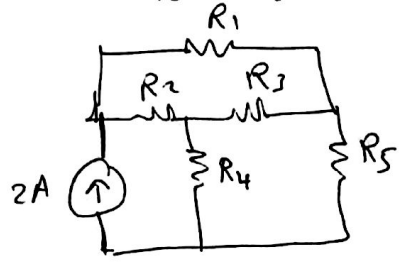
Lec (3) Sunday 9/10/2016
G1(61)

Δ (delta) → Y (Star) Conversion & vice versa (Y → Δ)

→ it is used to Simplify the Circuit to be easy to model and to Calculate total Resistance easily

ex)



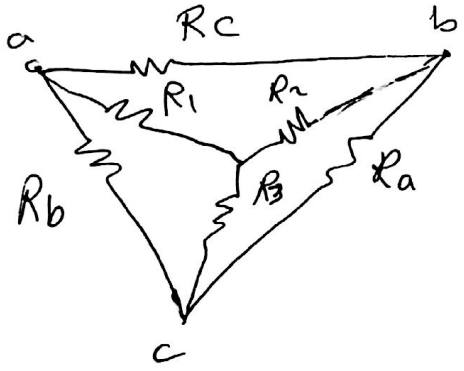
it is difficult to Calculate R_{total}

So we may convert

to

How?!

1 Y → Δ



$$R_C = \frac{R_1R_2 + R_2R_3 + R_1R_3}{R_3}$$ (البسط)

$$R_a = \frac{R_1R_2 + R_2R_3 + R_1R_3}{R_1}$$

$$R_b = \frac{R_1R_2 + R_2R_3 + R_1R_3}{R_2}$$

2 Δ → Y

$$R_1 = \frac{R_bR_c}{R_a + R_b + R_c}$$

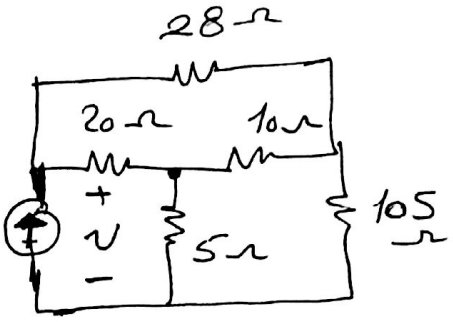
$$R_2 = \frac{R_aR_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_aR_b}{R_a + R_b + R_c}$$

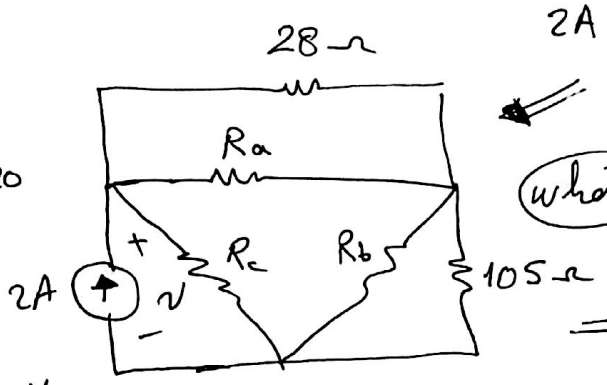
2

Problem (1)

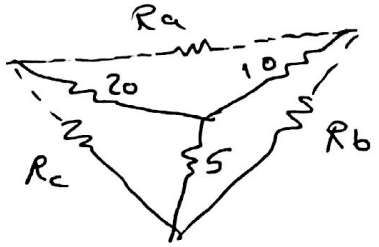
Use Y-to-Δ to Find (V)



Solution



where

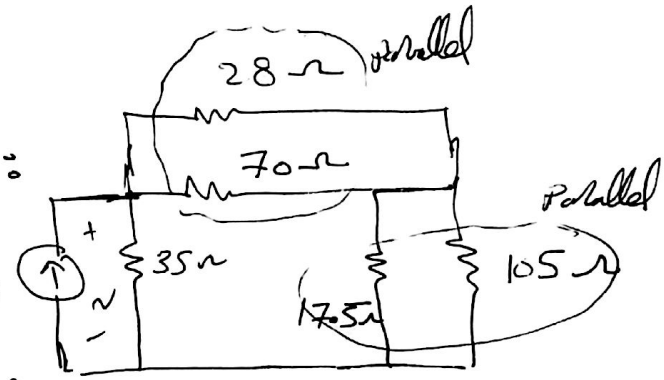


$$R_a = \frac{5\times10+5\times20+10\times20}{5} = 70\,\Omega$$

$$R_c = \frac{5\times10+5\times20+10\times20}{10} = 35\,\Omega$$

$$R_b = \frac{5\times10+5\times20+10\times20}{20} = 17.5\,\Omega$$

∴

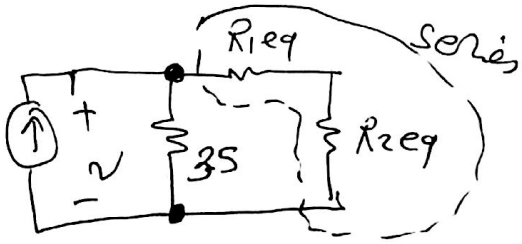


Now 28 parallel to 70

$$\therefore R_{1eq} = 28 \,//\, 70 = \frac{28\times70}{28+70} = 20\,\Omega$$

& 105 // to 17.5

$$R_{2eq} = \frac{105\times17.5}{105+17.5} = 15\,\Omega$$



R_{total} = 35 // ($R_{1eq} + R_{2eq}$)

$$= 35 \,//\, (15+20) = 35 \,//\, 35 = \frac{35\times35}{35+35} = 17.5\,\Omega$$

∴ $V_{total} = i_{total} \times R_{total} = 2\times17.5 = 35$ volt

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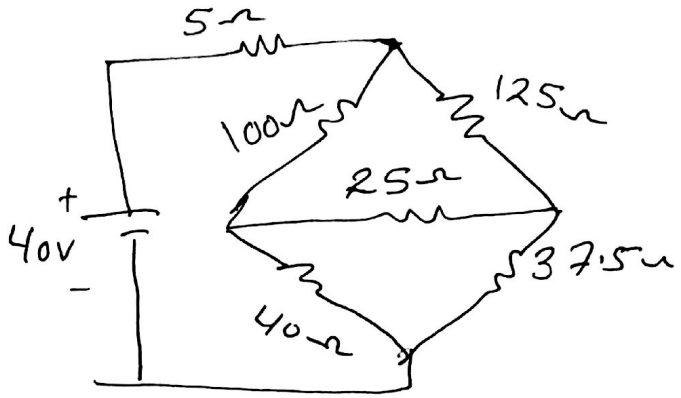
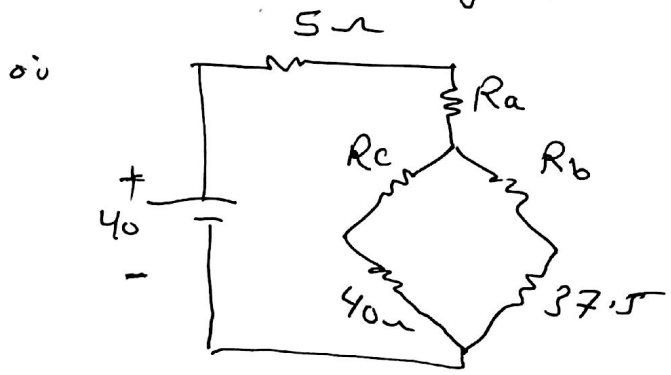
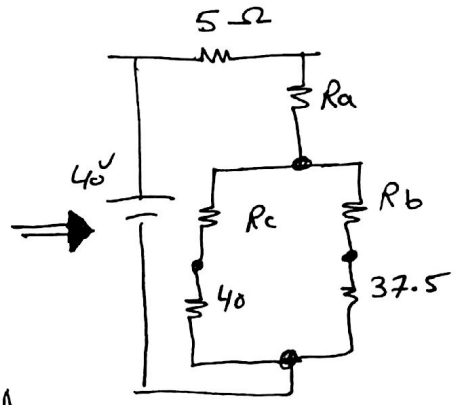
Problem (2) Find I and Power Supplied by 40V source



we Replace upper delta △ by Y

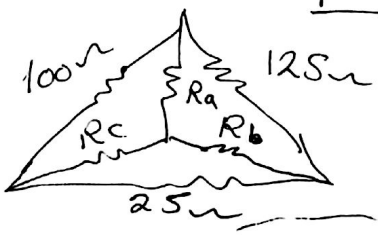




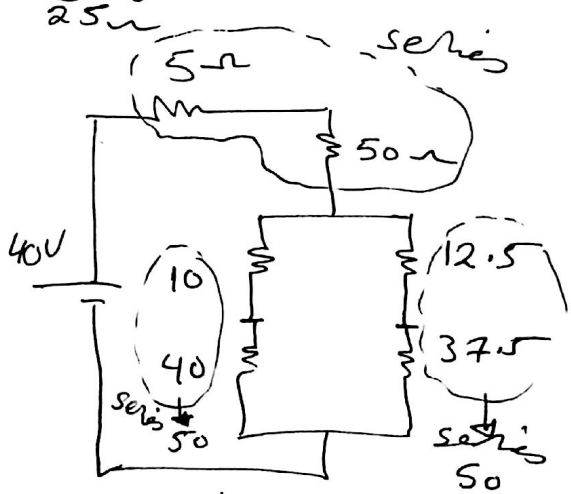
$$Ra = \frac{125 \times 100}{100+125+25} = 50\Omega$$

$$Rb = \frac{125 \times 25}{100+125+25} = 12.5\Omega$$

$$Rc = \frac{100 \times 25}{100+125+25} = 10\Omega$$



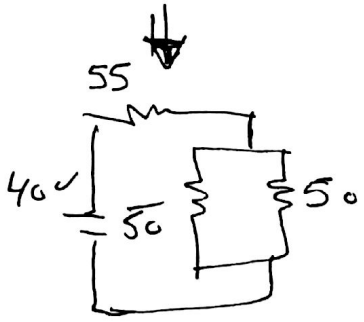
$\Rightarrow$



$$R_{total} = 5 + 50 + (50 // 50)$$
$$= 55 + 25 = 80\Omega$$

$$i = V/R_t = \frac{40}{80} = 0.5A$$

$$Power = V * i = 40 \times 0.5 = 20W$$



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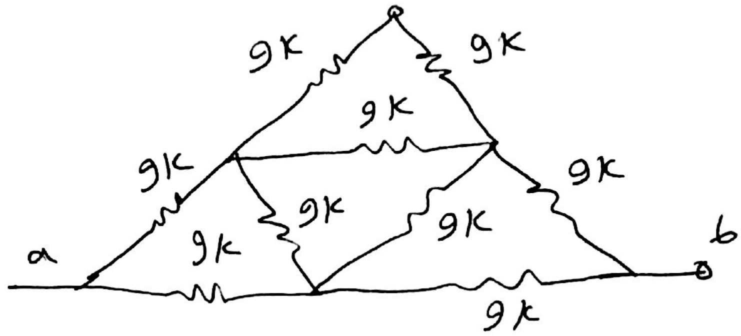
Problem(3)

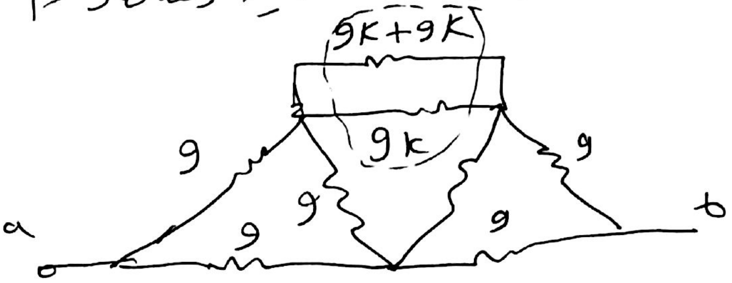
Find Rab



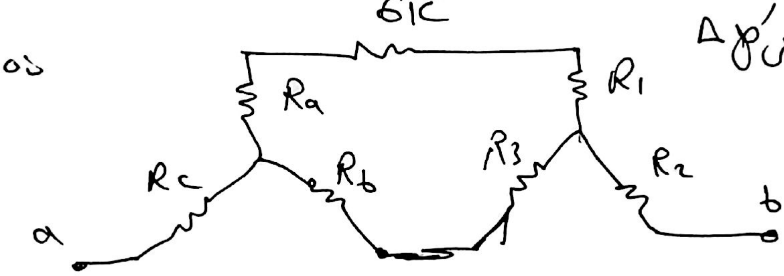
$(9+9)//9$
$= 6K$

← مـ فوجد اول مقاومتين series والتالية parallel معاه

=



نبدأ نفك Δ عشان Δ شكال دخول لـ Y



∴

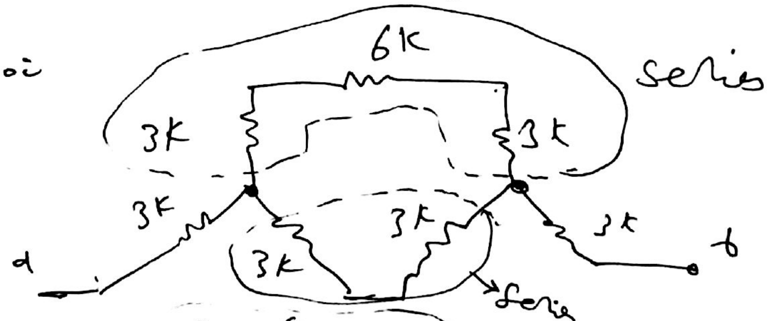
نلاحظ ان الـ ٣ مقاومات متماثلين في Δ

∴ $R_3 = R_2 = R_1$

$R_c = R_b = R_a =$

$$R_1 = R_2 = R_3 = R_a = R_b = R_c = \frac{(9 \times 9)K}{9+9+9} = 3K$$

∴



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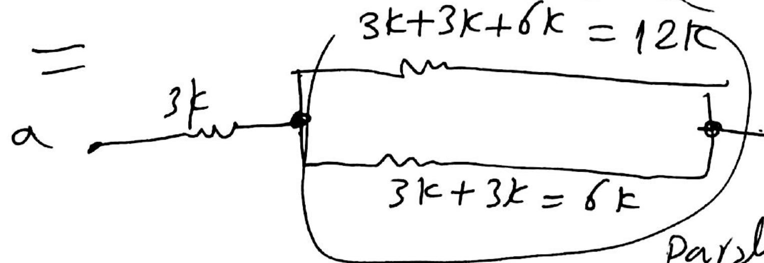

⇒

∴ $R_{total} = 3K + 4K + 3K = 10K$

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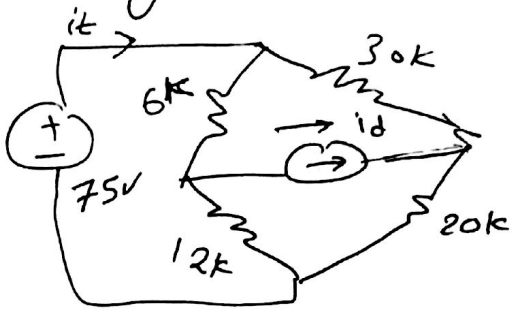
Problem (4) Find i_d in a detector if the voltage drop across detector be neglected.

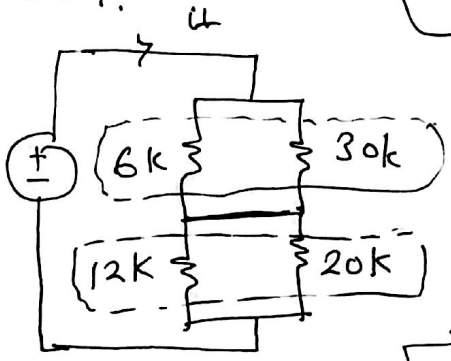
Solution/

we may calculate total current firstly

$i_t = ?!$



→ we replace detector with (Short Circuit)

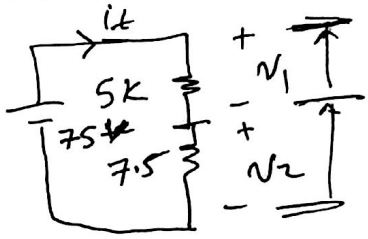


Parallel ⇒ 6K // 30K = 5K

Parallel ⇒ 20K // 12K = 7.5K

$$i_{total} = \frac{75}{5K + 7.5K} = 6mA$$

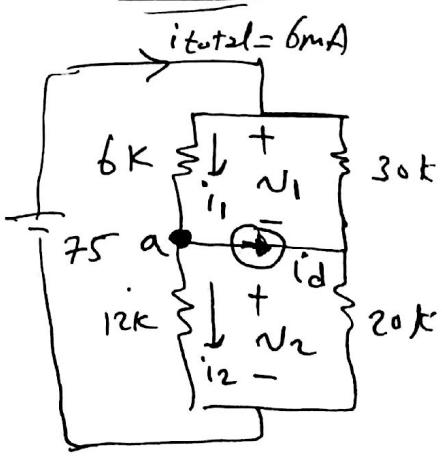
Parallel of 2 branches



Now using voltage divider →

$$V_1 = V_{across\ 6k} = V_{across\ 30k} = V_{across\ (equivalent\ 6//30)} = \frac{75 * (5k)}{(5K)+(7.5K)} = 30\ Volt$$

$$V_2 = V_{across\ 12k} = V_{across\ 20k} = V_{across\ (20k//12k)} = \frac{75 \times (7.5k)}{(5K)+(7.5K)} = 45\ Volt$$



$$i_1 = V_1/6K = \frac{30}{6K} = 5mA$$

$$i_2 = V_2/12K = \frac{45}{12K} = 3.75mA$$

at node (a)

$i_1 = i_d + i_2$

or $i_d = i_1 - i_2 = 5mA - 3.75mA = 1.25mA$

Good Luck