Q-1-

(1) $\boxed{-V_{s1} + R_1(I_a - I_d) + R_2(I_b - I_c) + V_{s_2} + R_3 I_b = 0}$ (6)

(2) $\boxed{I_{s1} = I_b - I_a}$ (4)

(3) $-V_{s3} + R_4 I_d + R_6(I_d - I_c) + R_1(I_d - I_a) = 0$ (6)

$-AV_6 + R_4 I_d + R_6(I_d - I_c) + R_1(I_d - I_a) = 0$

$V_6 = R_6(I_d - I_c)$ (2)

$\boxed{-A[R_6(I_d - I_c)] + R_4 I_d + R_6(I_d - I_c) + R_1(I_d - I_a) = 0}$

(4) $I_c = -I_{s2}$ (2)

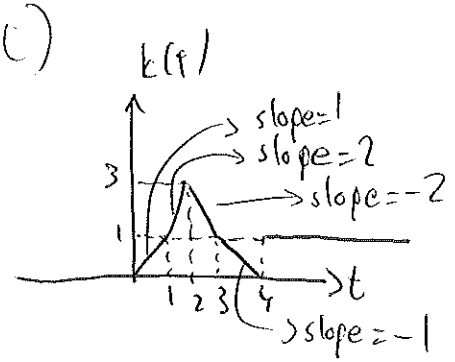
$I_c = -BV_1 = -BR_1(I_a - I_d)$

$V_1 = R_1(I_a - I_d)$

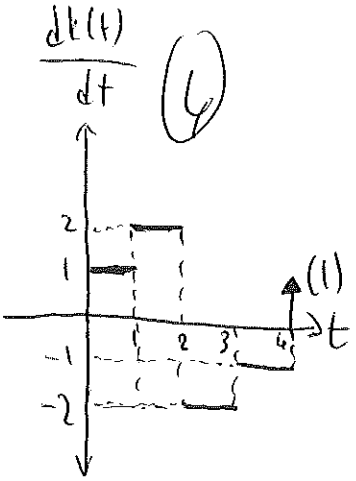
$\boxed{I_c = -BR_1(I_a - I_d)}$ (3)

Q-2 (2)

(a)



(b) $\frac{dx(t)}{dt} = u(t) + u(t-1) - 4u(t-2) + u(t-3) + u(t-4) + \delta(t-4)$ (4)



Q-3- $f(t) = 5t+5$ $\quad f(t)\delta(t) = f(0)\delta(t) = 5\delta(t)$

(4) $\hookrightarrow f(0) = 5$

$$\int_{-\infty}^{\infty} f(t)\delta(t)dt = \int_{-\infty}^{\infty} f(0)\delta(t)dt = \int_{-\infty}^{\infty} 5\delta(t)dt = 5\int_{-\infty}^{\infty}\delta(t)dt = 5 \;//$$

Q-4- $f(t)_{RMS} = \sqrt{\frac{1}{T}\int_0^T f^2(t)dt} = \sqrt{\frac{1}{T}\int_0^T A^2\sin^2\left(\frac{2\pi t}{T}\right)dt}$

(4)

use $1-2\sin^2 a = \cos 2a \rightarrow \frac{1-\cos 2a}{2} = \sin^2 a$ (2)

$$f(t)_{RMS} = \sqrt{\frac{A^2}{T}\int_0^T \frac{1-\cos\left(\frac{4\pi t}{T}\right)}{2}dt} = A\sqrt{\frac{1}{T2}\left[t - \frac{T}{4\pi}\sin\left(\frac{4\pi t}{T}\right)\right]_0^T}$$

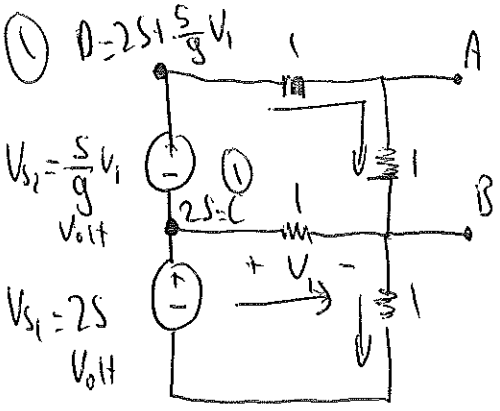
(2) (2)

$$= A\sqrt{\frac{1}{2T}\left[(T-0) - \frac{T}{4\pi}\left[\sin(4\pi)-\sin(0)\right]\right]} = \frac{A}{\sqrt{2}} \;//$$

(2) (1)

Q-5- Find V_{TH}

(1) $D = 2S + \frac{S}{9}V_1$



$V_{S_2} = \frac{S}{9}V_1$ Volt

$V_{S_1} = 2S$ Volt

$$\frac{2S + \frac{S}{9}V_1 - B}{2} + \frac{2S - B}{1} = \frac{B}{1} \quad (4)$$

$V_1 = C - B = 2S - B$ (3)

$$\frac{V_1 + \frac{S}{9}V_1}{2} + \frac{V_1}{1} = \frac{2S - V_1}{1}$$

$$\frac{14V_1}{18} + \frac{V_1}{1} = \frac{2S - V_1}{1} \rightarrow \frac{50V_1}{18} = 25$$

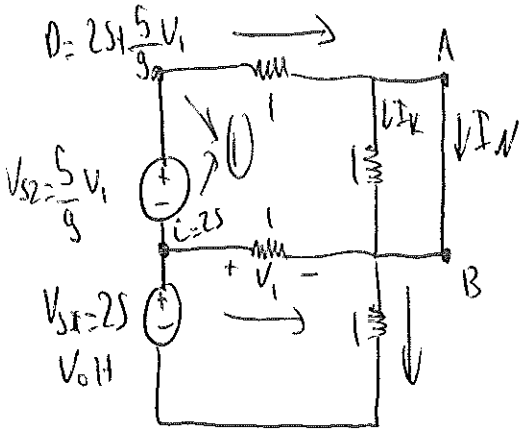
(1) $V_1 = 9$ Volt $\rightarrow B = 16$ Volt (1) $\rightarrow D = 2S + \frac{S}{9}V_1 = 30$ Volt //

$$\frac{D-A}{1} = \frac{A-B}{1} \qquad \frac{30-A}{1} = \frac{A-16}{1} \qquad A = 23 \text{ Volt}$$

$$V_{TH} = A - B = 23 - 16 = 7 \text{ Volt} \;//$$

(1)

Q-5 Find I_N



$I_{sc}=0$ (since there is I_N)

$A=B$

$$\frac{D-A}{1}=\frac{D-B}{1}=\frac{C-B}{1}+\frac{B}{1} \quad (4)$$

$V_1=2S-B$ (2)

$$\frac{\frac{5}{9}V_1+2S-B}{1}=\frac{2S-B}{1}+\frac{B}{1}$$

$\frac{5}{9}V_1+50=3B$ $\longrightarrow$ $\frac{5}{9}(2S-B)+50=3B$ $\quad \frac{125}{9}-\frac{5B}{9}+50=3B$

$\frac{125}{9}+50=3B+\frac{5B}{9}$ $\quad \frac{125+450}{9}=\frac{27B+5B}{9}$ $\quad 575=32B$

$B=\frac{575}{32}$ Volt (1) $\quad I_N=\frac{D-B}{1}=$

$V_1=2S-B=2S-\frac{575}{32}=\frac{225}{32}$ (1) $\quad I_N=\frac{B}{1}+\frac{V_1}{1}=\frac{\frac{575}{32}}{1}+\frac{\frac{225}{32}}{1}$

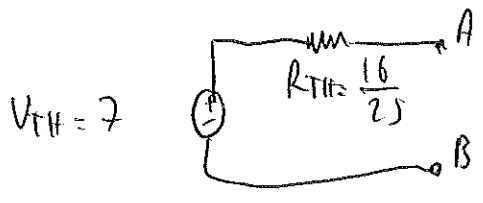
(1) (0.5)

$I_N=\frac{800}{32}=$ [illegible]

(0.5)

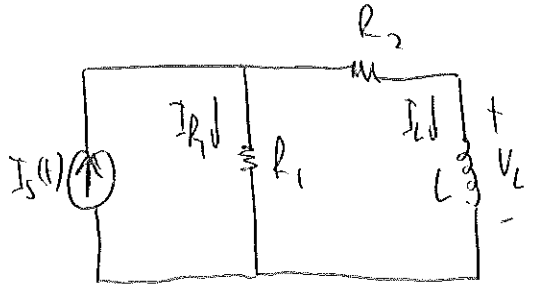
$R_{TH}=\frac{V_{TH}}{I_N}=\frac{7}{\frac{350}{32}}=\frac{7\times32}{350}=\frac{32}{50}\Omega=\frac{16}{25}\Omega$

Thevenin equivalent circuit



Q-6-

(12)



$I_s = I_{R_1} + I_L$ (3)

$V_{R_1} = V_{R_2} + V_L$ (2)

$V_{R_1} = R_2 I_L + L\frac{dI_L}{dt}$ (1)

$I_{R_1} = \frac{R_2 I_L + L\frac{dI_L}{dt}}{R_1}$

$I_s = \frac{R_2 I_L + L\frac{dI_L}{dt}}{R_1} + I_L$ (2)

$I_s = \left[\frac{R_2}{R_1} + 1\right] I_L + \frac{L}{R_1}\frac{dI_L}{dt}$ $\quad I_s = \frac{R_2 + R_1}{R_1} I_L + \frac{L}{R_1}\frac{dI_L}{dt}$

$$\boxed{\frac{dI_L}{dt} + \frac{R_2 + R_1}{L} I_L = \frac{R_1}{L} I_s}$$ (3)

Q-7- $x_p(t) = At^2 e^{-5t} + Bte^{-5t} + D$ (putt in diff-equation)

(4) $\frac{d}{dt}\left[At^2 e^{-5t} + Bte^{-5t} + D\right] + 5\left[At^2 e^{-5t} + Bte^{-5t} + D\right] = e^{-5t} + te^{-5t} + 1$

(6) $2Ate^{-5t} - 5At^2 e^{-5t} + Be^{-5t} - 5Bte^{-5t} + 5At^2 e^{-5t} + 5Bte^{-5t} + 5D = e^{-5t} + te^{-5t} + 1$

(3) $2Ate^{-5t} + Be^{-5t} + 5D = e^{-5t} + te^{-5t} + 1$ $\quad D = \frac{1}{5}$ $\quad A = \frac{1}{2}$

$B = 1$

(1) $x_p(t) = \frac{1}{2}t^2 e^{-5t} + te^{-5t} + \frac{1}{5}$

Gedisat

(1) $x_h(t) = Ke^{-5t}$

(3) $x(t) = x_p(t) + x_h(t) = \frac{1}{2}t^2 e^{-5t} + te^{-5t} + \frac{1}{5} + Ke^{-5t}$

(10)

$x(0) = \frac{2}{5} = \frac{1}{5} + K$ $\quad K = \frac{1}{5}$ $\longrightarrow$ $x(t) = \frac{1}{2}t^2 e^{-5t} + te^{-5t} + \frac{1}{5}e^{-5t} + \frac{1}{5}$