

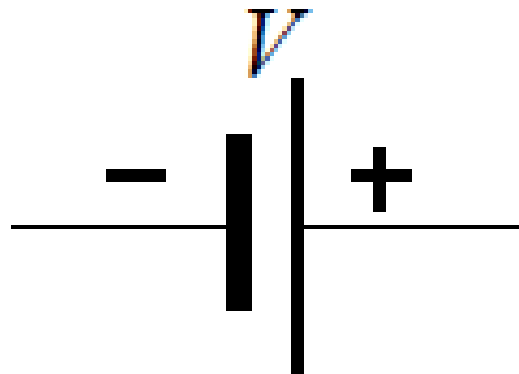
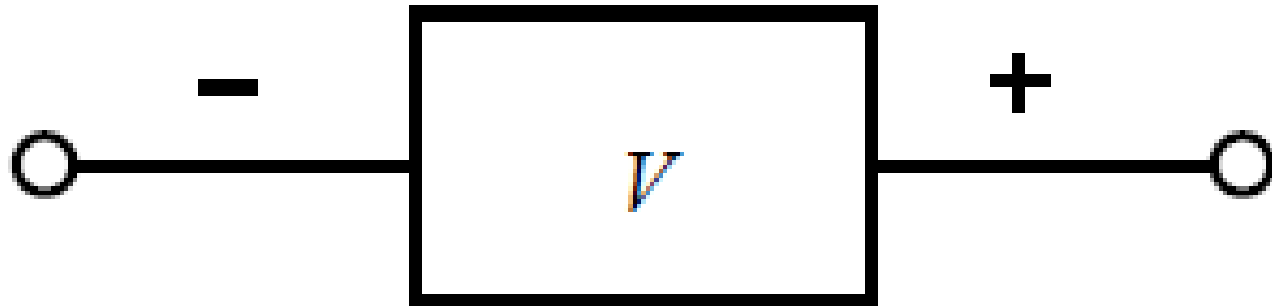


# **RANGKAIAN ARUS SEARAH** **(Direct-Current Circuit)**

# Reservoir Energi dalam Rangkaian DC

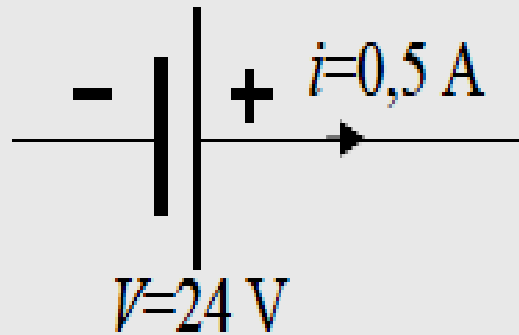
- Komponen rangkaian yang berfungsi sebagai reservoir energi dari arus yang dibawa rangkaian disebut emf (electromotive force).
- Emf mempunyai karakteristik fisis, yaitu:
  - (1) emf mempunyai beda potensial  $V$  yang konstan di antara ujung-ujung emf.
  - (2) emf berfungsi sebagai reservoir energi untuk rangkaian.

# Simbol emf

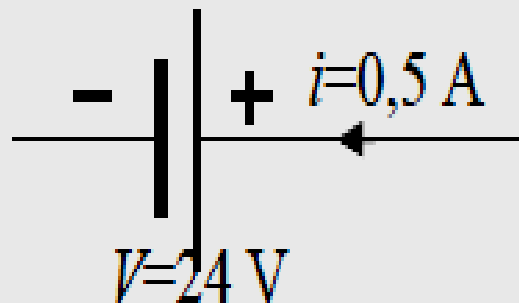


# Latihan

Latihan 1:



Emf memberikan laju energi 12 W

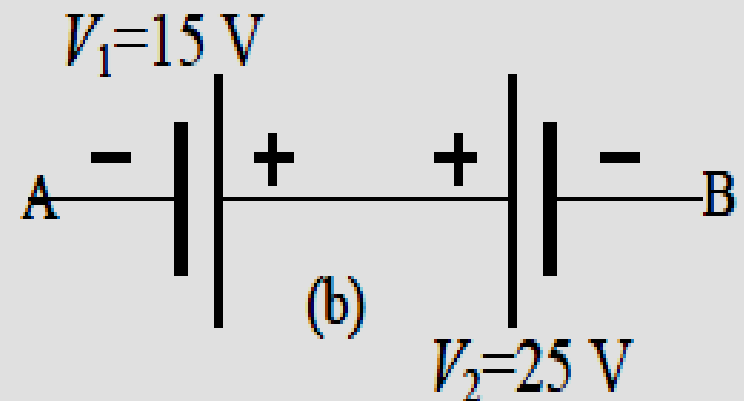
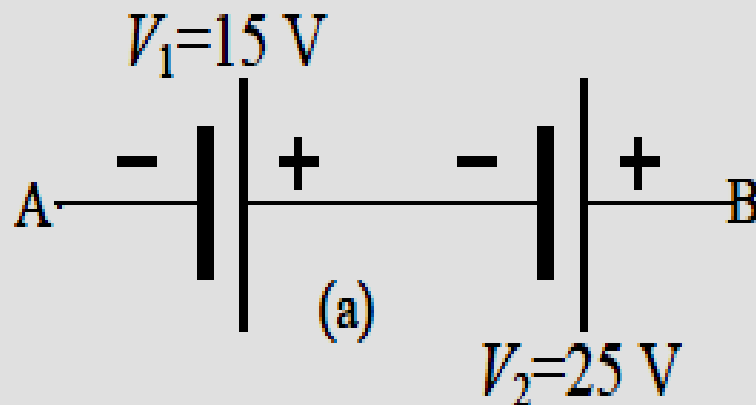


Emf menyimpan laju energi sebesar 12 W

# Latihan

Latihan 2.

Tentukan beda potensial  $V_B - V_A$  untuk setiap kasus dalam gambar berikut:



Jawaban:

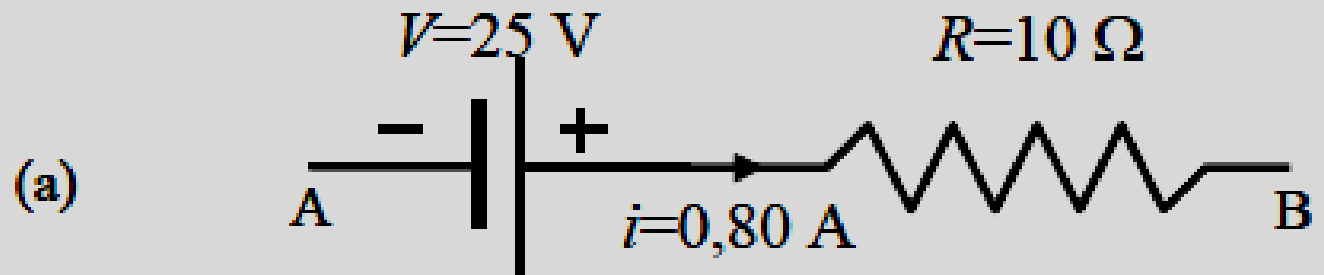
$$(a) \quad V_A + V_1 + V_2 = V_B$$

$$V_B - V_A = 15 + 25 = 40V$$

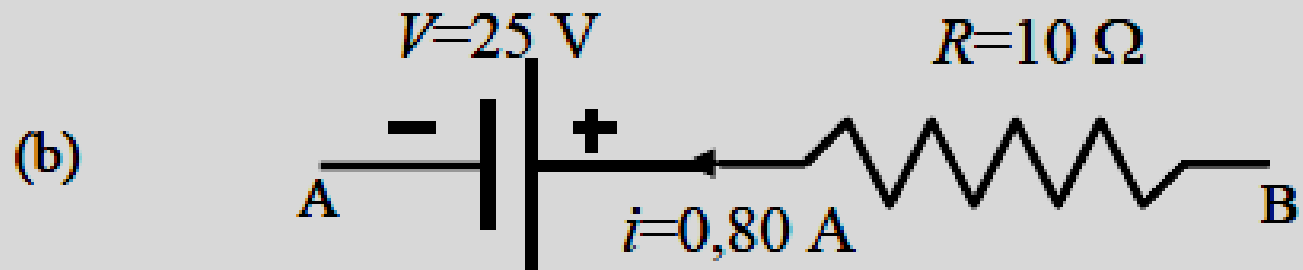
$$(a) \quad V_A + V_1 + V_2 = V_B$$

$$V_B - V_A = 15 - 25 = -10V$$

# Latihan



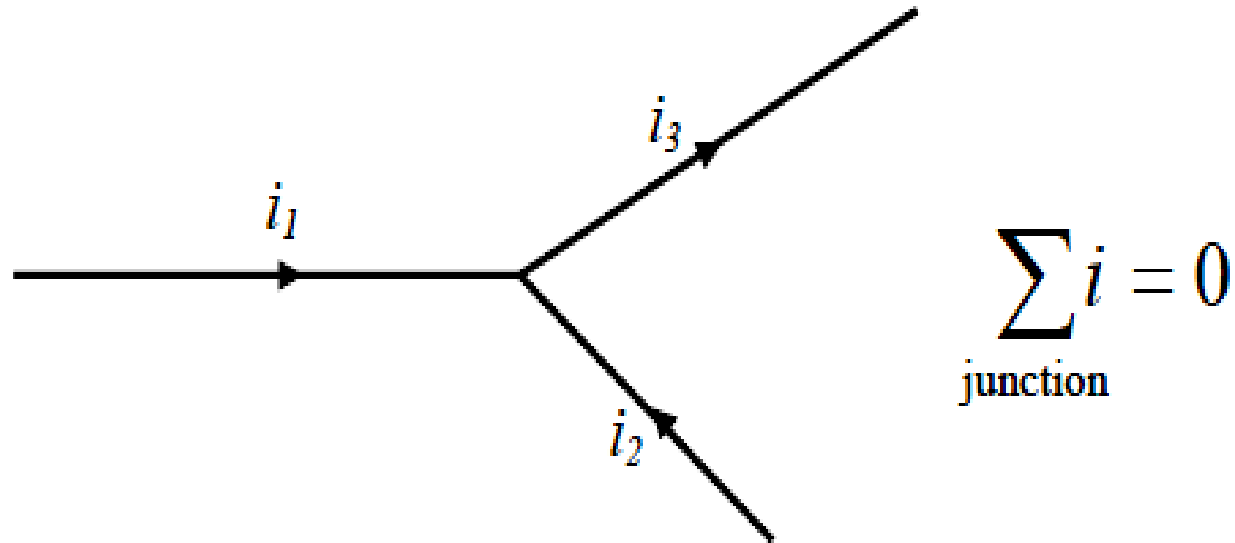
$$V_B - V_A = 17\text{ V}$$



$$V_B - V_A = 33\text{ V}$$

# Hukum Kirchhoff (Kirchhoff' Rules)

- **The junction rule:** At any junction of a circuit, the net current entering a junction is equal to the net current leaving that the junction.

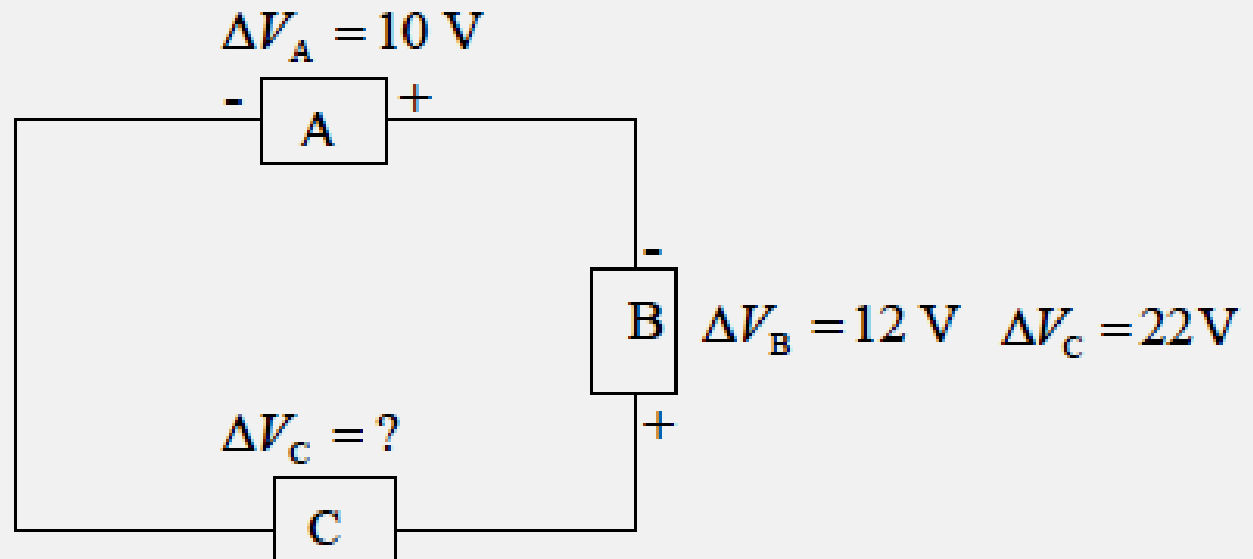


# Hukum Kirchhoff (Kirchhoff' Rules)

- The loop rule: The sum of all the changes in potential around a loop is equal to zero.

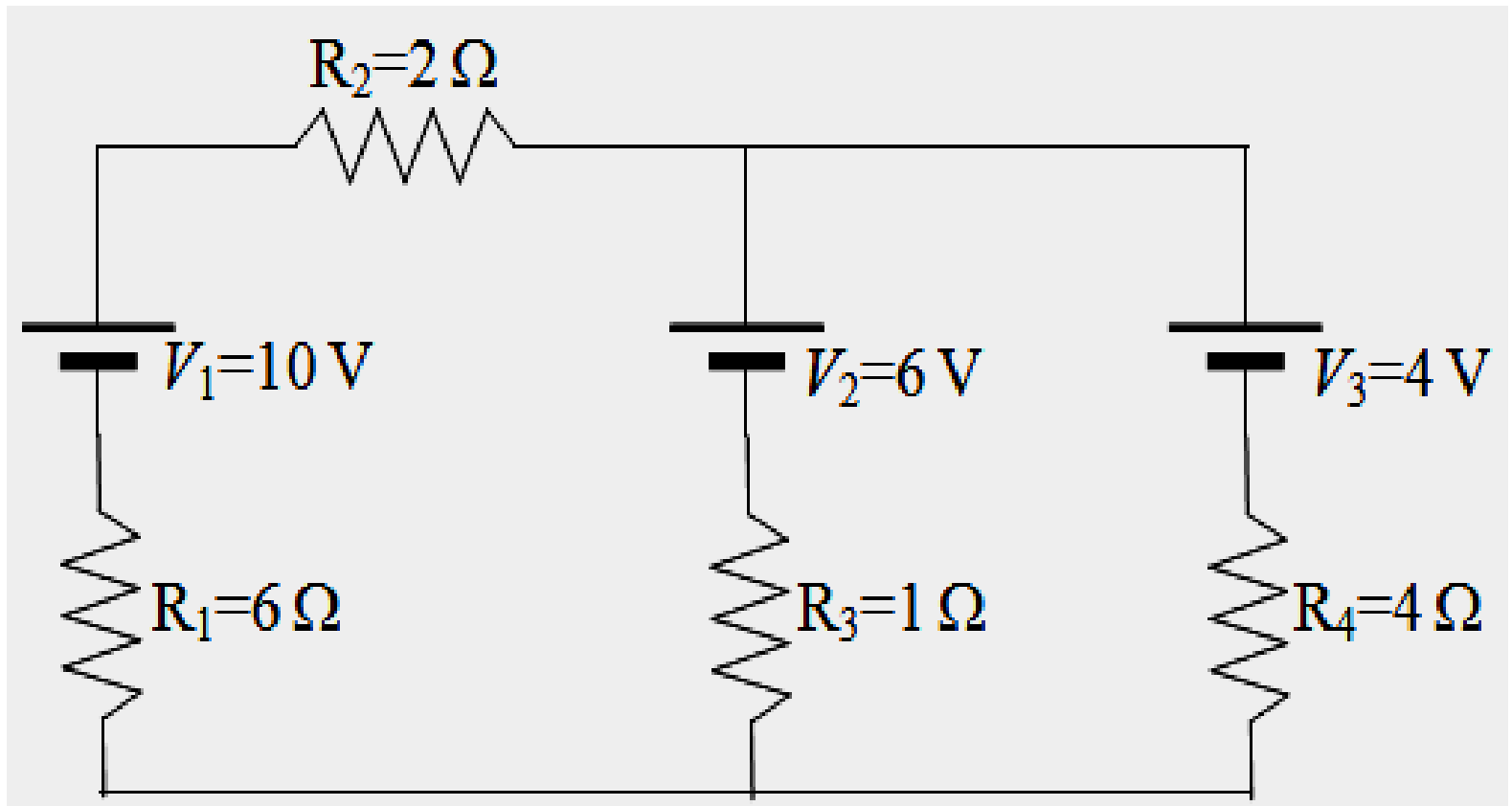
$$\sum_{\text{loop}} \Delta V = 0$$

Contoh:

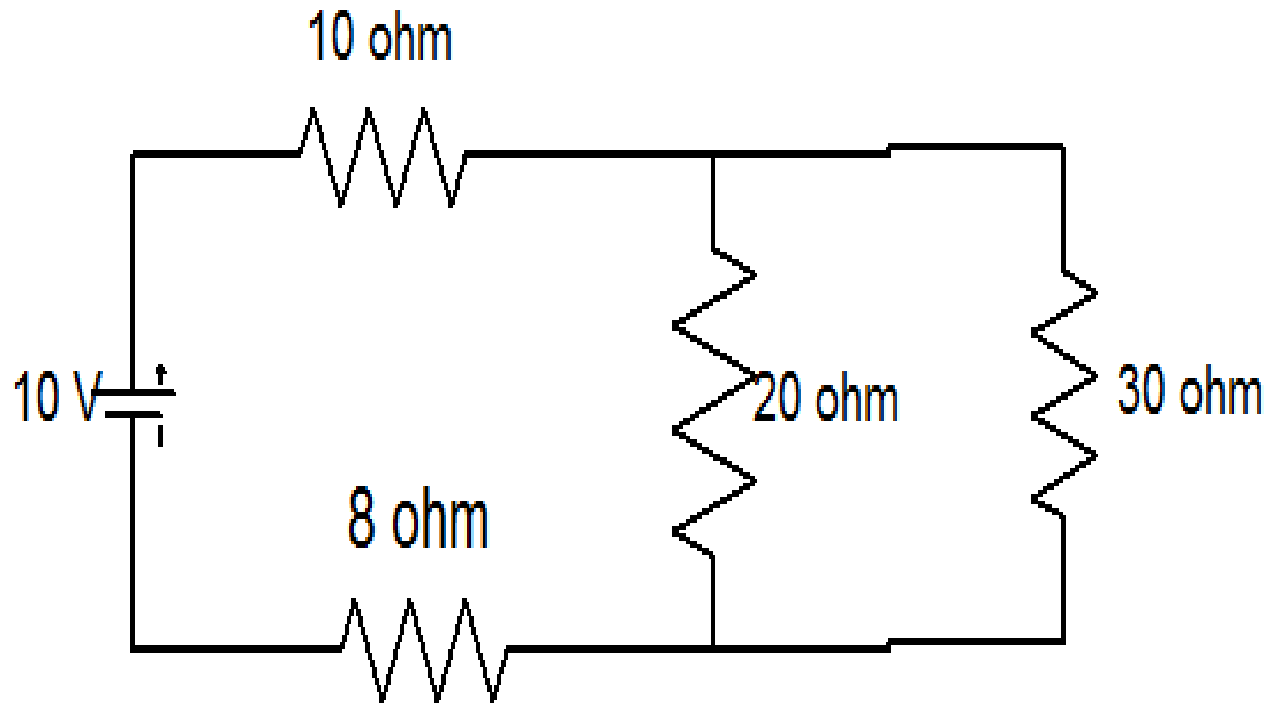




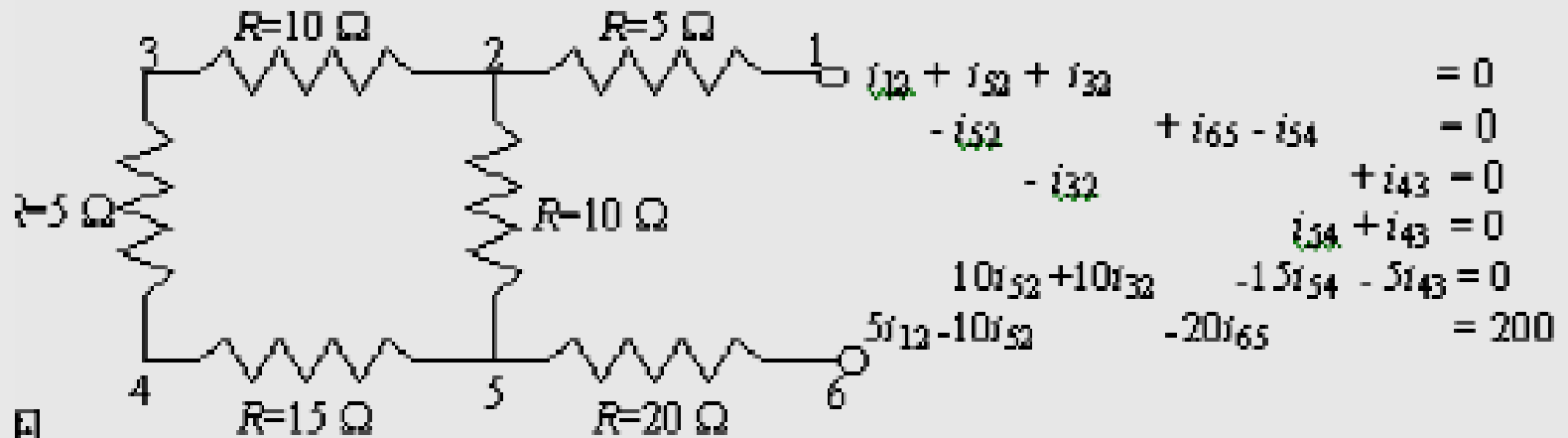
# Latihan Analisis Rangkaian



Untuk rangkaian di bawah ini, hitunglah: (a) arus yang melalui sumber tegangan (*emf*), (b) beda potensial antara ujung-ujung resistor 20 ohm, dan (c) daya yang terdisipasi dalam resistor 30 ohm.



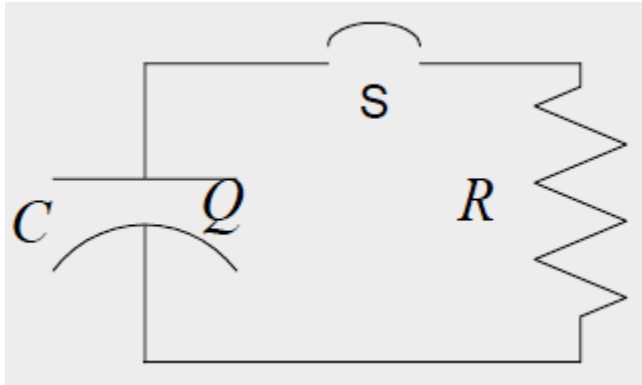
# Penyelesaian Persamaan Linear Simultan



E

|    | A | B                        | C      | D      | E       | F       | G      | H | I        | J | K     |
|----|---|--------------------------|--------|--------|---------|---------|--------|---|----------|---|-------|
| 1  |   | <u>Matriks A</u>         |        |        |         |         |        |   | X        |   | Y     |
| 2  |   | 1                        | 1      | 1      | 0       | 0       | 0      |   | $i_{12}$ |   | 0     |
| 3  |   | 0                        | -1     | 0      | 1       | -1      | 0      |   | $i_{32}$ |   | 0     |
| 4  |   | 0                        | 0      | -1     | 0       | 0       | 1      | X | $i_{32}$ | = | 0     |
| 5  |   | 0                        | 0      | 0      | 0       | 1       | -1     |   | $i_{54}$ |   | 0     |
| 6  |   | 0                        | 10     | -10    | 0       | -15     | -5     |   | $i_{65}$ |   | 0     |
| 7  |   | 5                        | -10    | 0      | -20     | 0       | 0      |   | $i_{43}$ |   | 200   |
| 8  |   | <u>Inversi Matriks A</u> |        |        |         |         |        |   | Y        |   | X     |
| 9  |   | 0.8462                   | 0.6154 | 0.7692 | 0.7308  | 0.00769 | 0.0308 |   | 0        |   | 6.154 |
| 10 |   | 0.1154                   | -0.462 | -0.077 | -0.1731 | 0.01923 | -0.023 |   | 0        |   | -4.62 |
| 11 |   | 0.0385                   | -0.154 | -0.692 | -0.5577 | -0.0269 | -0.008 | X | 0        | = | -1.54 |
| 12 |   | 0.1538                   | 0.3846 | 0.2308 | 0.2692  | -0.0077 | -0.031 |   | 0        |   | -6.15 |
| 13 |   | 0.0385                   | -0.154 | 0.3077 | 0.4423  | -0.0269 | -0.008 |   | 0        |   | -1.54 |
| 14 |   | 0.0385                   | -0.154 | 0.3077 | -0.5577 | -0.0269 | -0.008 |   | 200      |   | -1.54 |

# Rangkaian RC



$$\frac{Q}{C} - iR = 0 \quad \frac{1}{C} \frac{dQ}{dt} - R \frac{di}{dt} = 0$$

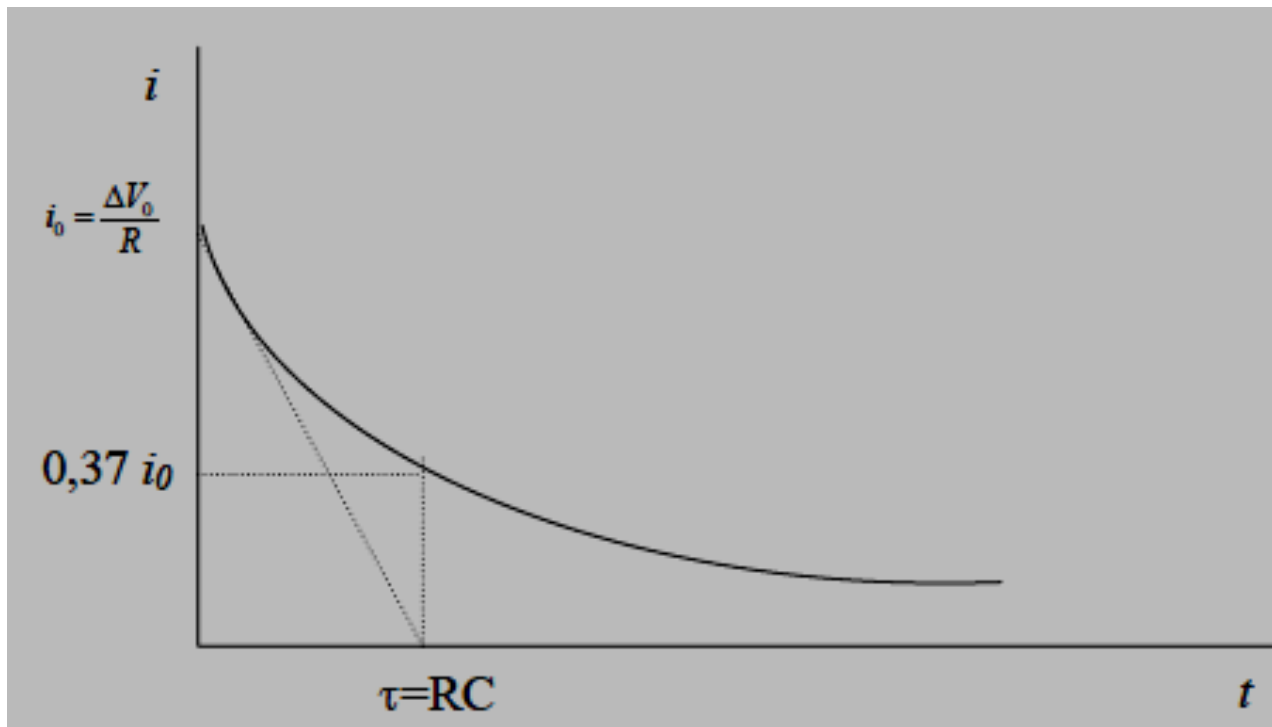
arus dalam rangkaian sama dengan laju penurunan muatan  $Q$  di  $C$ , sehingga

$$i = -\frac{dQ}{dt} \quad \frac{di}{dt} = -\frac{i}{RC}$$

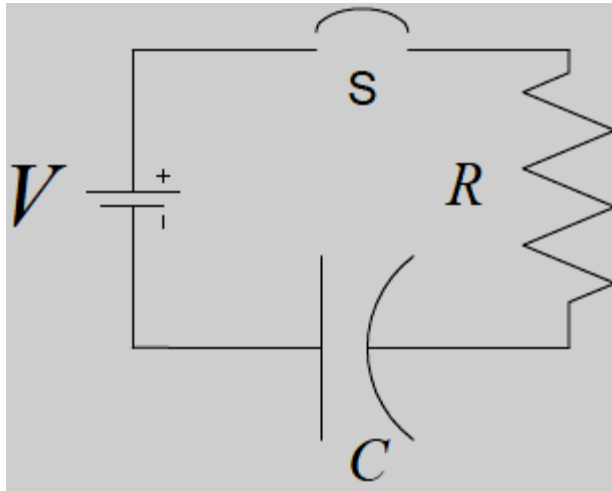
$$\frac{di}{i} = -\frac{1}{RC} dt \quad \int_{i=\Delta V_0/R}^{i=i_f} \frac{di}{i} = -\frac{1}{RC} \int_{t=0}^{t=t_f} dt$$

$$\frac{di}{i} = -\frac{1}{RC} dt \quad \int_{i=\Delta V_0/R}^{i=i_f} \frac{di}{i} = -\frac{1}{RC} \int_{t=0}^{t=t_f} dt$$

$$i = \frac{\Delta V_0}{R} e^{-t/RC} = i_0 e^{-t/RC}$$

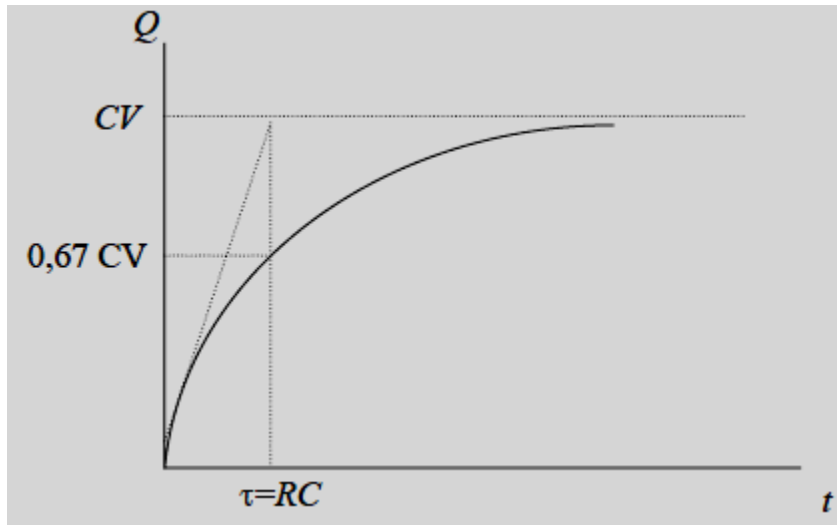


# Rangkaian RC dengan Sumber V



$$V - \frac{Q}{C} - iR = 0 \quad i = \frac{dq}{dt}$$
$$-\frac{1}{C}i - R \frac{di}{dt} = 0 \quad \frac{di}{i} = -\frac{1}{RC} dt$$

$$i = \frac{V}{R} e^{-t/RC} = i_0 e^{-t/RC}$$



$$Q(t) = CV (1 - e^{-t/RC})$$