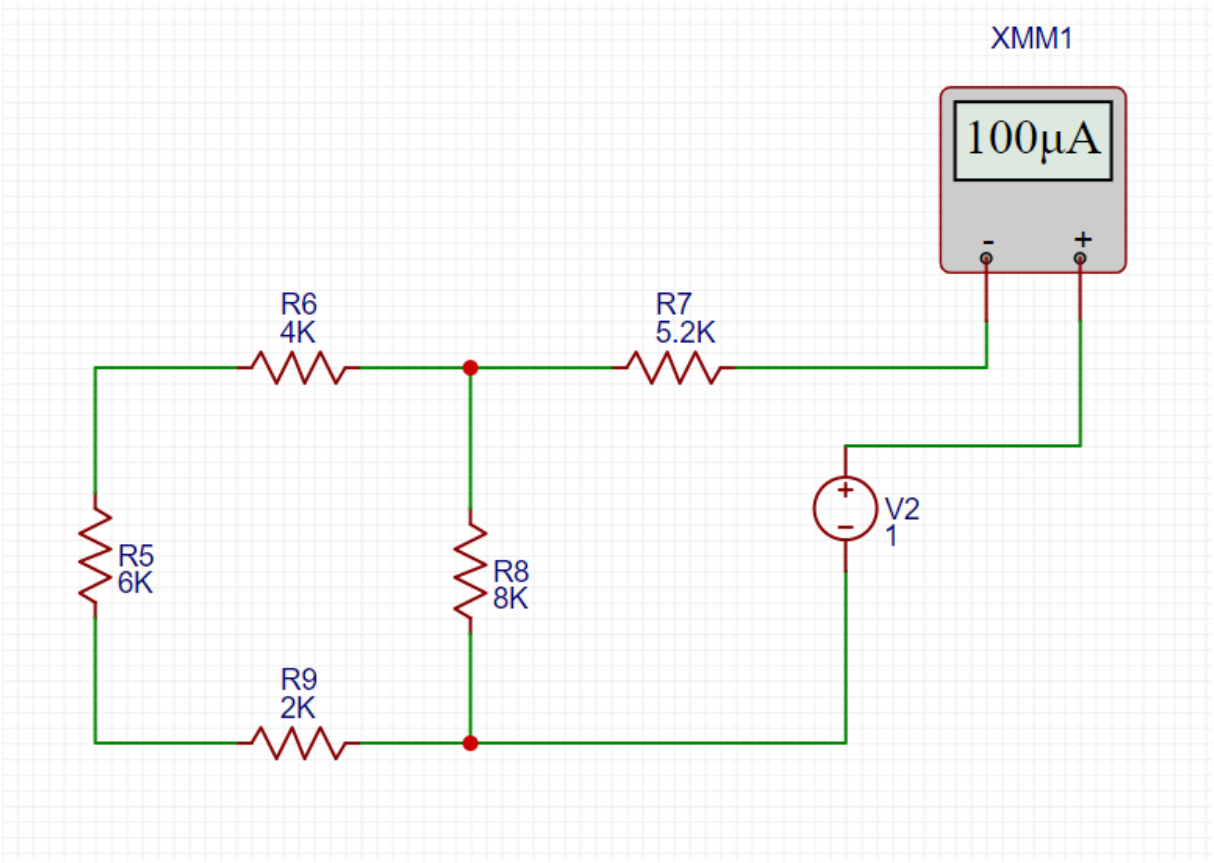
# 3.2


XWM4
576
1
V
I
XWM5
192
1
V
I
XWM2
1440
1
V
I
R14
4
R15
3
XWM7
384
V
I
XWM6
288
V
I
R16
18
R17
6
V2
120
GND

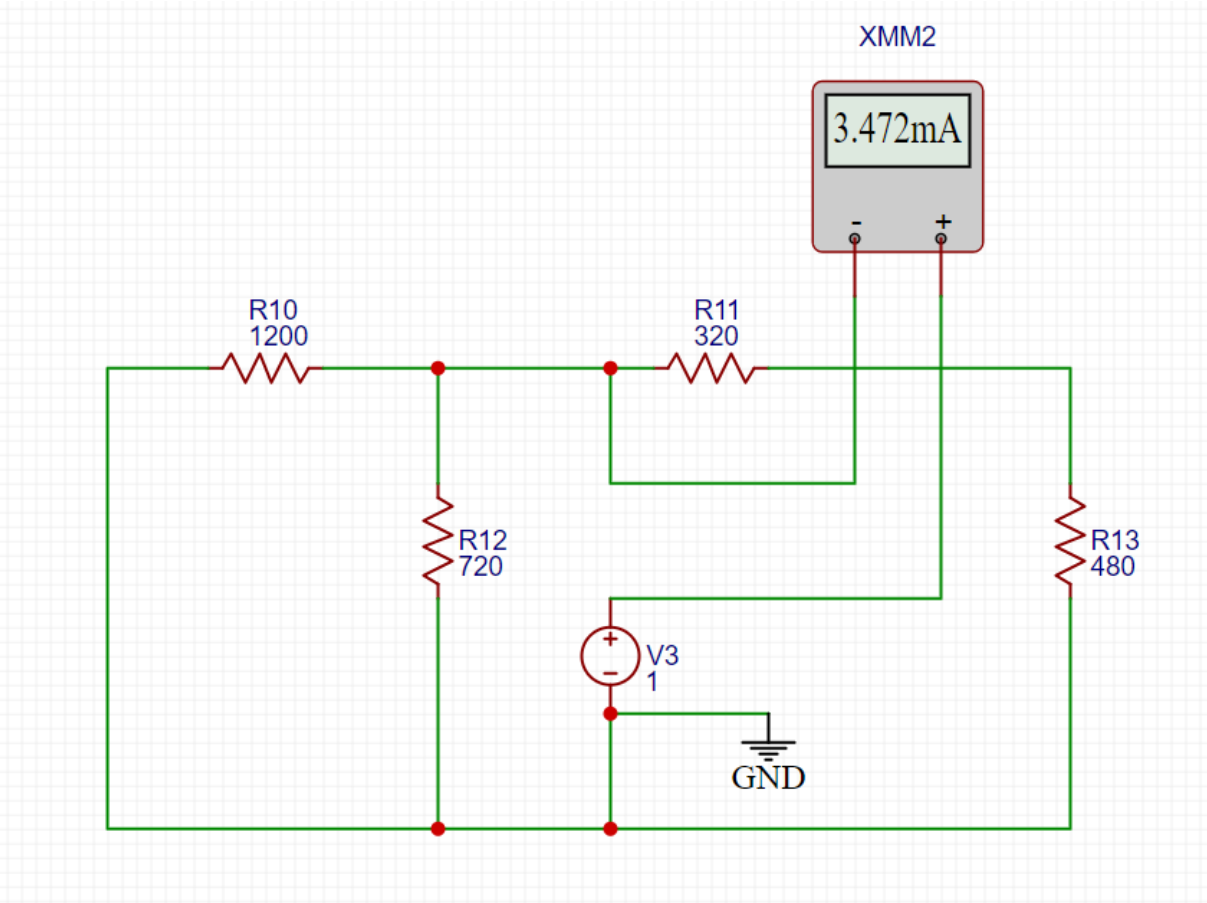
3.8.a



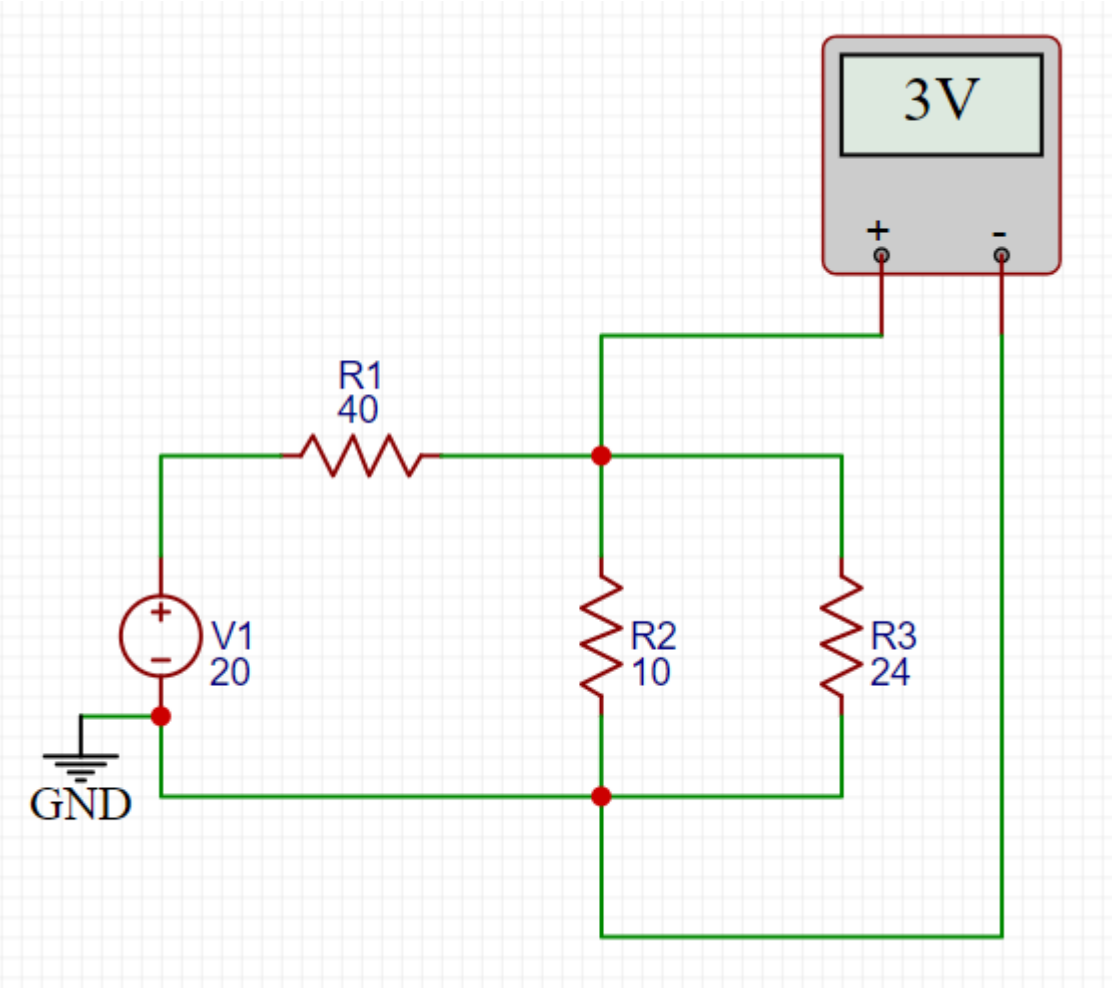
3.8.b



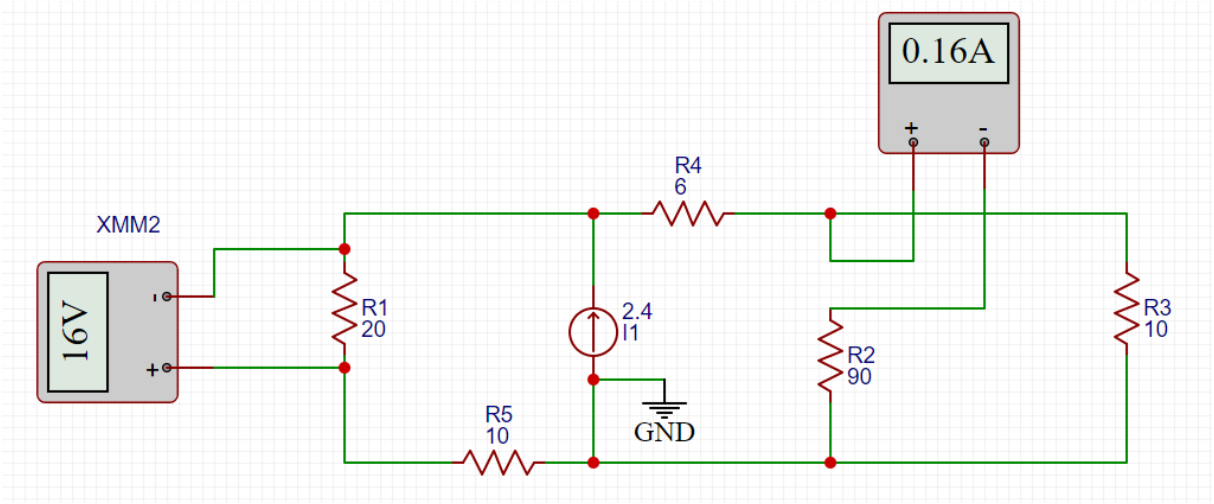
3.8.c



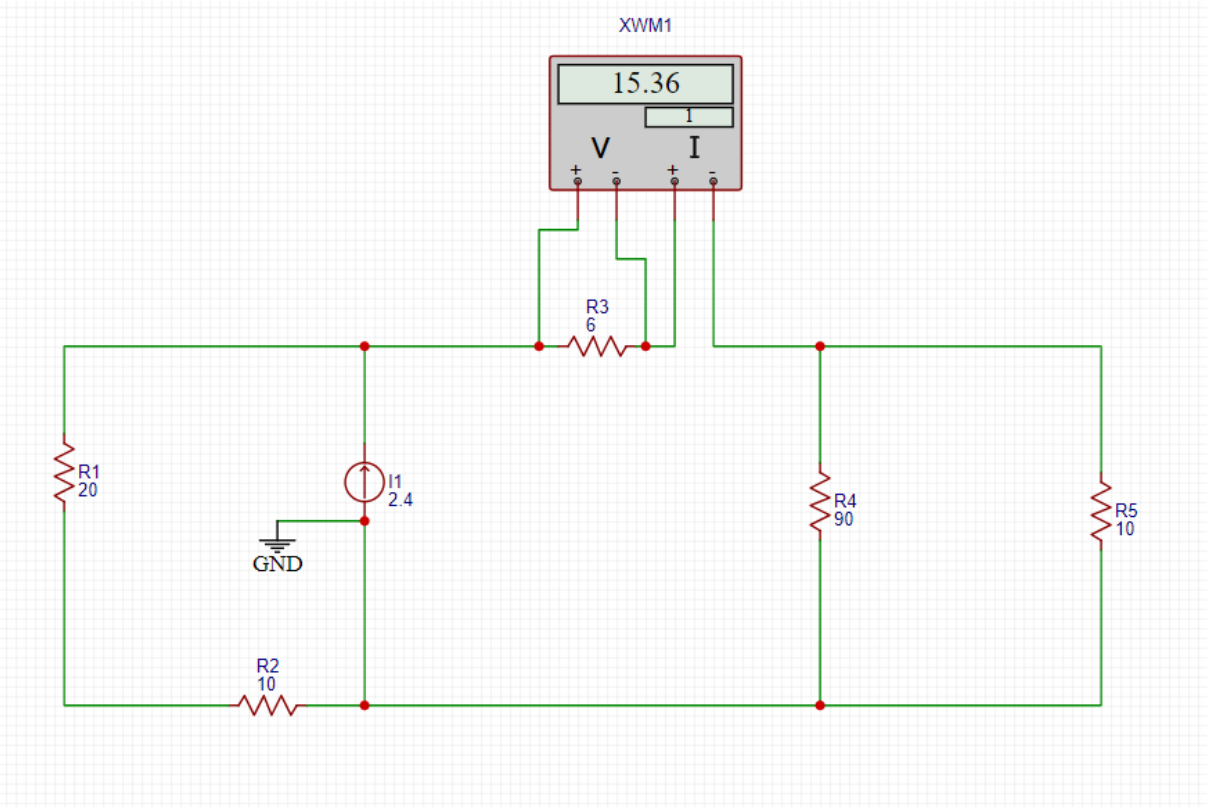
3.13



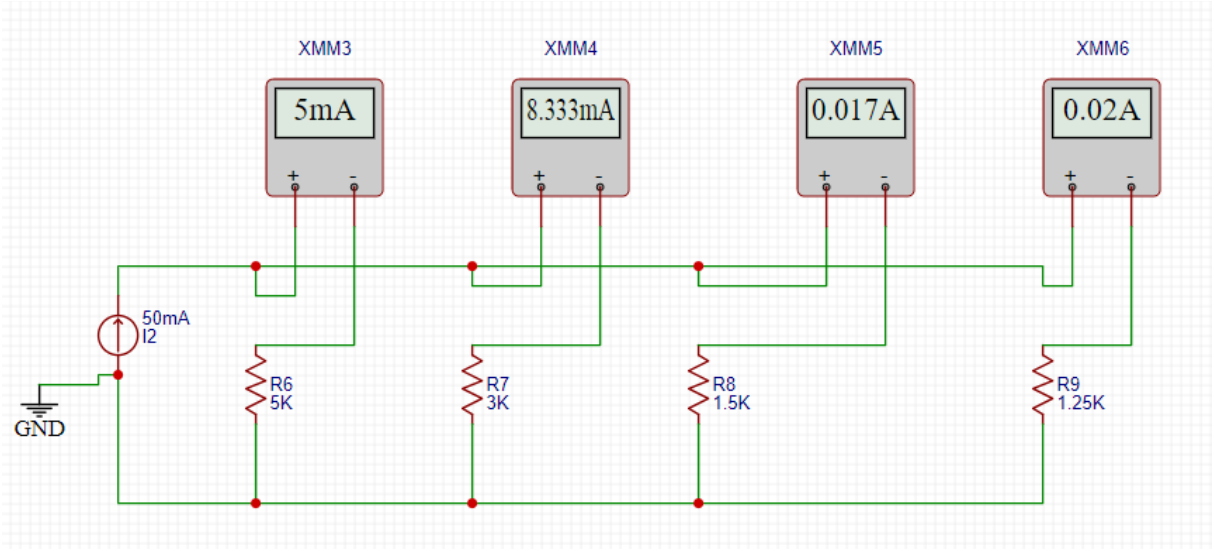
3.17.a



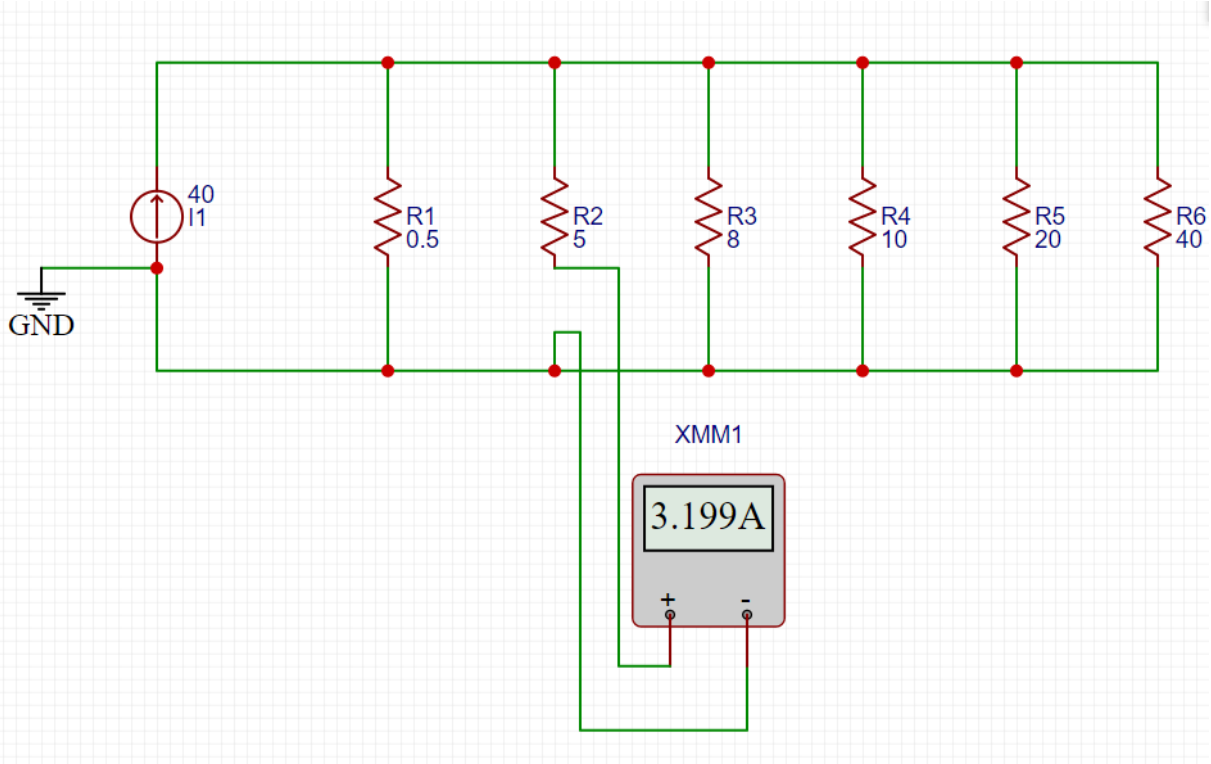
3.17.b



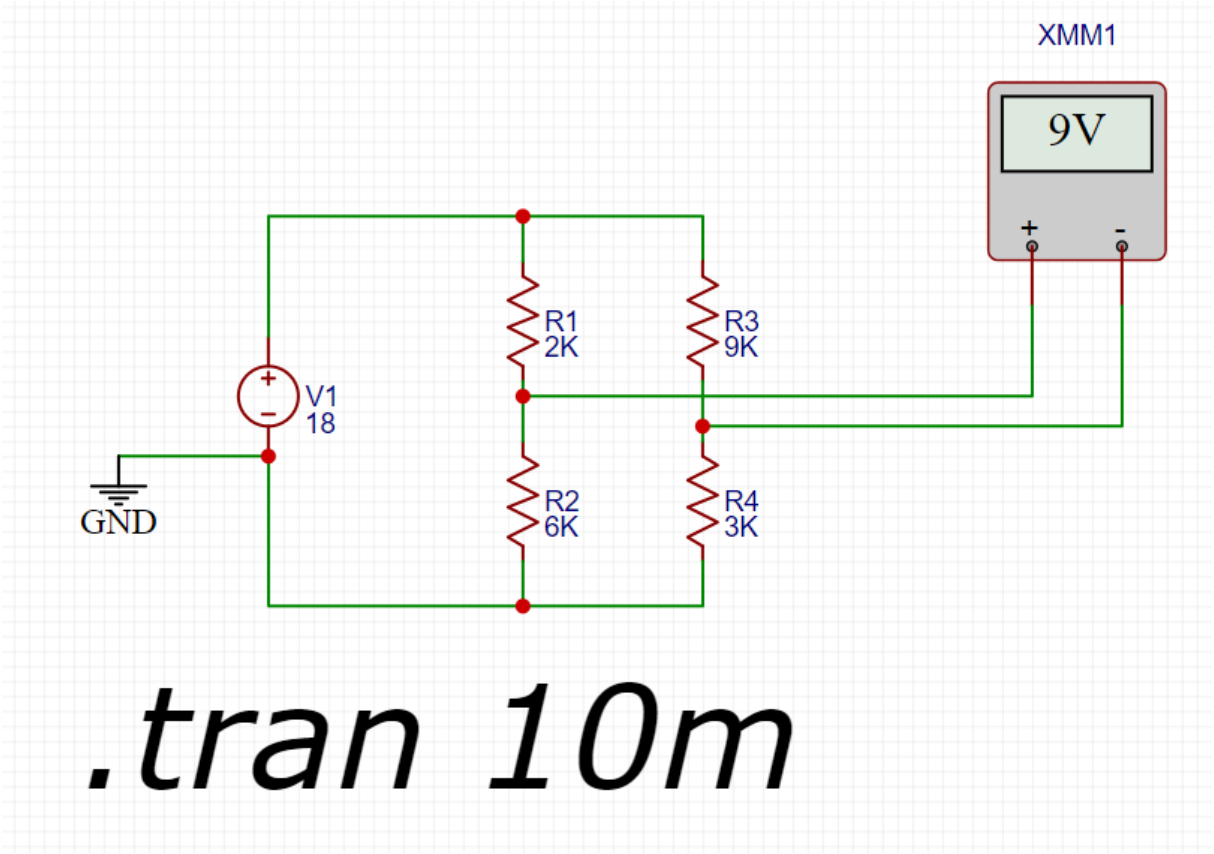
3.18


XMM3
5mA
XMM4
8.333mA
XMM5
0.017A
XMM6
0.02A
50mA
I2
GND
R6
5K
R7
3K
R8
1.5K
R9
1.25K

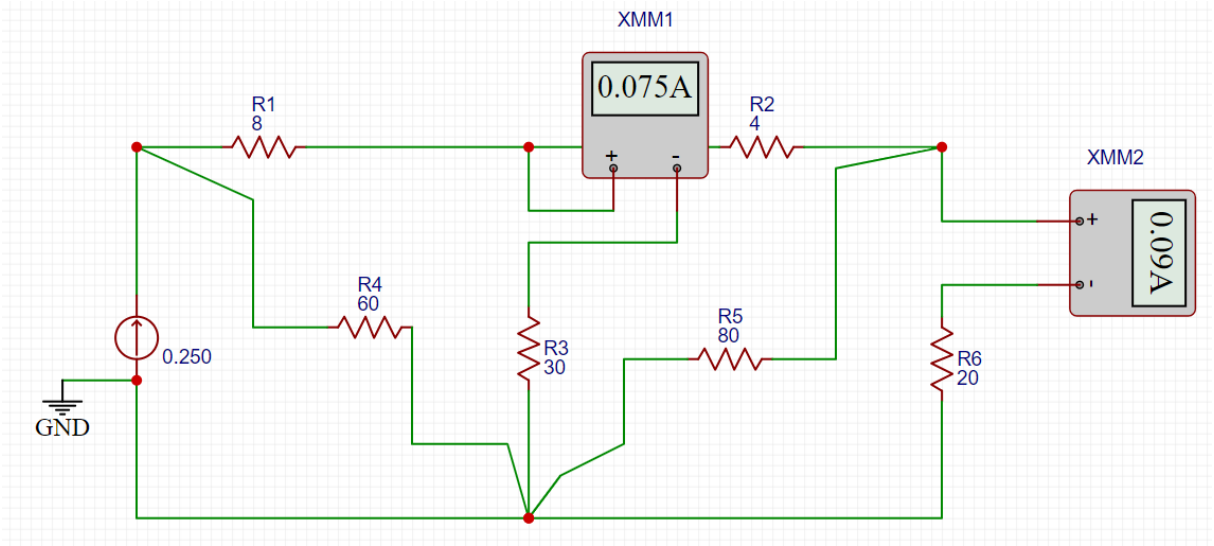
3.22



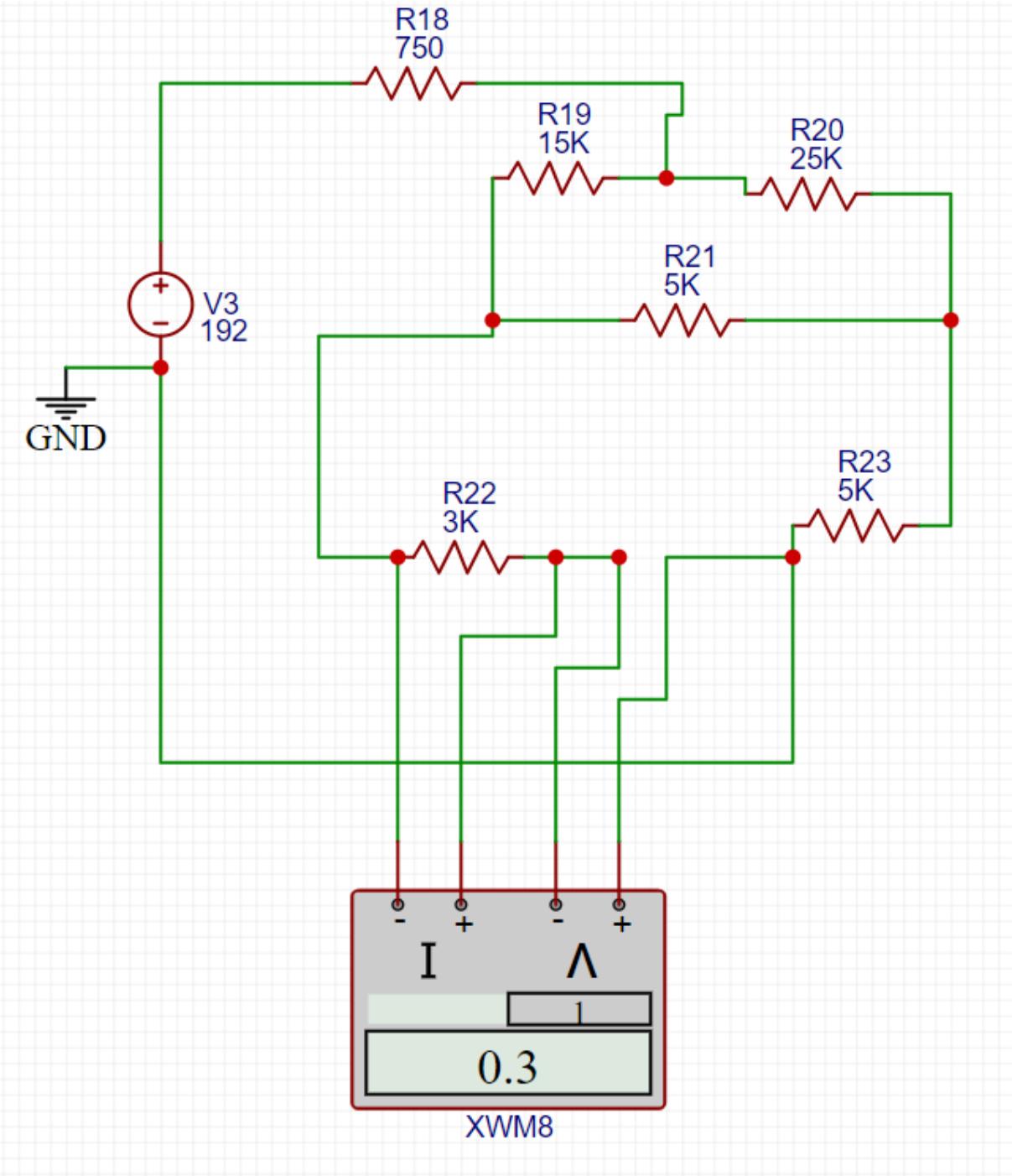
3.28



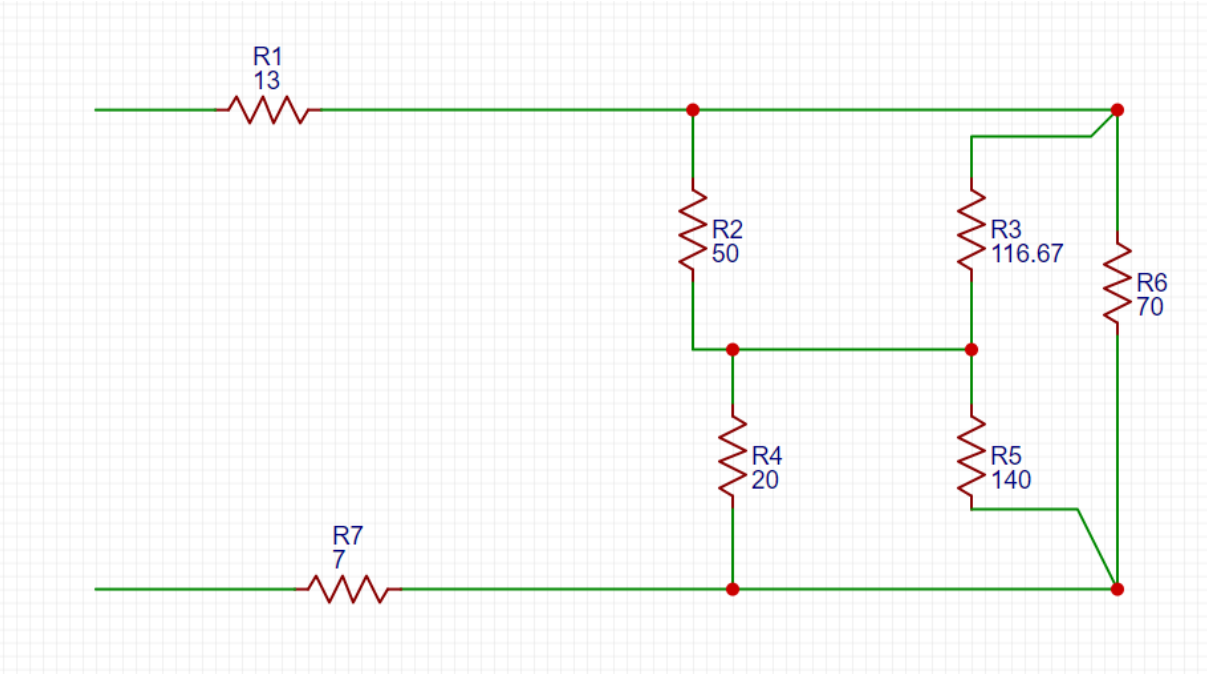
3.32



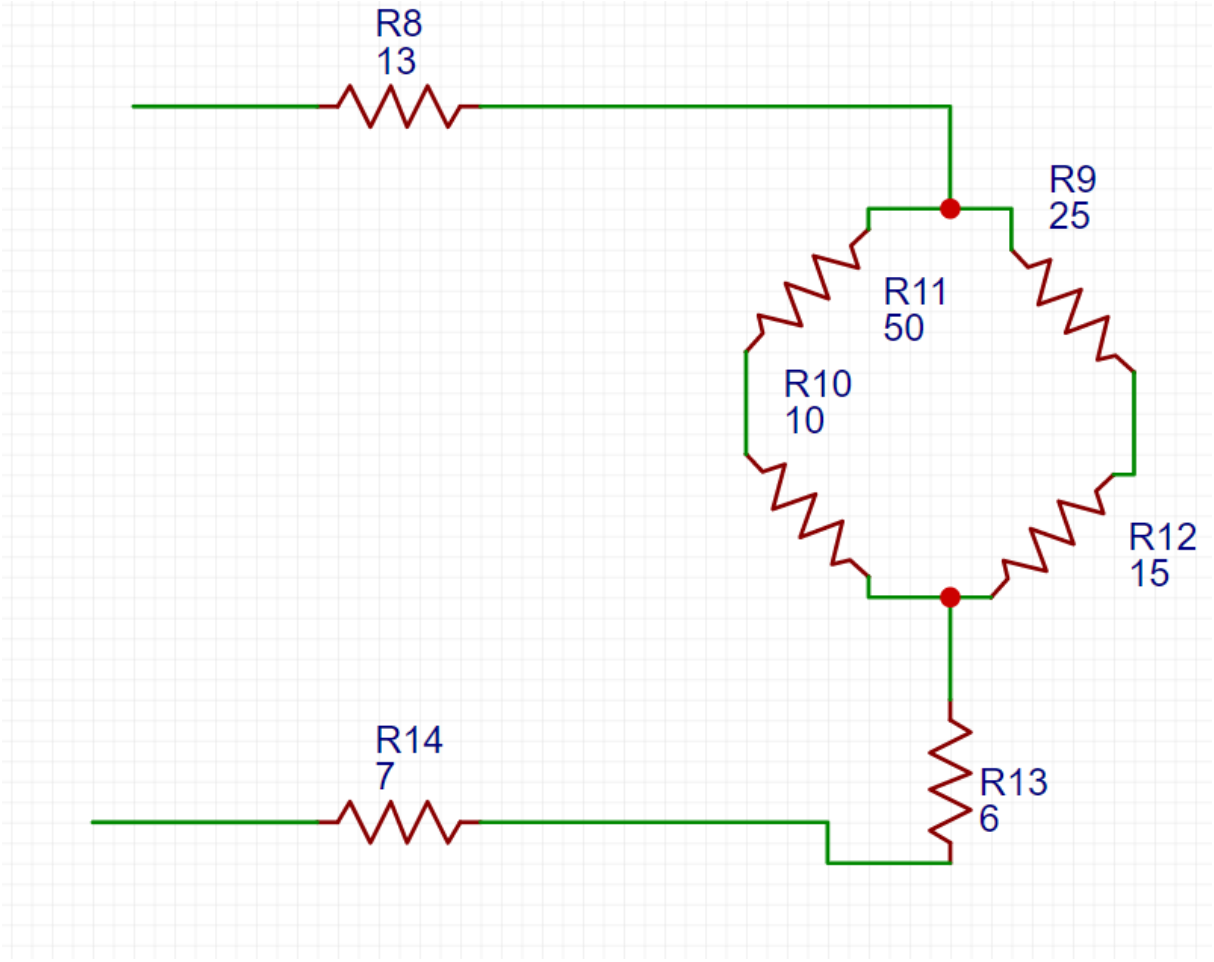
3.52


R18
750
R19
15K
R20
25K
R21
5K
V3
192
GND
R22
3K
R23
5K
I
Λ
1
0.3
XWM8

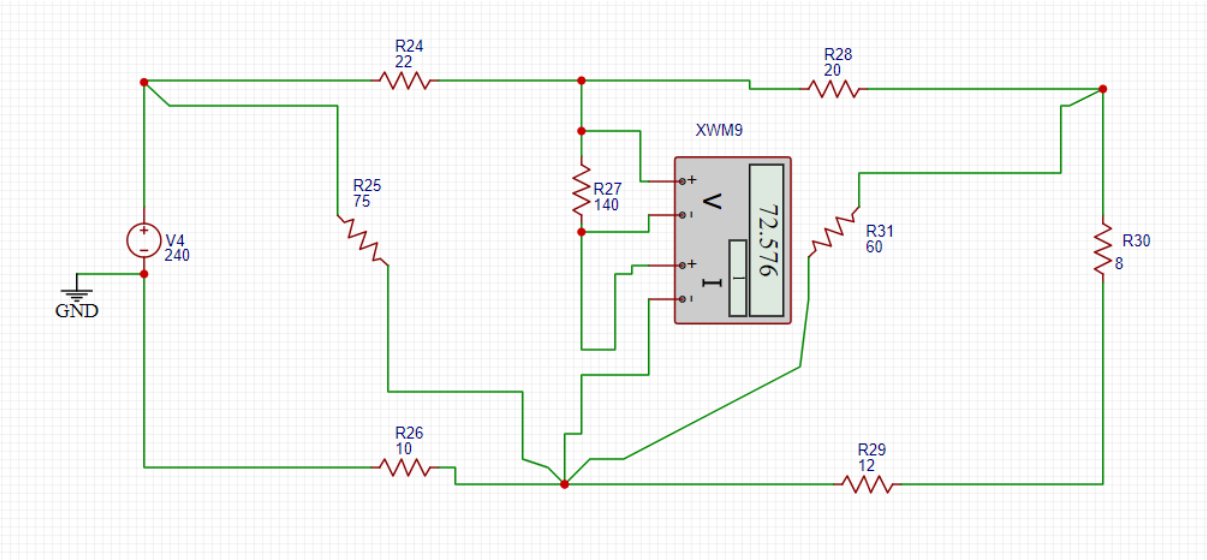
3.58.a



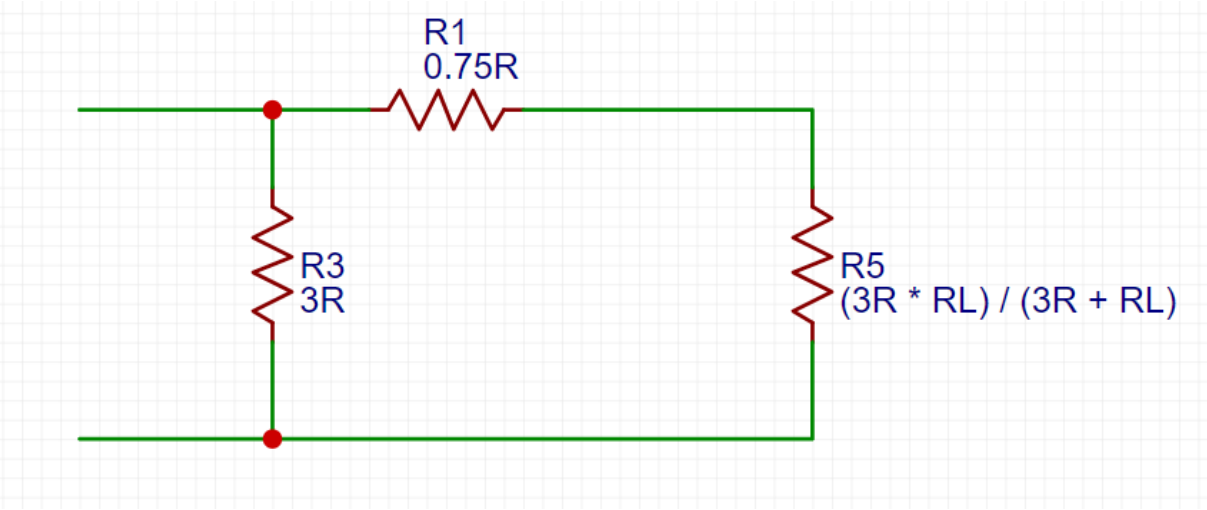
3.58.b



3.62


R24
22
R28
20
XWM9
R25
75
R27
140
V
72.576
I
V4
240
R31
60
R30
8
GND
R26
10
R29
12

3.67




Barış Ayyıldız 1901042252