ERT 1 9

Oppg 1) $i(t) = ?$ $v(t) = V_0 \cdot \cos(2\pi f t)$ $i(t) = C \cdot \frac{d}{dt} v(t)$

$$i(t) = C \cdot (V_0 \cdot (-\sin(2\pi f t)) \cdot 2\pi f)$$

$$= -V_0 C \cdot 2\pi f \sin(2\pi f t)$$

Oppg 2) $i(t) = I_0 \cdot \cos(2\pi f t)$ $v(t) = L \frac{d}{dt} i(t)$

$$v(t) = L I_0 2\pi f \sin(2\pi f t)$$

Oppg 3) $v(t) = V_0$ K $i(t) = C \frac{d}{dt} v(t)$

$$i(t) = 0$$

Oppg 4) $v(t) = 0$

Oppg 5)

a) Ja

b) Nei

c) Ja

d) Nei

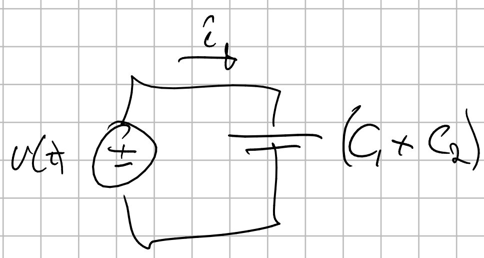
Oppg 6

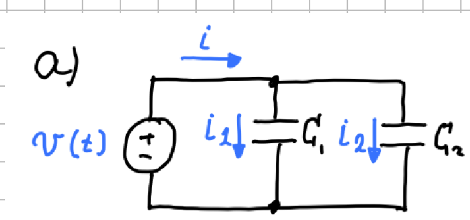
$i = C \frac{d}{dt} v$

a) $i = i_1 + i_2$

$$i = C_1 \frac{d}{dt} v(t) + C_2 \frac{d}{dt} v(t)$$

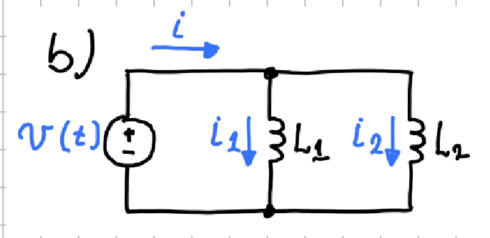
$$i(t) = (C_1 + C_2) \frac{d}{dt} v(t)$$





b)

$v(\tau) = L \frac{d}{d\tau} i(\tau)$

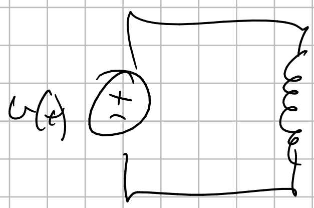


$i = i_1 + i_2$

$\int v(\tau)\, d\tau = L\, i(\tau)$

$i(t) = \frac{1}{L} \int v(\tau)$

$i = \frac{1}{L_1} \int v(\tau)\, d\tau + \frac{1}{L_2} \int v(\tau)\, d\tau$

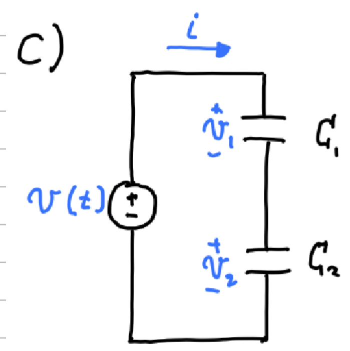


$(L_1 + L_2)^{-1}$

$i = (L_1 + L_2)^{-1} \int v(\tau)\, d\tau$

c) $v(t) = v_1(t) + v_2(t)$

$i(t) = C \frac{d}{d\tau} v(t)$



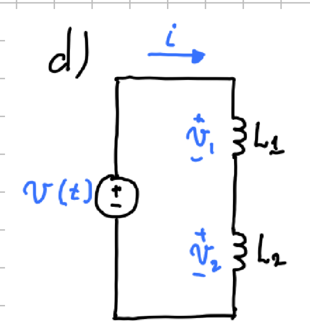
$v(t) = \left(\frac{1}{C_1} + \frac{1}{C_2}\right) \int i(t)\, d\tau$

$\int i(\tau) = C v(t)$

$v(t) = \frac{1}{C} \int i(t)\, d\tau$

d)

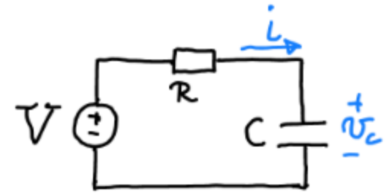
$v(t) = L \frac{d}{d\tau} i(t)$



$v(t) = v_1 + v_2$

$v(t) = (L_1 + L_2) \frac{d}{d\tau} i(t)$

Oppg 8) $RC\frac{d}{dt}v_c + v_c = V$ $\qquad i(t) = C\frac{d}{dt}v(t)$



$V = iR + v_c$ $\qquad$ i over motstand og C er lik

$= RC\frac{d}{dt}v_c + v_c$

Oppg 9) $v_c(0) = 0$ $\qquad v_c(t)$ & $i(t)$ $\quad t > 0$

$RC\frac{d}{dt}v_c + v_c = V$

$\dot{v}_c + \frac{1}{RC}v_c = \frac{V}{RC}$ $\qquad \lambda = \frac{1}{RC}$

$\dot{v}_c + \lambda v_c = \lambda V \quad | \cdot e^{\lambda t}$

$\frac{d}{dt}v_c e^{\lambda t} + \lambda v_c e^{\lambda t} = \lambda V e^{\lambda t}$

$\frac{d}{dt}(v_c e^{\lambda t}) = \lambda V e^{\lambda t} \quad | \cdot \int dt$

$v_c e^{\lambda t} = V e^{\lambda t} + C \qquad | \cdot e^{-\lambda t}$

$v_c = V + C e^{-\lambda t}$

$v_c = V + C e^{-\frac{1}{RC}t}$

$v_c(0) = 0$

$V + C = 0$

$C = -V$

$v_c(t) = V(1 - e^{-\frac{1}{RC}t}) = V - V e^{-\frac{1}{RC}t}$

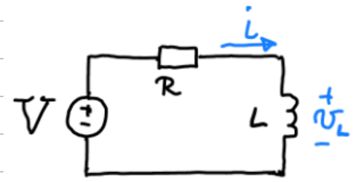
$i(t) = C\frac{d}{dt}v_c(t)$

$i(t) = C\cdot(0 - (-\frac{1}{RC})V e^{-\frac{1}{RC}t})$

$i(t) = \frac{1}{R}V e^{-\frac{1}{RC}t}$

Oppg 1 2) $v_L(\infty) = V$ $\quad$ $i(\infty) = 0$

Oppg 1 3) $V = iR + v_L$ $\quad$ $v(t) = L\frac{d}{dt} i(t)$



$$V = iR + L\frac{d}{dt} i(t)$$

$$\frac{d}{dt} i(t) + \frac{R}{L} i = \frac{1}{L} V$$

Oppg 1 4)

$$\frac{d}{dt} i(t) + \frac{R}{L} i = \frac{1}{L} V \quad \Big| \cdot e^{\frac{R}{L}t}$$

$$\frac{d}{dt} i(t) e^{\frac{R}{L}t} + \frac{R}{L} i e^{\frac{R}{L}t} = \frac{1}{L} V e^{\frac{R}{L}t}$$

$$\frac{d}{dt}\left(i(t) e^{\frac{R}{L}t}\right) = \frac{1}{L} V e^{\frac{R}{L}t} \quad \Big| \cdot \int dt$$

$$i(t) e^{\frac{R}{L}t} = R V e^{\frac{R}{L}t} + D \quad \Big| \cdot e^{-\frac{R}{L}t}$$

$$i(t) = \frac{1}{R} V + D e^{-\frac{R}{L}t}$$

$$i(0) = J_0$$

$$RV + D = J_0$$

$$D = J - \frac{1}{R} V$$

$$i(t) = \frac{1}{R} V - \left(J_0 - \frac{1}{R} V\right) e^{-\frac{R}{L}t}$$

$$v_L = L \frac{d}{dt} i(t)$$

$$v_L(t) = L \cdot \frac{R}{L}\left(J_0 - \frac{1}{R} V\right) e^{-\frac{R}{L}t}$$

$$= R\left(J_0 - \frac{1}{R} V\right) e^{-\frac{R}{L}t}$$

$$= J_0 R - V e^{-\frac{R}{L}t}$$

Oppg 1 b)

$i(\infty) = \frac{U}{R}$ $v_L(\infty) = J_0 R$