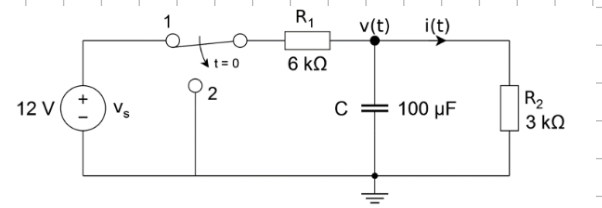
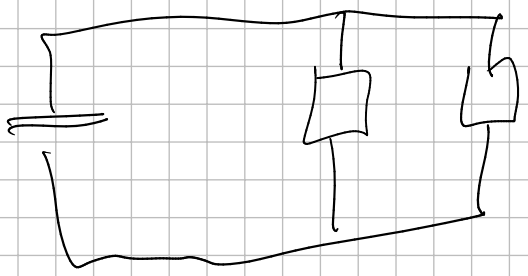
ERT 25

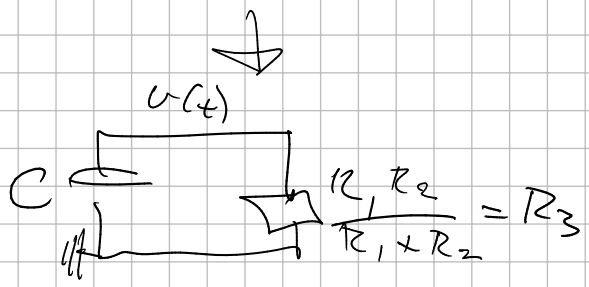
Opg 1)



Figur 1

a)





$$C \frac{d}{dt} v(t) = v(t) \cdot \frac{1}{R_3}$$

$$\frac{d}{dt} v(t) - \frac{1}{R_3 C} v(t) = 0 \qquad \tau = \frac{1}{R_3 C}$$

b) $i(t) > 0$

$$\frac{d}{dt} v + \lambda v = 0$$

$$\frac{d}{dt}\left(v e^{\lambda t}\right) = 0 \quad / \int dt$$

$$v e^{\lambda t} = C$$

$$v = C e^{-\lambda t}$$

$$v = C e^{\frac{1}{R_3 C} t}$$

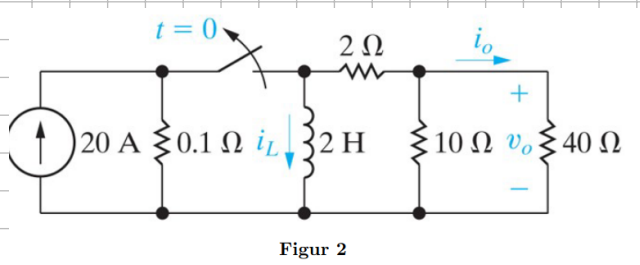
$$v(0) = V_s$$

$$C = V_s$$

$$v(t) = V_s e^{\frac{1}{R_3 C} t}$$

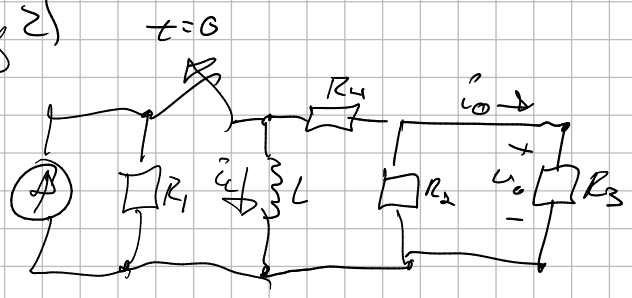
$$i(t) = v'(t) = R_3 V_s e^{\frac{1}{R_3 C} t}$$

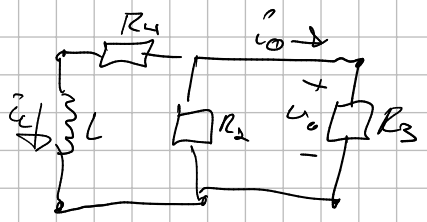
Oppg 2)



Figur 2

a)





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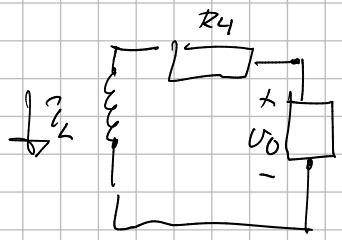


$\frac{R_2 R_3}{R_2+R_3} = R_T$

$i_L(0) = I_0 = 20\ A$

b)

$i_L(\infty) = 0$

c) $\tau = \frac{L}{R} = \frac{2}{10} = 0{,}200\ s = \frac{1}{5}$

$R = (2 + \frac{40 \cdot 10}{40+10}) = 10$

d) $i(t) = 0 + (20)e^{-5\tau}$

$= 20e^{-5t}$

e) $-i_o = i(t)\frac{R_2}{R_2+R_3}$

$i_o = -i(t)\frac{R_2}{R_2+R_3} = -i(t)\frac{10}{50}$

$i_o(t) = -\frac{1}{5}i(t)$

A) $P = UI \qquad U = RI$

$P = I^2R$

$i(t)^2 R = (20e^{-5\tau}) \cdot 10$

$E(t) = \int (20e^{-5t})^2 \cdot 10\, dt = \int 400e^{-10\tau} \cdot 10\, dt = 4000 \int_0^\infty e^{-10\tau} dt$

$= 4000 \cdot \left[\frac{1}{-10} e^{-10\tau}\right]_0^\infty = 0 - 4000 \cdot \frac{1}{-10} = \underline{400\ J}$

g) $E(t) = \frac{1}{2} \cdot 4000$

$$4000 \int_0^\tau e^{-10s}\, ds = 2000$$

$$\int_0^\tau e^{-10s}\, ds = \frac{1}{20}$$

$$\left[-\frac{1}{10} e^{-10s} \right]_0^\tau = \frac{1}{20}$$

$$-\frac{1}{10} e^{-10\tau} + \frac{1}{10} = \frac{1}{20}$$

$$-e^{-10\tau} + 1 = \frac{1}{2}$$

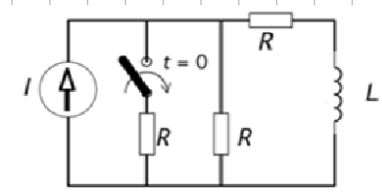
$$e^{-10\tau} = 1 - \frac{1}{2}$$

$$-10\tau = \ln\left(\frac{1}{2}\right)$$

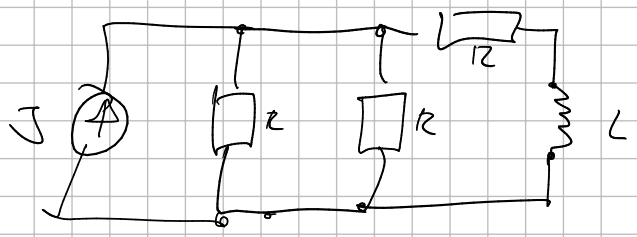
$$\tau = -\frac{1}{10} \ln\left(\frac{1}{2}\right)$$

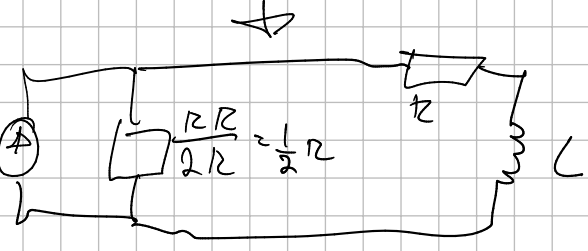
$$\underline{\tau = 0{,}0693}$$

Oppg 3)

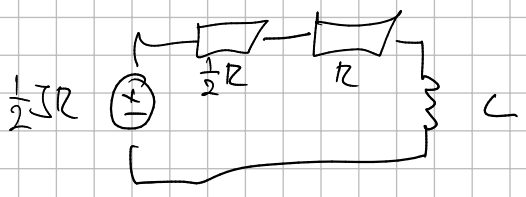


Figur 3





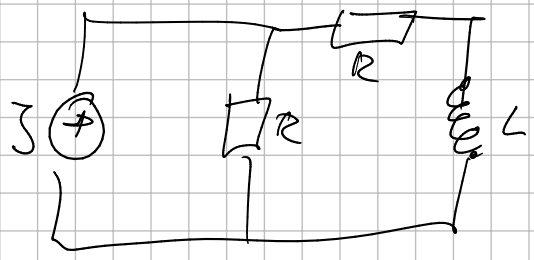
$\frac{2R \cdot R}{2R} = \frac{1}{2}R$



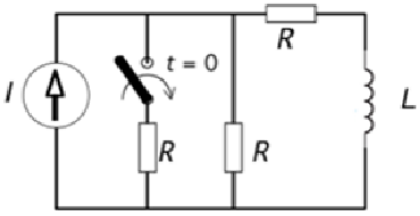
$R_T = \frac{3}{2}R$

$\tau = \frac{L}{R} = \frac{2}{3} \cdot \frac{L}{R}$ ← gjør

4)



$i(t) = J(1 - e^{-\frac{3L}{2R}t})$



Figur 3

$\tau = \frac{L}{2R}$

$W_1 = \int i(t)^2 \frac{3}{2}R$

$= \frac{3}{2}R \int i(t)^2 \, dt$

$= \frac{3}{2}R \cdot \int (J$

$W_2 = \int J^2 2R \, dt$

$= 2R \int J^2 \, dt$

$= 2R J^2 t$

C

Opg 5)

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