23W-EC ENGR-10-LEC-1 Hw #3

SANJIT SARDA

TOTAL POINTS

97.5 / 100

QUESTION 1

Problem 1 15 pts

1.1 a **4 / 4**

✓ **- 0 pts** *Correct*

  - 1 pts Wrong Answer

1.2 b **7 / 7**

✓ **- 0 pts** *Correct*

  - 1 pts Va is wrong

  - 1 pts Vb is wrong

  - 1 pts $$\tau$$ is wrong, which should be 2L/3R

  - 1 pts one or more of these is wrong caculated.k1=-v/3, k2=v/3, k3=-v/2, k4=0

1.3 c **4 / 4**

✓ **- 0 pts** *Correct*

  - 1 pts Va(t) is wrong

  - 1 pts Vb(t) is wrong

QUESTION 2

Problem 2 20 pts

2.1 a **5 / 5**

✓ **- 0 pts** *Correct*

  - 2 pts wrong answer

  - 3 pts did not calculate the final answer

2.2 b **5 / 5**

✓ **- 0 pts** *Correct*

  - 2 pts wrong sign

  - 3 pts answer should be -2

2.3 c **5 / 5**

✓ **- 0 pts** *Correct*

  - 3 pts answer should be 0.

2.4 d **5 / 5**

✓ **- 0 pts** *Correct*

  - 2 pts wrong sign

  - 3 pts answer should be $$-2e^{-4t}$$

  - 5 pts did not answer

QUESTION 3

Problem 3 20 pts

3.1 a **8 / 8**

✓ **- 0 pts** *Correct*

  - 2 pts did not use series calculation formula

  - 8 pts did not answer this question

3.2 b **4 / 4**

✓ **- 0 pts** *Correct*

  - 2 pts Ib answer should be 0.075A

  - 2 pts Ia = 0

  - 4 pts did not answer this question

3.3 c **6 / 8**

  - 0 pts Correct

  ✓ **- 2 pts** *wrong sign*

  - 4 pts answer should be -150$$V/s$$

  - 8 pts did not answer

QUESTION 4

Problem 4 20 pts

4.1 a **2 / 2**

  ✓ **- 0 pts** *Correct*

  - 2 pts wrong answer

4.2 b **2 / 2**

  ✓ **- 0 pts** *Correct*

  - 1 pts answer should be $$1.125*10^9 ns$$

  - 2 pts no answer

4.3 c **6 / 6**

  ✓ **- 0 pts** *Correct*

  - 1 pts $$V_1(0^+)=1600V$$

  - 1 pts $$i(0^+)=7.11A$$

  - 1 pts $$V_2(0^+)=-533.33V$$

  - 1 pts $$i(\infty)=0$$

  - 1 pts $$V_1(\infty)=0$$

  - 1 pts $$V_2(\infty)=0$$

  - 6 pts No answer

4.4 d **3 / 3**

  ✓ **- 0 pts** *Correct*

  - 1 pts answer should be $$V_1(t)=1600e^{-8t/9}$$

  - 1 pts answer should be $$V_2(t)=-533.33e^{-8t/9}$$

  - 3 pts No answer

4.5 e **2 / 2**

  ✓ **- 0 pts** *Correct*

  - 1 pts V1

  - 1 pts V2

  - 2 pts No answer

4.6 f **2 / 2**

  ✓ **- 0 pts** *Correct*

  - 2 pts No answer

4.7 g **3 / 3**

  ✓ **- 0 pts** *Correct*

  - 1 pts partially incorrect

  - 3 pts did not answer

QUESTION 5

Problem 5 15 pts

5.1 a **5 / 5**

  ✓ **- 0 pts** *Correct*

  - 1 pts partially incorrect

  - 5 pts did not answer

5.2 b **10 / 10**

  ✓ **- 0 pts** *Correct*

  - 2 pts $$2*10^8 (A/s)$$

  - 2 pts $$-8*10^{17} (A/s^2)$$

  - 10 pts did not answer

QUESTION 6

Problem 6 10 pts

6.1 a **4 / 4**

✓ **- 0 pts** *Correct*

    - 1 pts $V_R(t)=-2V$

    - 1 pts $i_1(t=0^+)=6mA$

    - 4 pts did not answer this question

6.2 **b** **5.5 / 6**

    - 0 pts Correct

✓ **- 0.5 pts** *wrong sign*

    - 1 pts answer should be $-6*10^6(V/s)$

    - 6 pts No answer

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1.1 a **4 / 4**

✓ **- 0 pts** *Correct*

- 1 pts Wrong Answer

①
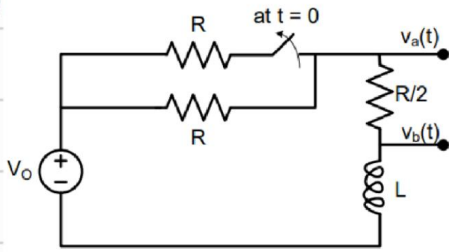
Figure 1.

ⓐ When $t < 0$,

$V_0 \overset{\pm}{\bigoplus} \quad R/2 \quad \lessgtr R/2 \quad \overset{\underline{\underline{}}}{\underline{\underline{}}} L \quad = \quad V_0 \overset{\pm}{\bigoplus} \quad \curvearrowright$
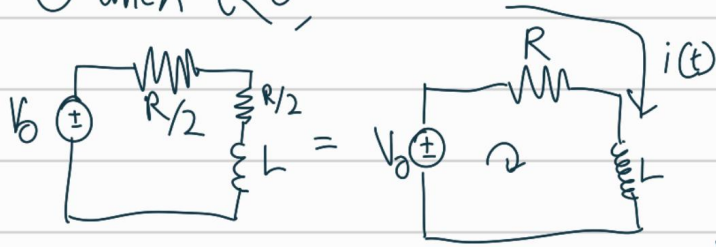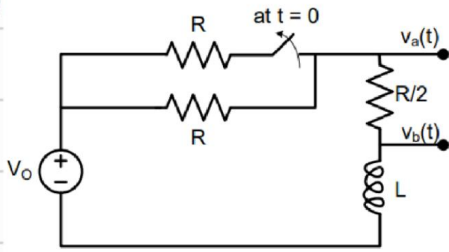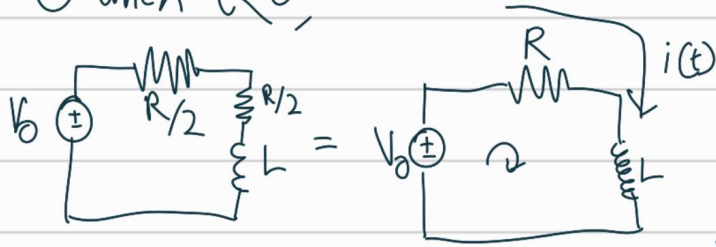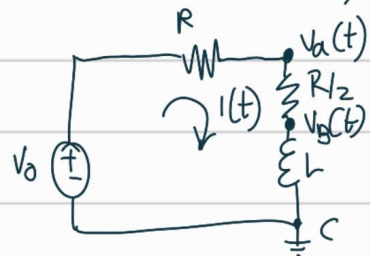
@ Steady State, $i(0-) = V_0/R = \frac{V_0}{R}$

@ $i(0+)$, there is no jump in current, $i(0+) = \frac{V_0}{R}$

$i(t) = \frac{1}{L} \int V_B(t)\, dt \quad \therefore \ Li = \int V_B\, dt$

$\therefore \ Li' = V_B$

ⓑ When $t \geq 0$,
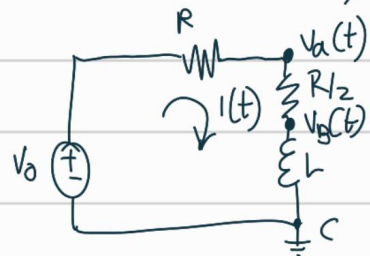
$KVL \rightarrow i \cdot R + iR/2 + L\frac{di}{dt} = V_0$

$V_A = V_B(t) + \frac{i(t) \cdot R}{2} = -\frac{V_0}{2}e^{-\frac{R}{L}t} + \frac{V_0}{3} + \frac{V_0}{6}e^{-\frac{R}{L}t}$
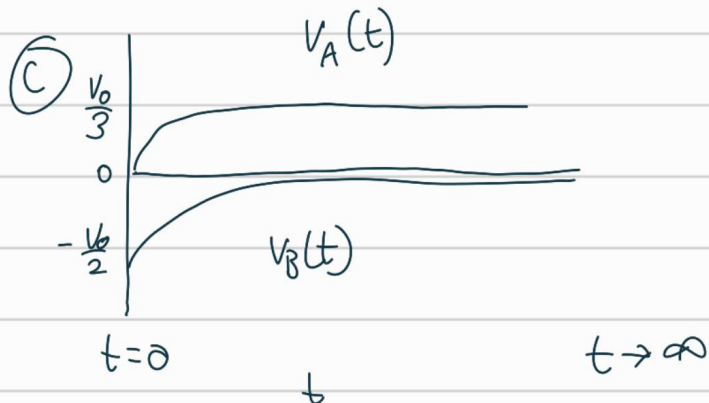
$\therefore \ L\frac{di}{dt} + \frac{3}{2}iR = V_0$

$\boxed{4 = -\frac{V_0}{3}e^{\frac{3R}{2L}t} + \frac{V_0}{3}}$

$\therefore \ i'(t) + \frac{3R}{2L}i = \frac{V_0}{L}$

$\therefore \ V_B = Li' = \not{L}\left(-\frac{V_0 \cdot 3R}{3R \cdot 2\not{L}} e^{-\frac{R}{L}t}\right) = \boxed{-\frac{V_0}{2}e^{-\frac{3R}{2L}t}}$

Solving for $i(t)$, $i(t) = Ce^{-\frac{3R}{2L}t} + \frac{2V_0}{3R} = \frac{2V_0}{3R} + \frac{V_0}{3R}e^{-\frac{3Rt}{2L}}$ ↰

from ⓐ, $i(0) = \frac{V_0}{R} \quad \therefore \ \frac{V_0}{R} = C \cdot 1 + \frac{2V_0}{3R} \quad \therefore \ C = \frac{3-2}{3} \cdot \frac{V_0}{R} = \frac{1}{3}\frac{V_0}{R}$

$\therefore$

ⓒ

$V_A(t)$

$\frac{V_0}{3}$

0

$-\frac{V_0}{2}$

$V_B(t)$

$t = 0 \qquad\qquad t \rightarrow \infty$

t

1.2 b **7 / 7**

✓ **- 0 pts** *Correct*

    - 1 pts Va is wrong

    - 1 pts Vb is wrong

    - 1 pts $$\tau$$ is wrong, which should be 2L/3R

    - 1 pts one or more of these is wrong caculated.k1=-v/3, k2=v/3, k3=-v/2, k4=0

✓ **- 0 pts** *Correct*

(1)

Figure 1.

(a) When $t < 0$,

$$V_0 \overset{\pm}{\circlearrowright} \quad R/2 \lessgtr R/2 \quad L = \quad V_0 \overset{\pm}{\circlearrowright} \quad R \quad i(t) \quad L$$
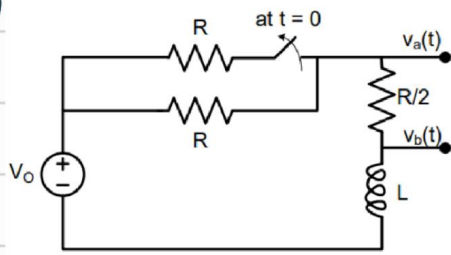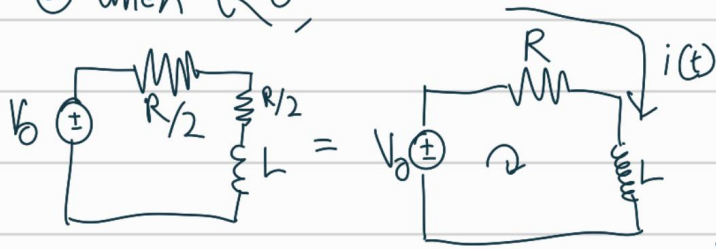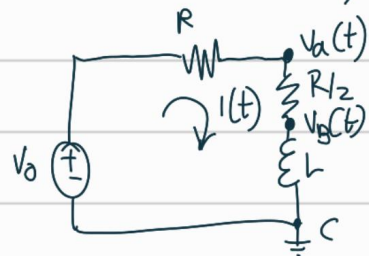
@ Steady State, $i(0^-) = V_0/R = \dfrac{V_0}{R}$

@ $i(0^+)$, there is no jump in current, $i(0^+) = \dfrac{V_0}{R}$

$$i(t) = \frac{1}{L}\int V_B(t)\,dt \quad \therefore Li = \int V_B\,dt$$
$$\therefore Li' = V_B$$

(b) When $t \geq 0$,

$KVL \rightarrow i\cdot R + iR/2 + L\frac{di}{dt} = V_0$

$V_A = V_B(t) + \dfrac{i(t)\cdot R}{2} = -\dfrac{V_0}{2}e^{-\frac{Rt}{L}} + \dfrac{V_0}{3} + \dfrac{V_0}{6}e^{-\frac{R}{L}t}$
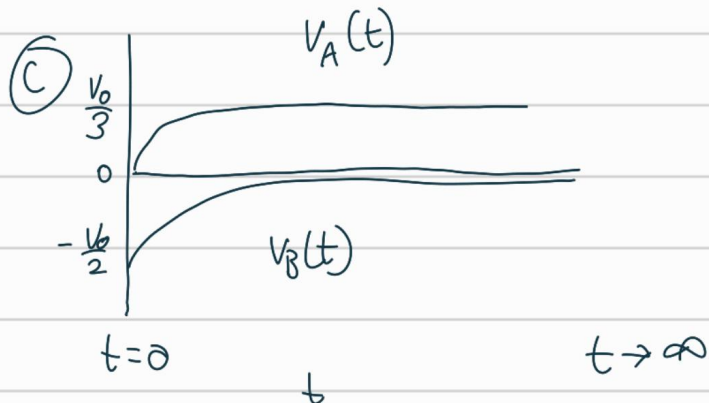
$\boxed{= -\dfrac{V_0}{3}e^{\frac{3R}{2L}t} + \dfrac{V_0}{3}}$

$\therefore L\frac{di}{dt} + \frac{3}{2}iR = V_0$

$\therefore i'(t) + \frac{3R}{2L}i = \frac{V_0}{L}$

$\therefore V_B = Li' = L\left(-\dfrac{V_0}{3}\dfrac{3R}{2L}e^{-\frac{R}{L}t}\right) = \boxed{-\dfrac{V_0}{2}e^{-\frac{3R}{2L}t}}$

Solving for $i(t)$, $i(t) = Ce^{-\frac{3R}{2L}t} + \dfrac{2V_0}{3R} = \dfrac{2V_0}{3R} + \dfrac{V_0}{3R}e^{-\frac{3Rt}{2L}}$

from @, $i(0) = \dfrac{V_0}{R}$ $\therefore \dfrac{V_0}{R} = C\cdot 1 + \dfrac{2V_0}{3R}$ $\therefore C = \dfrac{3-2}{3}\cdot\dfrac{V_0}{R} = \dfrac{1}{3}\dfrac{V_0}{R}$
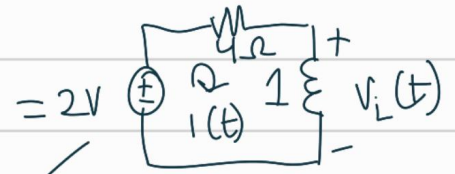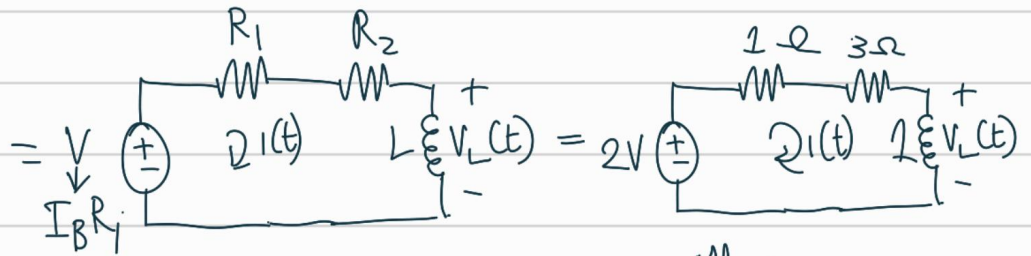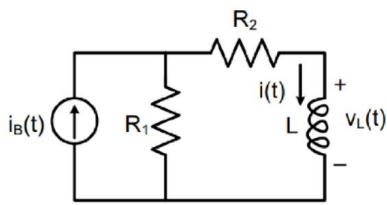
$\therefore$

(c)

$t = 0$ \qquad $t \to \infty$

1.3 C **4 / 4**

✓ **- 0 pts** *Correct*

   - 1 pts Va(t) is wrong

   - 1 pts Vb(t) is wrong

✓ **- 0 pts** *Correct*

②

$$= V \quad \stackrel{+}{\ominus} \quad R\,i(t) \quad L \lessgtr v_L(t)$$
$$= \overset{\downarrow}{\underset{\downarrow}{V}}$$
$$I_B R_1$$

$$R_1 \quad R_2$$

$$= 2V \quad \stackrel{+}{\ominus} \quad R\,i(t) \quad 1 \lessgtr v_L(t)$$

$$1\Omega \quad 3\Omega$$

$$= 2V \quad \stackrel{+}{\ominus} \quad \underset{i(t)}{R} \quad 1 \lessgtr v_L(t)$$

$$4\Omega$$

ⓐ $\tau = \dfrac{L}{R} = \dfrac{1}{4} = \dfrac{1}{4}s$

KVL $\qquad i(t) = \dfrac{1}{L}\int -v_L(t)\,dt$

ⓑ $V_L(0+)$

$= -2e^0 = -2V$

$2 = 4 \cdot i(t) + 1 \cdot i'(t)$
solving for $i(t) = ce^{-4t} + \dfrac{1}{2}$
$i(0) = 1 \quad \therefore 1 = c \cdot 1 + \dfrac{1}{2}$
$\therefore c = \dfrac{1}{2}$

ⓒ $V_L(\infty) = -2e^{\infty} = 0V$

$\therefore i(t) = \dfrac{1}{2}\left(e^{-4t} + 1\right)$

ⓓ $V_L(t) = -2e^{-4t}$

$-V_L(t) = L \cdot i'(t) = -2e^{-4t}$
$\therefore V_L(t) = -2e^{-4t}$

2.1 a **5 / 5**

✓ **- 0 pts** *Correct*

- 2 pts wrong answer

- 3 pts did not calculate the final answer

✓ **- 0 pts** *Correct*

- 2 pts wrong answer

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②

$$= \frac{V}{I_B R_1}$$

$$= 2V$$

$$= 2V$$

ⓐ $\tau = \frac{L}{R} = \frac{1}{4} = \frac{1}{4}s$

KVL

$i(t) = \frac{1}{L}\int -V_L(t)\,dt$

ⓑ $V_L(0+)$

$= -2e^0 = -2V$

$2 = 4 \cdot i(t) + 1 \cdot i'(t)$

solving for $i(t) = ce^{-4t} + \frac{1}{2}$

$i(0) = 1 \therefore 1 = C \cdot 1 + \frac{1}{2}$

$\therefore C = \frac{1}{2}$

ⓒ $V_L(\infty) = -2e^{\infty} = 0V$

$\therefore i(t) = \frac{1}{2}\left(e^{-4t} + 1\right)$

ⓓ $V_L(t) = -2e^{-4t}$

$-V_L(t) = L \cdot i'(t) = -2e^{-4t}$

$\therefore V_L(t) = -2e^{-4t}$

2.2 b **5 / 5**

✓ **- 0 pts** *Correct*

- 2 pts wrong sign

- 3 pts answer should be -2

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②

R_1 R_2

$= \frac{V}{I_B R_1}$ $\quad 2I(t)$ $\quad L \lessgtr V_L(t) = 2V$ $\quad 1\Omega \quad 3\Omega$

$\quad 2I(t) \quad 1 \lessgtr V_L(t)$

$= 2V$ $\quad 4\Omega$ $\quad 1 \lessgtr V_L(t)$ $\quad I(t)$

ⓐ $\tau = \frac{L}{R} = \frac{1}{4} = \frac{1}{4} s$

ⓑ $V_L(0+)$
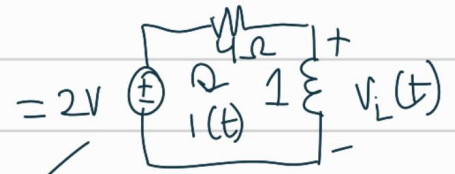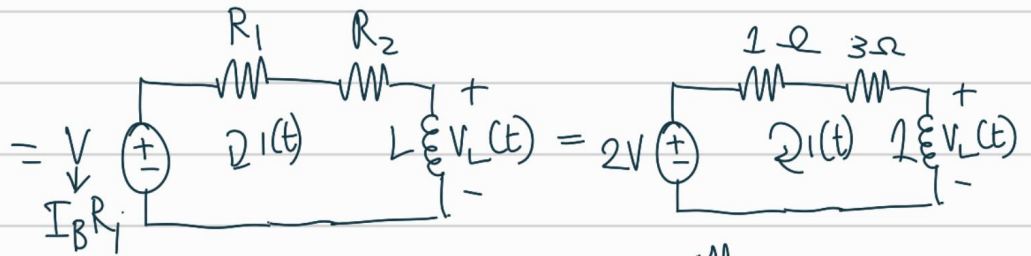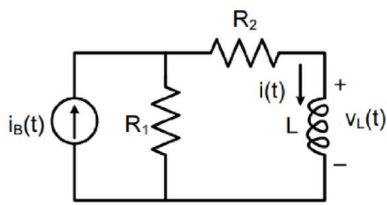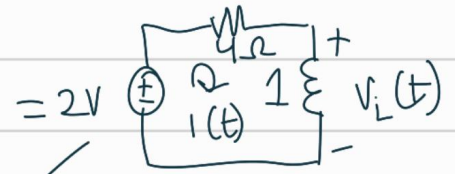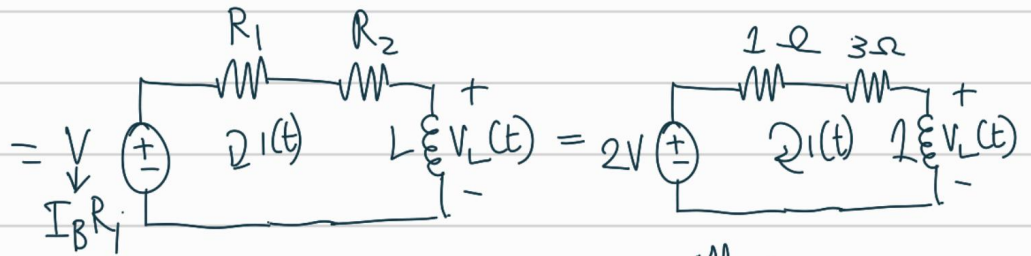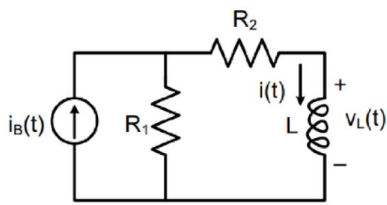
$= -2e^0 = -2V$

ⓒ $V_L(\infty) = -2e^\infty = 0V$

ⓓ $V_L(t) = -2e^{-4t}$

KVL $\qquad i(t) = \frac{1}{L}\int -V_L(t)dt$

$2 = 4 \cdot i(t) + 1 \cdot i'(t)$

solving for $i(t) = Ce^{-4t} + \frac{1}{2}$

$i(0) = 1 \therefore 1 = C \cdot 1 + \frac{1}{2}$

$\therefore C = \frac{1}{2}$

$\therefore i(t) = \frac{1}{2}(e^{-4t} + 1)$

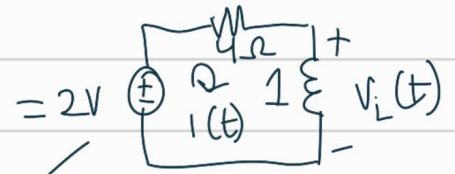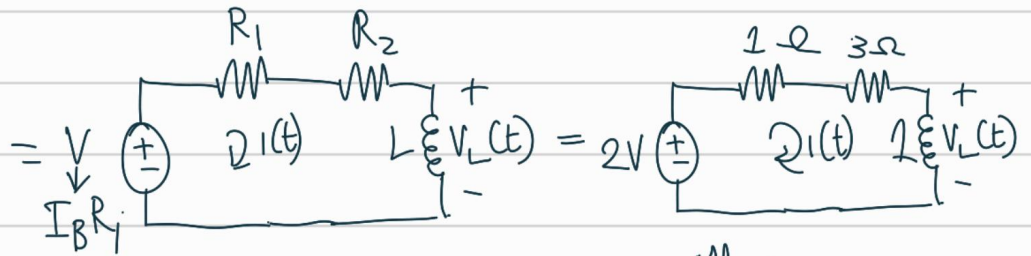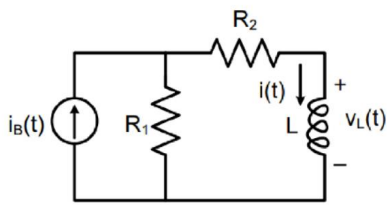$-V_L(t) = L \cdot i'(t) = -2e^{-4t}$
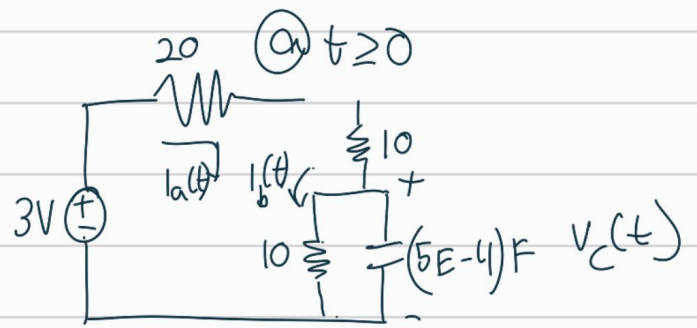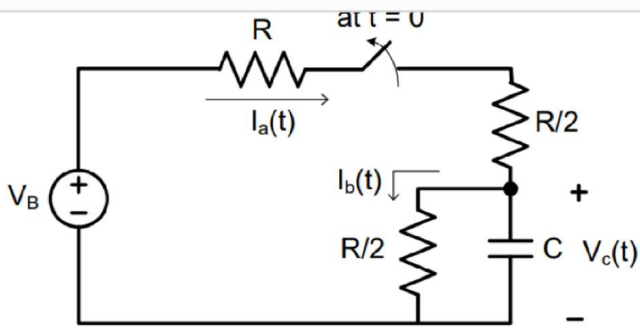
$\therefore V_L(t) = -2e^{-4t}$

2.3 C **5 / 5**

   ✓ **- 0 pts** *Correct*

     - 3 pts answer should be 0.

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②

$$\equiv \underset{I_B R_1}{\overset{V}{\downarrow}} \; \left(\pm\right) \; 2i(t) \quad L \lessgtr V_L(t)$$

$$= 2V \left(\pm\right) \quad 2i(t) \quad 1 \lessgtr V_L(t)$$

$$= 2V \left(\pm\right) \quad \underset{i(t)}{2} \; 1 \lessgtr V_L(t)$$

ⓐ $\tau = \dfrac{L}{R} = \dfrac{1}{4} = \dfrac{1}{4}s$

KVL $\qquad i(t) = \dfrac{1}{L}\int -V_L(t)\,dt$

ⓑ $V_L(0+)$

$= -2e^0 = -2V$

$2 = 4\cdot i(t) + 1\cdot i'(t)$

solving for $i(t) = Ce^{-4t} + \frac{1}{2}$

$i(0) = 1 \quad \therefore 1 = C\cdot 1 + \frac{1}{2}$

$\therefore C = \frac{1}{2}$

ⓒ $V_L(\infty) = -2e^{\infty} = 0V$

$\therefore i(t) = \dfrac{1}{2}\left(e^{-4t} + 1\right)$

ⓓ $V_L(t) = -2e^{-4t}$

$-V_L(t) = L\cdot i'(t) = -2e^{-4t}$

$\therefore V_L(t) = -2e^{-4t}$

2.4 d **5 / 5**

✓ **- 0 pts** *Correct*

   - 2 pts wrong sign

   - 3 pts answer should be $-2e^{-4t}$

   - 5 pts did not answer

✓ **- 0 pts** *Correct*

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③

at t = 0

R $I_a(t)$

V_B R/2

$I_b(t)$

R/2   C $V_c(t)$

+

−

20   @ t ≥ 0

3V $I_a(t)$ $I_b(t)$ 10

10   $(5E-4)F$ $V_c(t)$

+

−

$@ t ≥ 0, \ V_c(t) = i_B(t) \cdot 10$

ⓐ Given $V_c(0-) = \dfrac{3}{4} V$

$V_c(0+) = V_c(0-) = \dfrac{3}{4} V$

since there is a resistor
no impulse.

$I_B(t) = C V_c'$

$\therefore V_c(t) = -10 C V_c'$

Solving for V_c, $\quad V_c = C e^{-t/10 \cdot (5E-4)}$

$V_c(0) = \dfrac{3}{4} \quad \therefore \dfrac{3}{4} = C e^0 = C$

$\therefore V_c(t) = \dfrac{3}{4} e^{\frac{-t}{10(5E-4)}}$

ⓑ $I_a(0+) = 0$, since there is no closed loop

$I_b(0+) = \dfrac{3}{40} A$

$I_B(t) = (5E-4) \cdot \dfrac{3}{4} \cdot \dfrac{1}{10(5E-4)} e^{-t/10(5E-4)}$

$= \dfrac{3}{40} e^{\frac{-t}{5E-4}}$

ⓒ $\dfrac{dV_c(t)}{dt} = \dfrac{1}{C} \cdot C \dfrac{dV_c(t)}{dt} = \dfrac{1}{C} \cdot i_B(t) = \dfrac{3 e^{\frac{-t}{5E-4}}}{40 \cdot (5E-4)} \Big|_{t=0} = \dfrac{3}{40(5E-4)} = 150 \ Vs^{-1}$
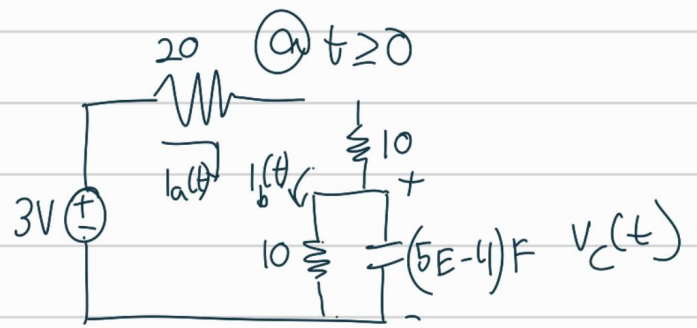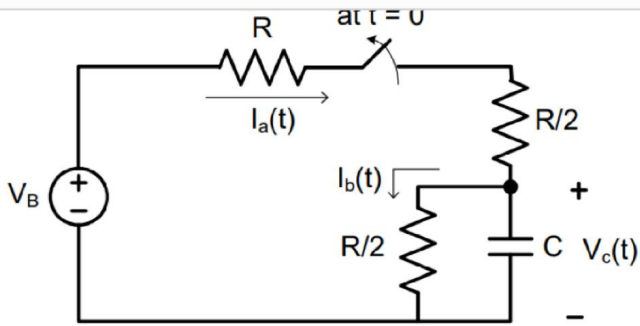
3.1 a **8 / 8**

✓ **- 0 pts** *Correct*

- 2 pts did not use series calculation formula

- 8 pts did not answer this question

③

R — at t = 0
$I_a(t)$
R/2
V_B (+ −)
$I_b(t)$ ↓
R/2
C $V_c(t)$
+
−

20 @ t ≥ 0
3V (±)
$I_a(t)$ $I_b(t)$
10
10
$(5E-4)F$ $V_c(t)$
+

$$@t \geq 0, \quad V_c(t) = i_B(t) \cdot 10$$

ⓐ Given $V_c(0-) = \dfrac{3}{4}$ V

$V_c(0+) = V_c(0-) = \dfrac{3}{4}$ V

since there is a resistor
no impulse.

$$I_B(t) = C V_c'$$
$$\therefore V_c(t) = -10 C V_c'$$

Solving for V_c, $\quad V_c = C e^{-t/_{10 \cdot (5E-4)}}$

$V_c(0) = \dfrac{3}{4} \quad \therefore \dfrac{3}{4} = C e^0 = C$

ⓑ $I_a(0+) = 0$, since there is no closed loop

$I_b(0+) = \dfrac{3}{40}$ A

$$\therefore V_c(t) = \dfrac{3}{4} e^{\frac{-t}{10(5E-4)}}$$

$$I_B(t) = (5E-4) \cdot \dfrac{3}{4} \cdot \dfrac{1}{10(5E-4)} e^{-t/_{10(5E-4)}}$$

$$= \dfrac{3}{40} e^{\frac{-t}{5E-4}}$$

ⓒ $\dfrac{dV_c(t)}{dt} = \dfrac{1}{C} \cdot C \dfrac{dV_c(t)}{dt} = \dfrac{1}{C} \cdot i_B(t) = \dfrac{3 e^{\frac{-t}{5E-4}}}{40 \cdot (5E-4)} \Big|_{t=0} = \dfrac{3}{40(5E-4)} = 150 \text{ Vs}^{-1}$
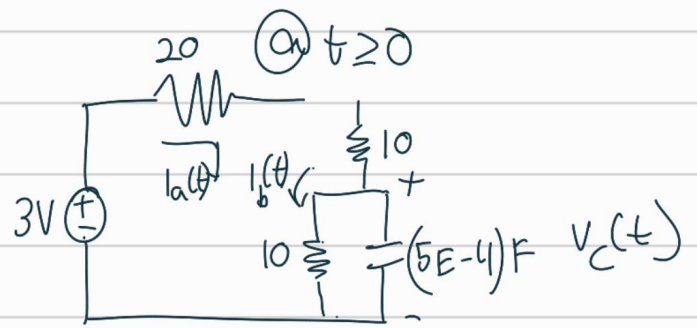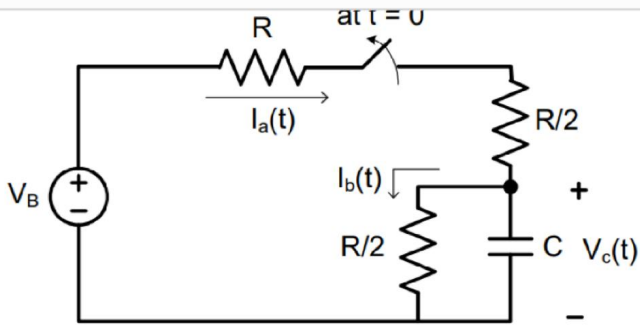
3.2 b **4 / 4**

✓ **- 0 pts** *Correct*

  - 2 pts Ib answer should be 0.075A

  - 2 pts Ia = 0

  - 4 pts did not answer this question

✓ **- 0 pts** *Correct*

③

at t = 0, R, I_a(t), R/2, I_b(t), R/2, C, V_c(t), V_B

20, @ t ≥ 0, 3V, I_a(t), I_b(t), 10, 10, $(5E-4)F$, $V_c(t)$

$$@ t ≥ 0, \quad V_c(t) = i_B(t) \cdot 10$$

(a) Given $V_c(0^-) = \dfrac{3}{4} V$

$V_c(0^+) = V_c(0^-) = \dfrac{3}{4} V$
since there is a resistor
no impulse.

$I_B(t) = C V_c'$

$∴ V_c(t) = -10 C V_c'$

Solving for V_c, $\quad V_c = C e^{-t/10 \cdot (5E-4)}$

$V_c(0) = \dfrac{3}{4} \quad ∴ \dfrac{3}{4} = C e^0 = C$

(b) $I_a(0^+) = 0$, since there is no closed loop

$∴ V_c(t) = \dfrac{3}{4} e^{\frac{-t}{10(5E-4)}}$

$I_B(t) = (5E-4) \cdot \dfrac{3}{4} \cdot \dfrac{1}{10(5E-4)} e^{-t/10(5E-4)}$

$I_b(0^+) = \dfrac{3}{40} A$

$= \dfrac{3}{40} e^{\frac{-t}{5E-4}}$

(c) $\dfrac{dV_c(t)}{dt} = \dfrac{1}{C} \cdot C \dfrac{dV_c(t)}{dt} = \dfrac{1}{C} \cdot i_B(t) = \dfrac{3 e^{\frac{-t}{5E-4}}}{40 \cdot (5E-4)} \Big|_{t=0} = \dfrac{3}{40(5E-4)} = 150 \, Vs^{-1}$
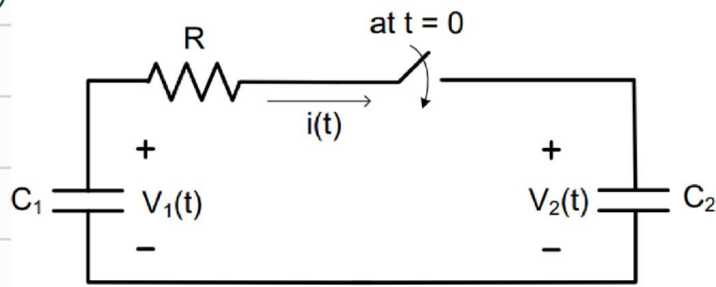
3.3 C **6 / 8**

    - 0 pts Correct

  ✓ **- 2 pts** *wrong sign*

    - 4 pts answer should be -150$$V/s$$

    - 8 pts did not answer

ili gradescope

③

$Q = CV$

at t = 0

R

$i(t)$

+
C_1 ⊣⊢ $V_1(t)$
−

+
$V_2(t)$ ⊢⊣ C_2
−

@ $t = 0^-$,

Q_1 & Q_2

∴ $Q_1 = C_1 V_1(0-)$

& $Q_2 = C_2 V_2(0-)$

KVL @ $t \geq 0$, $-V_1 + iR + V_2 = 0$

∴ $V_1 = V_2 + iR$

$\frac{1}{C_1}\int i\,dt + \frac{1}{C_2}\int i\,dt = iR$
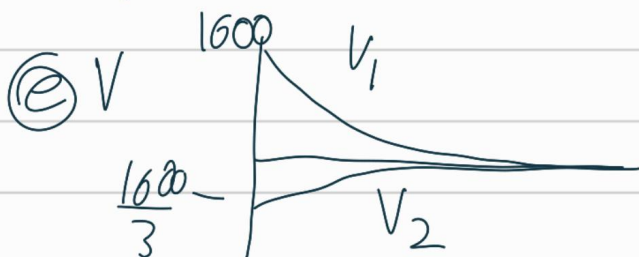
∴ $\frac{1}{C_1}\cdot i + \frac{1}{C_2}\cdot i = i'R$

ⓐ $\quad \therefore 0 = \frac{800}{3}i + 3i'$

ⓑ ∴ Time constant $= R \cdot \frac{C_1 C_2}{C_1 + C_2} = 1.125\,E9\,nS$

ⓒ $V_1(0+) = V_1(0-) = \frac{8}{5E-3} = 1600V$ $\quad V_1(\infty) = 0$

$V_2(0+) = V_2(0-) = \frac{-8}{15E-3} = -\frac{1600}{3}V$ $\quad V_2(\infty) = \partial$

$i(0+) = \frac{V_1 - V_2}{R} = 7.11A$ $\quad i(\infty) = 0$

ⓖ Like an Impulse.

ⓓ $V_1(t) = 1600\,e^{-t/1.125}$ $\quad V_2(t) = -\frac{1600}{3}e^{-t/1.125}$

ⓔ V

1600 V_1

$\frac{1600}{3}$ V_2

ⓕ $i(t) = 7.11e^{-t/1.125}$

I   7.11
0.08
0 ——— 3 ——— 0

4.1 a **2 / 2**

✓ **- 0 pts** *Correct*

- 2 pts wrong answer

4.1 a **2 / 2**

✓ **- 0 pts** *Correct*

gradescope

③

at t = 0

$Q = CV$

$$@ \ t = 0^-,$$
$$Q_1 \ \& \ Q_2$$
$$\therefore Q_1 = C_1 V_1(0-)$$
$$\& \ Q_2 = C_2 V_2(0-)$$

KVL @ $t \geq 0$, $\quad -V_1 + iR + V_2 = 0$

$$\therefore V_1 = V_2 + iR$$

$$\therefore \frac{1}{C_1}\int i \, dt + \frac{1}{C_2}\int i \, dt = iR$$

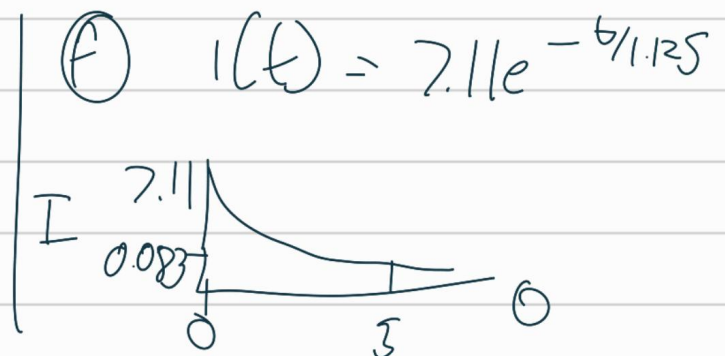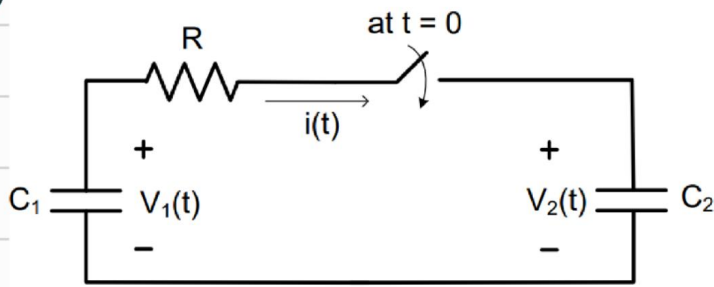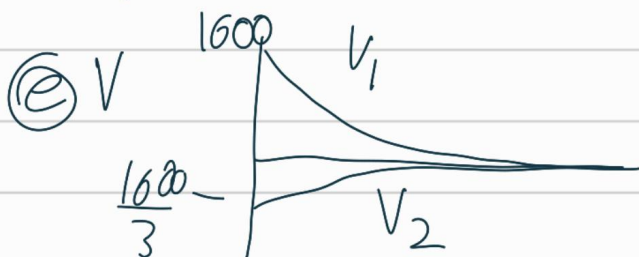$$\therefore \frac{1}{C_1} \cdot i + \frac{1}{C_2} \cdot i = i'R$$

(a)

$$\therefore 0 = \frac{800}{3} i + 3i'$$

(b) $\therefore$ Time constant $= R \cdot \dfrac{C_1 C_2}{C_1 + C_2} = 1.125 \ E9 \ nS$

(c) $V_1(0+) = V_1(0-) = \dfrac{8}{5E-3} = 1600V \qquad V_1(\infty) = 0 \qquad$ (g) Like an Impulse.

$V_2(0+) = V_2(0-) = \dfrac{-8}{15E-3} = -\dfrac{1600}{3}V \qquad V_2(\infty) = 0$

$i(0+) = \dfrac{V_1 - V_2}{R} = 7.11A \qquad i(\infty) = 0$

(d) $V_1(t) = 1600 \, e^{-t/1.125} \qquad V_2(t) = -\dfrac{1600}{3} e^{-t/1.125}$

(e) V

(f) $i(t) = 7.11 e^{-t/1.125}$

4.2 b **2 / 2**

✓ **- 0 pts** *Correct*

- 1 pts answer should be $$1.125*10^9 \text{ ns}$$

- 2 pts no answer

✓ **- 0 pts** *Correct*

- 1 pts answer should be $$1.125*10^9 \text{ ns}$$

gradescope

③

at t = 0

$Q = CV$

$$@\; t = 0^-,$$
$$Q_1 \,\&\, Q_2$$
$$\therefore Q_1 = C_1 V_1(0-)$$
$$\&\; Q_2 = C_2 V_2(0-)$$

$KVL @ t \geq 0,$ $\quad -V_1 + iR + V_2 = 0$

$$\therefore V_1 = V_2 + iR$$

$$\therefore \frac{1}{C_1}\int i\,dt + \frac{1}{C_2}\int i\,dt = iR$$

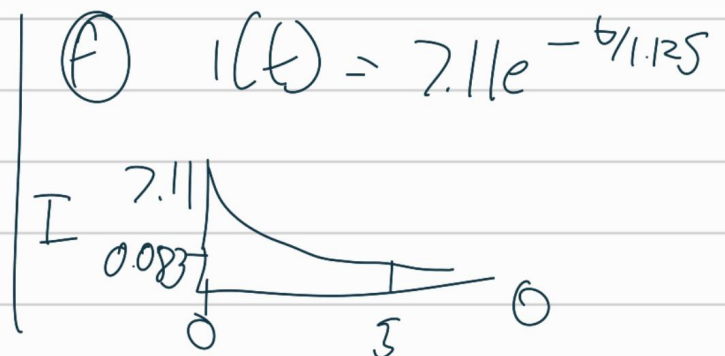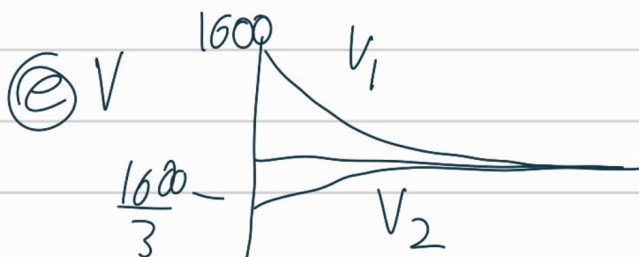$$\therefore \frac{1}{C_1}\cdot i + \frac{1}{C_2}\cdot i = i'R$$

ⓐ
$$\therefore 0 = \frac{800}{3}i + 3i'$$

ⓑ $\therefore$ Time constant $= R\cdot\dfrac{C_1 C_2}{C_1 + C_2} = 1.125\,E9\,nS$

ⓒ $V_1(0+) = V_1(0-) = \dfrac{8}{5E-3} = 1600V$ $\qquad V_1(\infty) = 0$

$V_2(0+) = V_2(0-) = \dfrac{-8}{15E-3} = -\dfrac{1600}{3}V$ $\qquad V_2(\infty) = 0$

$i(0+) = \dfrac{V_1 - V_2}{R} = 7.11A$ $\qquad i(\infty) = 0$

ⓖ Like an Impulse.

ⓓ $V_1(t) = 1600\,e^{-t/1.125}$ $\qquad V_2(t) = -\dfrac{1600}{3}\,e^{-t/1.125}$

ⓔ

ⓕ $i(t) = 7.11e^{-t/1.125}$

4.3 C **6 / 6**

✓ **- 0 pts** *Correct*

- **1 pts** $$V_1(0^+)=1600V$$

- **1 pts** $$i(0^+)=7.11A$$

- **1 pts** $$V_2(0^+)=-533.33V$$

- **1 pts** $$i(\infty)=0$$

- **1 pts** $$V_1(\infty)=0$$

- **1 pts** $$V_2(\infty)=0$$

- **6 pts** No answer

✓ **- 0 pts** *Correct*

ılıl gradescope

③

$Q = CV$

at t = 0

R

i(t)

+
C_1 $V_1(t)$
−

+
$V_2(t)$ C_2
−

@ $t = 0^-$,

Q_1 & Q_2

∴ $Q_1 = C_1 V_1(0-)$

& $Q_2 = C_2 V_2(0-)$

KVL @ $t \geq 0$, $-V_1 + iR + V_2 = 0$

∴ $V_1 = V_2 + iR$

$$\frac{1}{C_1} \int i\,dt + \frac{1}{C_2} \int i\,dt = iR$$

∴ $\frac{1}{C_1} \cdot i + \frac{1}{C_2} \cdot i = i'R$

ⓐ ∴ $0 = \frac{800}{3} i + 3i'$
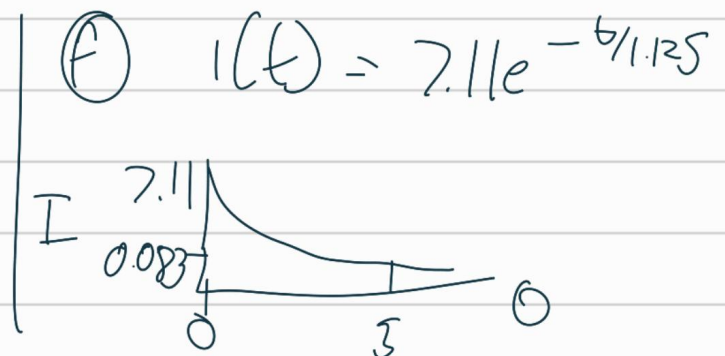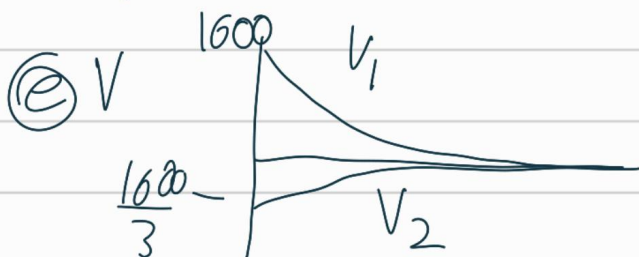
ⓑ ∴ Time constant $= R \cdot \frac{C_1 C_2}{C_1 + C_2} = 1.125 E9\,nS$

ⓒ $V_1(0+) = V_1(0-) = \frac{8}{5E-3} = 1600V$ $V_1(\infty) = 0$ ⓖ Like
$V_2(0+) = V_2(0-) = \frac{-8}{15E-3} = -\frac{1600}{3}V$ $V_2(\infty) = \partial$ an Impulse.
$i(0+) = \frac{V_1 - V_2}{R} = 7.11A$ $i(\infty) = 0$

ⓓ $V_1(t) = 1600\, e^{-t/1.125}$ $V_2(t) = -\frac{1600}{3}\, e^{-t/1.125}$

ⓔ V

1600 V_1

$\frac{1600}{3}$ V_2

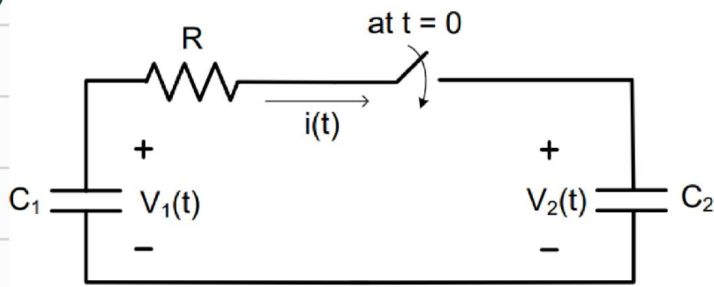ⓕ $i(t) = 7.11 e^{-t/1.125}$

I   7.11

0.08

0   3   0

✓ - 0 pts *Correct*

- 1 pts answer should be $$V_1(t)=1600e^{-8t/9}$$

- 1 pts answer should be $$V_2(t)=-533.33e^{-8t/9}$$

- 3 pts No answer

llı gradescope

③

$Q = CV$

at $t = 0$

R

$i(t)$

$+$
C_1 $V_1(t)$ $-$

$+$
$V_2(t)$ C_2 $-$

@ $t = 0^-$,

Q_1 & Q_2

$\therefore Q_1 = C_1 V_1(0-)$

& $Q_2 = C_2 V_2(0-)$

KVL @ $t \geq 0$, $\quad -V_1 + iR + V_2 = 0$

$\therefore V_1 = V_2 + iR$

$\therefore \frac{1}{C_1}\int i\,dt + \frac{1}{C_2}\int i\,dt = iR$

$\therefore \frac{1}{C_1} \cdot i + \frac{1}{C_2} \cdot i = i'R$

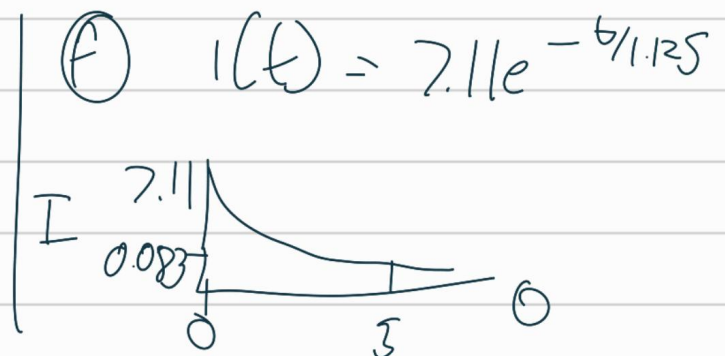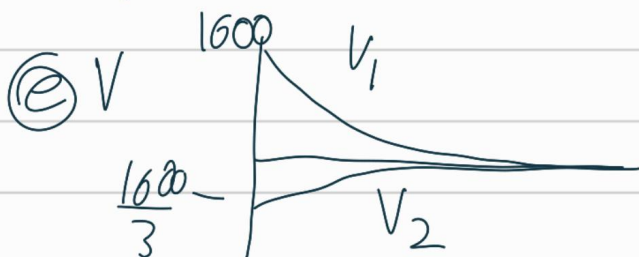ⓐ $\qquad \therefore 0 = \frac{800}{3} i + 3i'$

ⓑ $\therefore$ Time constant $= R \cdot \dfrac{C_1 C_2}{C_1 + C_2} = 1.125 \, E9 \, nS$

ⓒ $V_1(0+) = V_1(0-) = \frac{8}{5E-3} = 1600V \qquad V_1(\infty) = 0 \qquad$ ⓖ Like

$V_2(0+) = V_2(0-) = \frac{-8}{15E-3} = -\frac{1600}{3}V \qquad V_2(\infty) = 0$ $\qquad$ an Impulse.

$i(0+) = \frac{V_1 - V_2}{R} = 7.11A \qquad i(\infty) = 0$

ⓓ $V_1(t) = 1600\,e^{-t/1.125} \qquad V_2(t) = -\frac{1600}{3}\,e^{-t/1.125}$

ⓔ V

1600 V_1

$\frac{1600}{3}$ V_2

ⓕ $\quad i(t) = 7.11e^{-t/1.125}$

I $\quad$ 7.11

0.08

$0 \qquad 3 \qquad 0$

4.5 e **2 / 2**

   ✓ **- 0 pts** *Correct*

    - 1 pts V1

    - 1 pts V2

    - 2 pts No answer

   ✓ **- 0 pts** *Correct*

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③

$Q = CV$

at t = 0

$@ \ t = 0^-,$

$Q_1 \ \& \ Q_2$

$\therefore Q_1 = C_1 V_1(0-)$

$\& \ Q_2 = C_2 V_2(0-)$

$KVL @ t \geq 0, \quad -V_1 + iR + V_2 = 0$

$\therefore V_1 = V_2 + iR$

$\therefore \frac{1}{C_1}\int I \, dt + \frac{1}{C_2}\int I \, dt = iR$
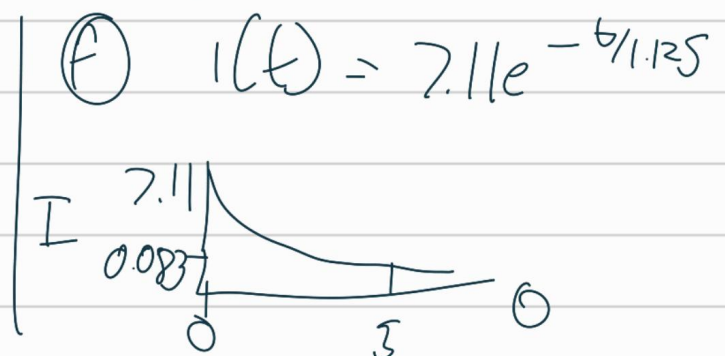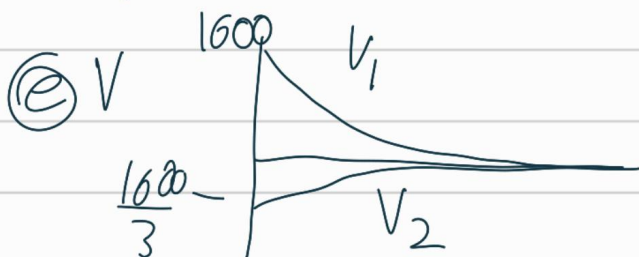
$\therefore \frac{1}{C_1} \cdot i + \frac{1}{C_2} \cdot i = i'R$

ⓐ $\therefore 0 = \frac{800}{3}i + 3i'$

ⓑ $\therefore$ Time constant $= R \cdot \dfrac{C_1 C_2}{C_1 + C_2} = 1.125 \, E9 \, nS$

ⓒ $V_1(0+) = V_1(0-) = \dfrac{8}{5E\text{-}3} = 1600 V \qquad V_1(\infty) = 0$ ⓖ Like

$V_2(0+) = V_2(0-) = \dfrac{-8}{15E\text{-}3} = -\dfrac{1600}{3} V \qquad V_2(\infty) = 0$ an Impulse.

$I(0+) = \dfrac{V_1 - V_2}{R} = 7.11 A \qquad\qquad I(\infty) = 0$

ⓓ $V_1(t) = 1600 \, e^{-t/1.125} \qquad V_2(t) = -\dfrac{1600}{3} e^{-t/1.125}$

ⓔ V

$\dfrac{1600}{3}$

V_1

V_2

ⓕ $I(t) = 7.11 e^{-t/1.125}$

I

7.11

0.08

0

3

0

4.6 f **2 / 2**

✓ **- 0 pts** *Correct*

- 2 pts No answer

4.6 f **2 / 2**

✓ **- 0 pts** *Correct*

③

at t = 0

$Q = CV$

@ $t = 0^-$,

$Q_1 \& Q_2$

$\therefore Q_1 = C_1 V_1(0-)$

$\& Q_2 = C_2 V_2(0-)$

KVL @ $t \geq 0$, $-V_1 + iR + V_2 = 0$

$\therefore V_1 = V_2 + iR$

$\therefore \frac{1}{C_1}\int i \, dt + \frac{1}{C_2}\int i \, dt = iR$

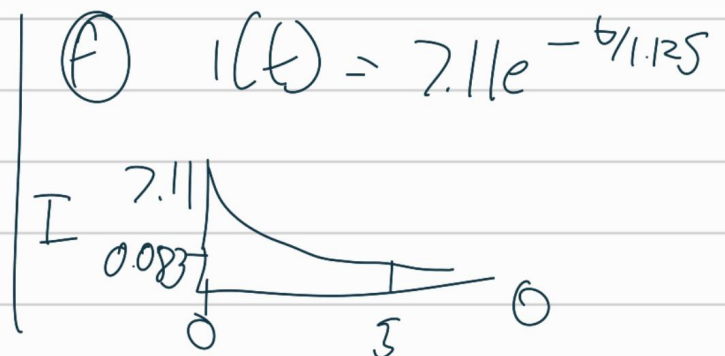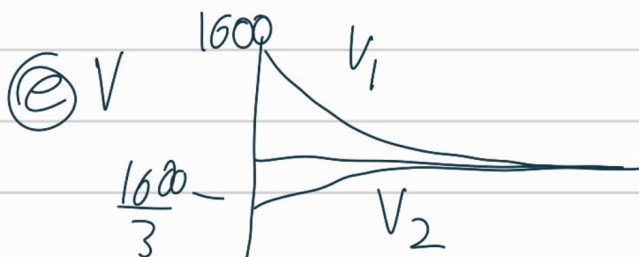$\therefore \frac{1}{C_1} \cdot i + \frac{1}{C_2} \cdot i = i'R$

ⓐ $\therefore 0 = \frac{800}{3} i + 3 i'$

ⓑ $\therefore$ Time constant $= R \cdot \frac{C_1 C_2}{C_1 + C_2} = 1.125 \, E9 \, nS$

ⓒ $V_1(0+) = V_1(0-) = \frac{8}{5E-3} = 1600V$ $V_1(\infty) = 0$

$V_2(0+) = V_2(0-) = \frac{-8}{15E-3} = -\frac{1600}{3}V$ $V_2(\infty) = 0$

$i(0+) = \frac{V_1 - V_2}{R} = 7.11 A$ $i(\infty) = 0$

ⓖ Like an Impulse.

ⓓ $V_1(t) = 1600 \, e^{-t/1.125}$ $V_2(t) = -\frac{1600}{3} e^{-t/1.125}$

ⓔ V

1600 V_1

$\frac{1600}{3}$ V_2

ⓕ $i(t) = 7.11 e^{-t/1.125}$

I 7.11

0.08

0   3   0

4.7 g **3 / 3**

✓ **- 0 pts** *Correct*

- 1 pts partially incorrect

- 3 pts did not answer

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⑤

$$L\dot{i} = V$$
$$C\dot{V} = i$$
$$V = \frac{1}{C}\int i\, dt$$

ⓐ Steady State: $V_c = V_0$

ⓐ $V_c(0-) = V_0$, & $V_c(0+) = V_c$

$$0 = \frac{1}{C}\int i\, dt + iR_2 + L\frac{di}{dt}$$
$$0 = \frac{1}{C}i + i'R_2 + Li''$$

ⓑ $i(0+) = i(0-) = 0$ ✓

$$\left.\frac{di(t)}{d(t)}\right|_{t=0} = \frac{V_c(0+)}{L} = 2E8$$

$$0 = \frac{1}{C}i(0+) + R_2\frac{di}{dt}\Big|_{t=0} + L\frac{d^2 i}{dt^2}\Big|_{t=0}$$

$$0 + 40(2E8) + 10E\text{-}9\, i'' = 0$$
$$\therefore i'' = -80\,E16$$
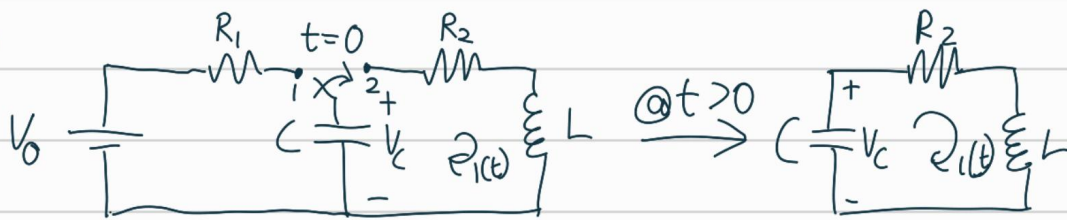
5.1 a **5 / 5**

   ✓ **- 0 pts** *Correct*

     - 1 pts partially incorrect

     - 5 pts did not answer

⑤

$Li' = V$
$CV' = i$
$V = \frac{1}{C}\int i\,dt$

ⓐ Steady State: $V_C = V_0$

ⓐ $V_C(0-) = V_0$, & $V_C(0+) = V_C$

$0 = \frac{1}{C}\int i\,dt + i R_2 + L\frac{di}{dt}$

$0 = \frac{1}{C}i + i'R_2 + Li''$

ⓑ $i(0+) = i(0-) = 0$ ✓

$\left.\frac{di(t)}{d(t)}\right|_{t=0} = \frac{V_C(0+)}{L} = 2E8$

$0 = \frac{1}{C}i(0+) + R_2\left.\frac{di}{dt}\right|_{t=0} + L\left.\frac{d^2i}{dt^2}\right|_{t=0}$

$0 + 40(2E8) + 10E-9\, i'' = 0$

$\therefore i'' = -80\,E16$

5.2 b **10 / 10**

  ✓ **- 0 pts** *Correct*

    - 2 pts $$2*10^8 (A/s)$$

    - 2 pts $$-8*10^{17} (A/s^2)$$

    - 10 pts did not answer

  ✓ **- 0 pts** *Correct*
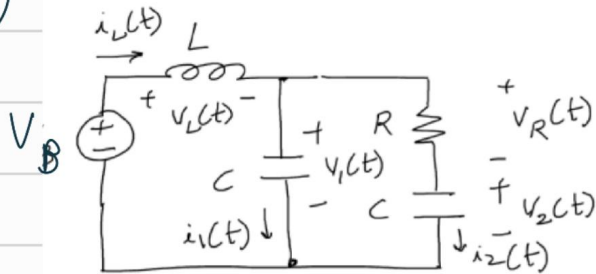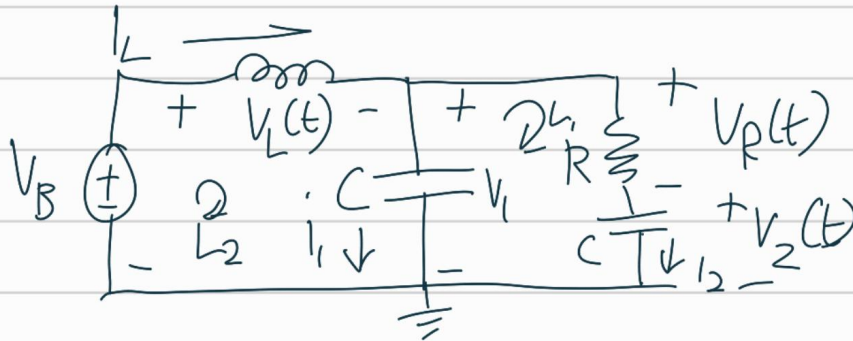
ıllı gradescope

⑥

Figure 6.

$$V = \frac{1}{C}\int i\, dt$$
$$i = V$$
$$i = \frac{1}{L}\int V\, dt$$

@ L_1 : $\quad V_R(t) + V_2(t) = V_1(t) \longrightarrow i_2 R + \frac{1}{C}\int i_2 dt = \frac{1}{C}\int i_1 dt$

@ L_2 : $\quad V_B(t) = V_L(t) + V_1(t) \longrightarrow V_B = L i_L' + R i_2(t) + \frac{1}{C}\int i_2 dt$

@ KCL : $\quad i_L(t) = i_1(t) + i_2(t)$

ⓐ $i_1(0+) = i_L(0+) - i_R(0+) = 4mA - \frac{-2}{1000} = 6 mA$

$$V_B = V_L + V_1 \qquad \qquad -\frac{dV_L}{dt} = \frac{i}{C} = \frac{6mA}{1nF} = 6E6 \, V_s^{-1}$$

✓ **- 0 pts** *Correct*

- 1 pts $$V\_R(t)=-2V$$

- 1 pts $$i\_1(t=0^+)=6mA$$

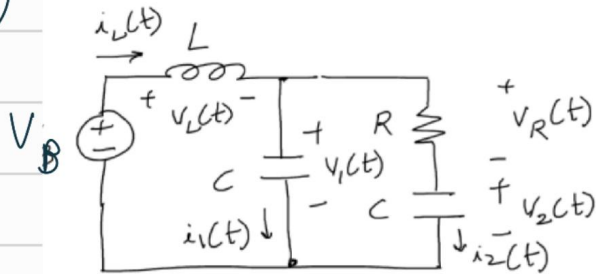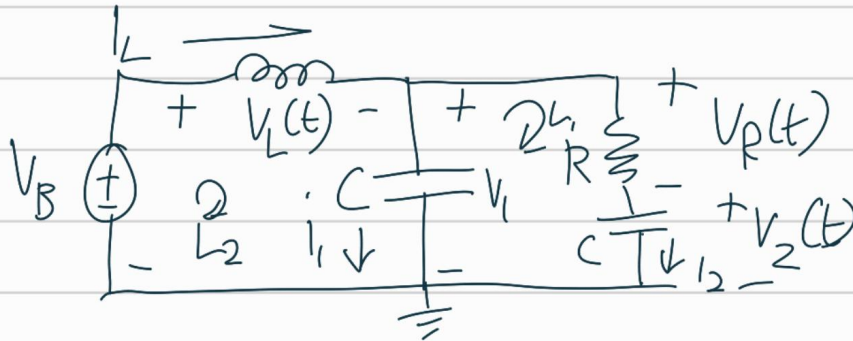**- 4 pts** did not answer this question

⑥

Figure 6.

$$V = \frac{1}{C}\int i\,dt$$
$$i = V$$
$$i = \frac{1}{L}\int V\,dt$$

@ L_1 : $V_R(t) + V_2(t) = V_1(t) \longrightarrow i_2 R + \frac{1}{C}\int i_2\,dt = \frac{1}{C}\int i_1\,dt$

@ L_2 : $V_B(t) = V_L(t) + V_1(t) \longrightarrow V_B = L i_L' + R i_2(t) + \frac{1}{C}\int i_2\,dt$

@ KCL : $i_L(t) = i_1(t) + i_2(t)$

ⓐ $i_1(0+) = i_L(0+) - i_R(0+) = 4mA - \frac{-2}{1000} = 6\,mA$

$$V_B = V_L + V_1 \qquad\qquad -\frac{dV_L}{dt} = \frac{i}{C} = \frac{6mA}{1nF} = 6E6\,Vs^{-1}$$

6.2 b **5.5 / 6**

   - 0 pts Correct

   ✓ **- 0.5 pts** *wrong sign*

   - 1 pts answer should be $$-6*10^6(V/s)$$

   - 6 pts No answer

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