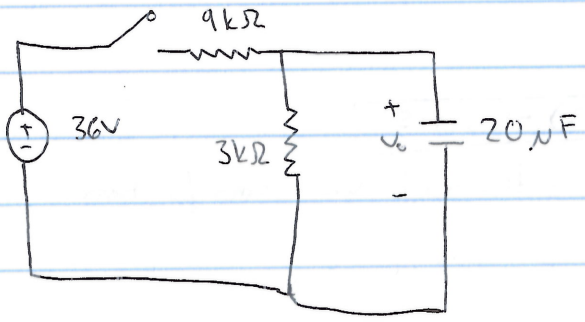
Rishabh Shah

11103 12017

46555 41192

EECS 215 HW7

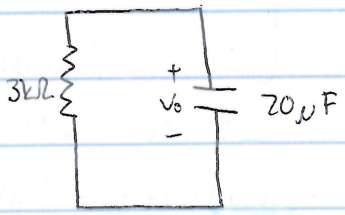
10.



before $t=0$ ($t<0$):

$V_c = 36 \cdot \left(\frac{3000}{12000}\right) = 9V$

after $t=0$ ($t>0$):



$V_o = 9V$

$\tau = RC = 0.06$

$v_o(t) = V_o e^{-t/\tau}$

$= 9e^{-t/0.06}$

$v_o(t_s) = 9e^{-t/0.06} = 3$

$\frac{1}{3} = e^{-t/0.06}$

$\ln(1/3) = \frac{-t}{0.06}$

$-0.06 \ln(1/3) = t = 0.0659s$

$v(t) = 9e^{-t/0.06}$ V

$v(0.0659) = 3V$

19. $i(0) = 5A$

$i(t) = i(0)e^{-t/\tau}$

$= 5e^{-t/0.2}$

$= 5e^{-5t}$

Determine R_{TH}:

$-i + 0.5i + i_{40} = 0$; $i_{40} = 0.5i$

$10i - 1 + 40i_{40} = 0$

$10i - 1 + 20i = 0$

$30i = 1$

$i = 1/30$ A

$R_{TH} = (1/30)^{-1} = 30\Omega$

24. b. $i(t) = \begin{cases} 0 & t<1 \\ -10 & 1<t<3 \\ 10 & 3<t<5 \\ 0 & t>5 \end{cases}$ in terms of unit step functions

$$\boxed{i(t) = -10u(t-1) + 20u(t-3) - 10u(t-5)}$$

c. $x(t) = \begin{cases} t-1 & 1<t<2 \\ 1 & 2<t<3 \\ 4-t & 3<t<4 \\ 0 & \text{otherwise} \end{cases}$ in terms of unit ramp functions

$$x(t) = (t-1)(u(t-1) - u(t-2)) + (u(t-2) - u(t-3)) + (4-t)(u(t-3) + u(t-4))$$

$$= (t-1)u(t-1) - (t-1)(u(t-2)) + u(t-2) - u(t-3) + (4-t)u(t-3)$$

$$- (4-t)(u(t-4))$$

~~$(t-1)u(t-1) - tu(t-2) + (3-t)u(t-3) - (4-t)u(t-4)$~~

26. a. $\boxed{= r(t-1) - r(t-2) - r(t-3) - r(t-4)}$

26. c. $v_3(t) = 2(u(t-2) - u(t-4))$

$+ v_3(t) = 4(u(t-4) - u(t-6))$

$$= 2u(t-2) - 2u(t-4) + 4u(t-4) - 4u(t-6)$$

$$\boxed{= 2u(t-2) + 2u(t-4) - 4u(t-6)}$$

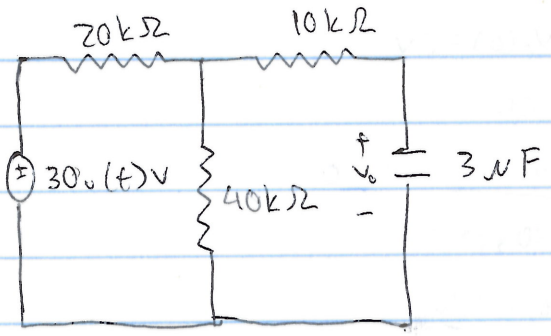
d. $v_4(t) - 1 = \frac{-2+1}{2-1}(t+1)$

$v_4(t) = -t(u(t-1) - u(t-2))$

$$\boxed{= -(t-1)u(t-1) - u(t-1) + (t-2)u(t-2) + 2u(t-2)}$$

$$\boxed{= -r(t-1) - u(t-1) + r(t-2) + 2u(t-2)}$$

45.



$v_o(0) = 5\,V$

$$v_o(t) = v_o(\infty) + (v_o(0) - v_o(\infty))\, e^{-t/\tau}\, u(t)$$

$$v_o(\infty) = \frac{40\times10^3}{20\times10^3 + 40\times10^3}\, v_s = \frac{4}{6}\cdot 30 = 20\,V$$

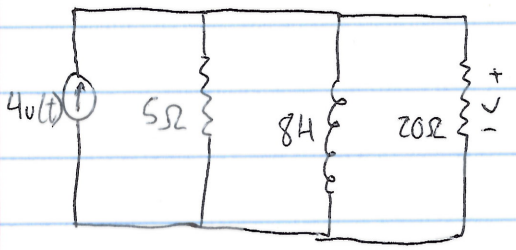
$$R_{TH} = 10\times10^3 + \left(\frac{1}{40\times10^3} + \frac{1}{20\times10^3}\right)^{-1} = 23.3\,k\Omega$$

$$\tau = RC = 0.07$$

$$v_o(t) = 20 + (-15)\, e^{-t/0.7}\, u(t)$$

$$= 20 - 15\, e^{-t/0.7}\, u(t)\ V$$

60



$$i_{20} = 4\cdot\frac{5}{25} = 0.8\,A$$

$$v(0^+) = 16\,V$$

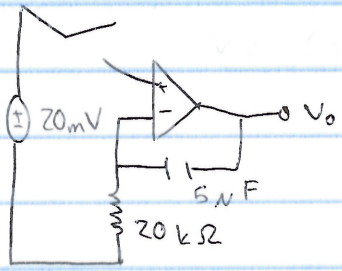
$$R_{eq} = \left(\frac{1}{5} + \frac{1}{20}\right)^{-1} = 4$$

$$\tau = 2$$

$$v(t) = v(\infty) + (v(0) - v(\infty))\, e^{-t/\tau}$$

$$= 16\, e^{-t/2}\ V$$

70.



$V_c(0) = 0V$

KCL:

$$\frac{V_s}{20 \times 10^3} + i_c = 0$$

$$i_c = C\frac{dv_c}{dt}$$

$$\frac{V_s}{20 \times 10^3} + C\frac{d}{dt}v_c = 0$$

$$\frac{d}{dt}v_c = \frac{1}{5}$$

$$V_c = \int_0^t \frac{1}{5}\,dt + v_c(0)$$

$$= \frac{-1}{5}t$$

$$V_s - V_c = V_o$$

$$20 \times 10^{-3} - \frac{1}{5}t = V_o$$

$$V_o = 20 \times 10^{-3} - 0.2t$$

$$= \boxed{20(1 + 10t)\ mV}$$