SCHOOL OF ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING

NETWORKS 4_

Week C_

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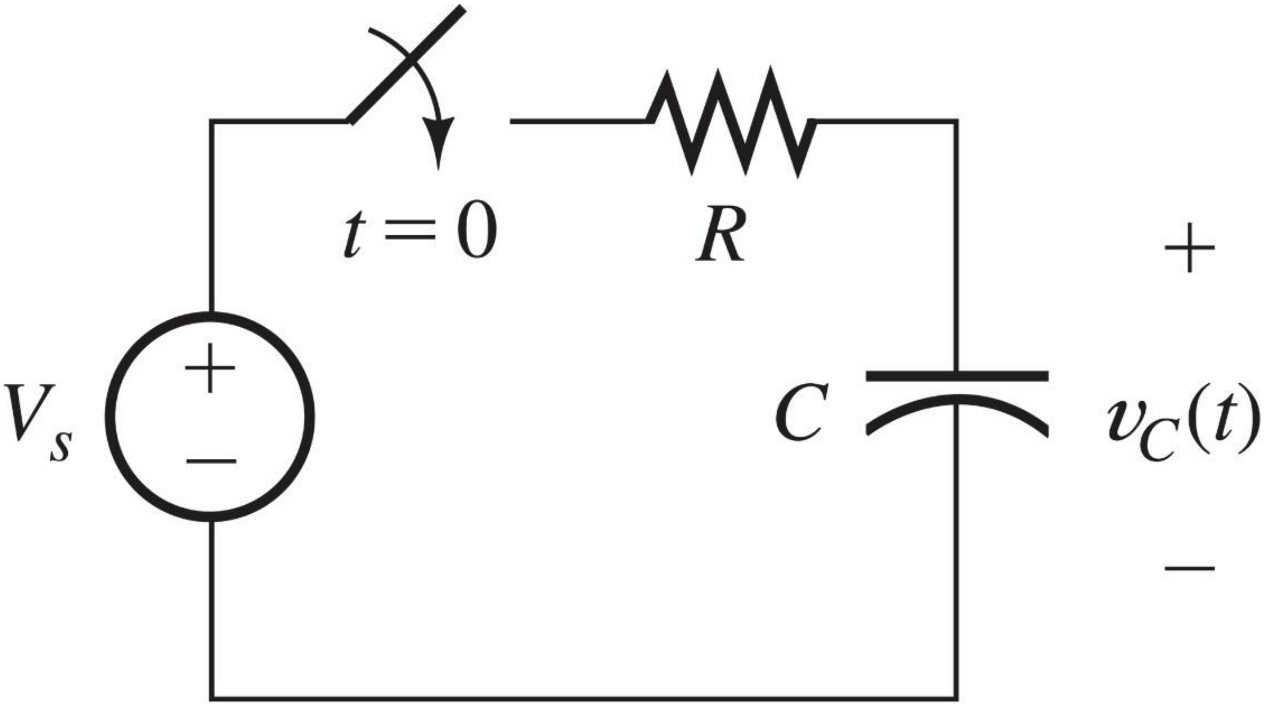
NET4 PROGRAM BY WEEK

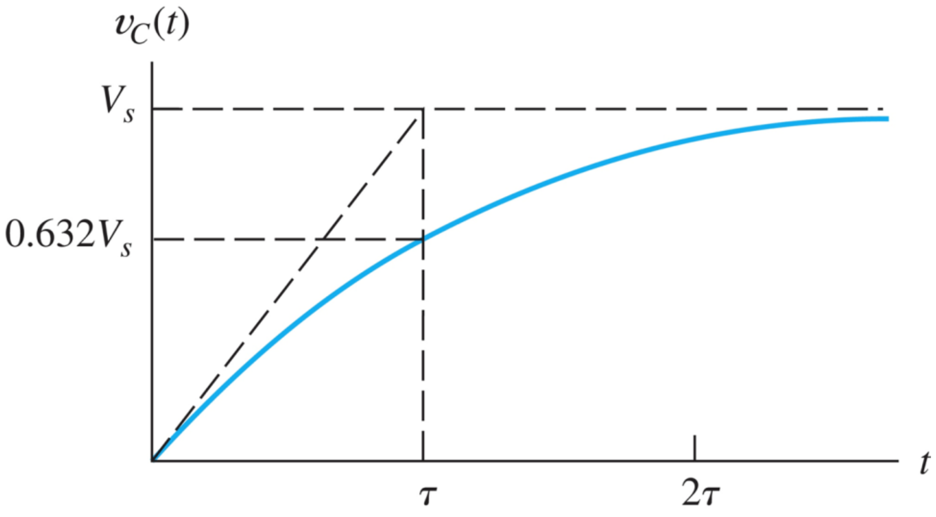
1. 1^{st} order RC networks – discharging – DC source
2. 1^{st} order RC networks – charging –DC source
3. RL networks – Steady-state DC
4. RL networks – Switched DC source
5. RC & RL networks – complementary solution
6. <spare week>
7. Sample Exam

CAPACITOR & INDUCTOR RELATIONS

	Capacitor	Inductor
Voltage	$v = \frac{1}{C}\int i(t)dt$	$v = L\frac{di}{dt}$
Current	$i = C\frac{dv}{dt}$	$i = \frac{1}{L}\int v(t)dt$
Power	$P(t) = v(t) \cdot i(t)$	
Energy	$W(t) = \frac{1}{2}Cv^2(t)$	$W(t) = \frac{1}{2}Li^2(t)$
Energy stored in:	Electric field	Magnetic field

WEEK B: CHARGING A CAPACITOR





$$C\frac{dv_C(t)}{dt} + \frac{v_C(t) - V_s}{R} = 0$$

$$v_C(t) = V_s - V_s e^{-t/\tau}$$

$$\tau = RC$$

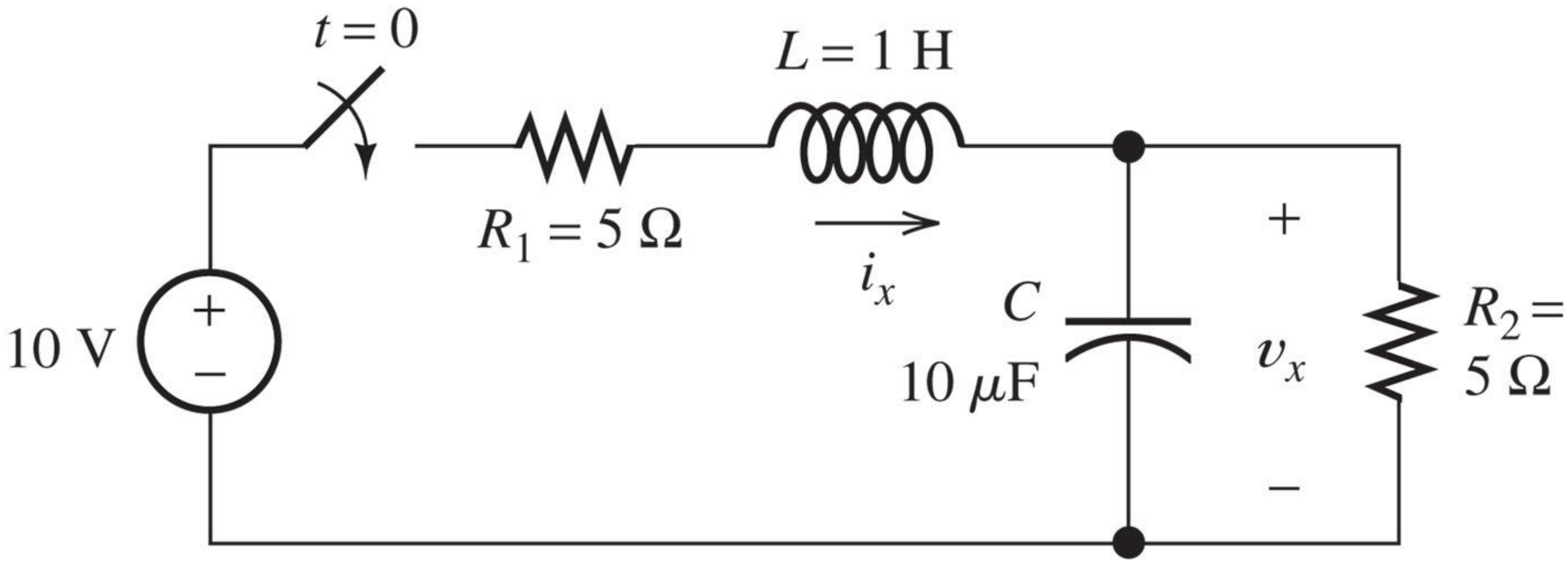
STEADY STATE

- Stable (steady) situation
- (at $t = \infty$)

- DC Steady State: circuit stabilises to fixed (DC) values
  - Inductor: consider to be a short circuit
  - Capacitor: consider to be open (i.e. no connection)

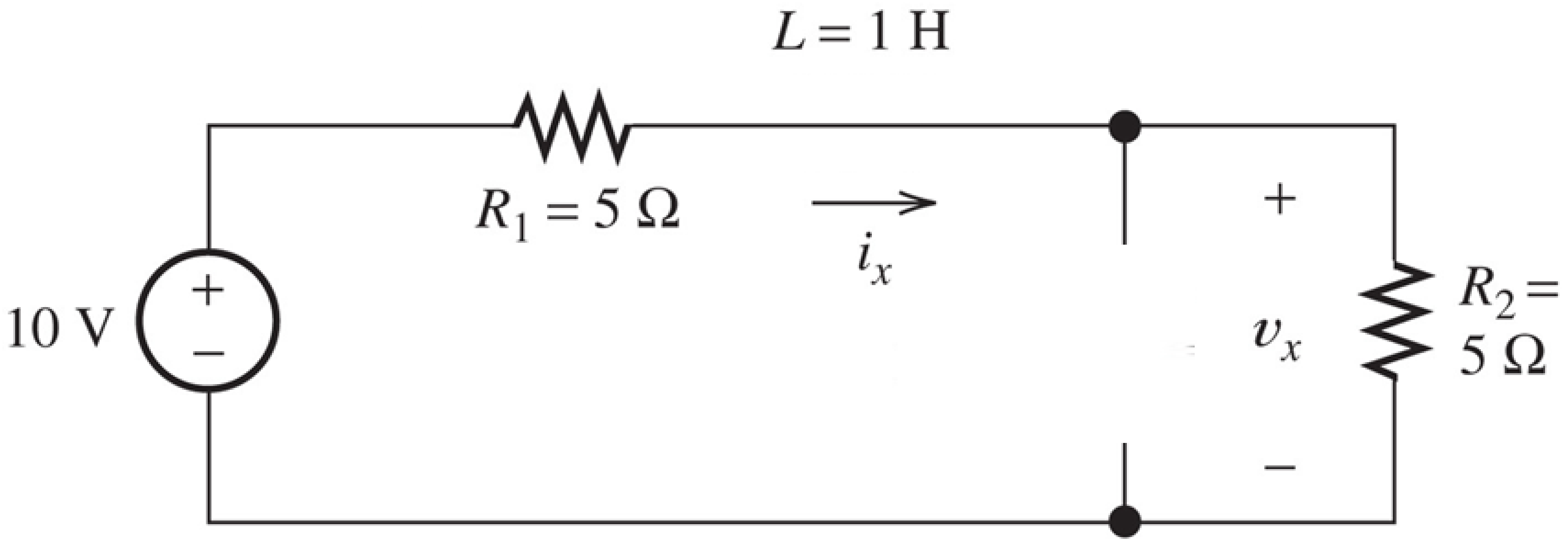
EXAMPLE: DC STEADY STATE

At $t = 0$ we close the switch



EXAMPLE SOLVED:

Equivalent circuit at $t = \infty$

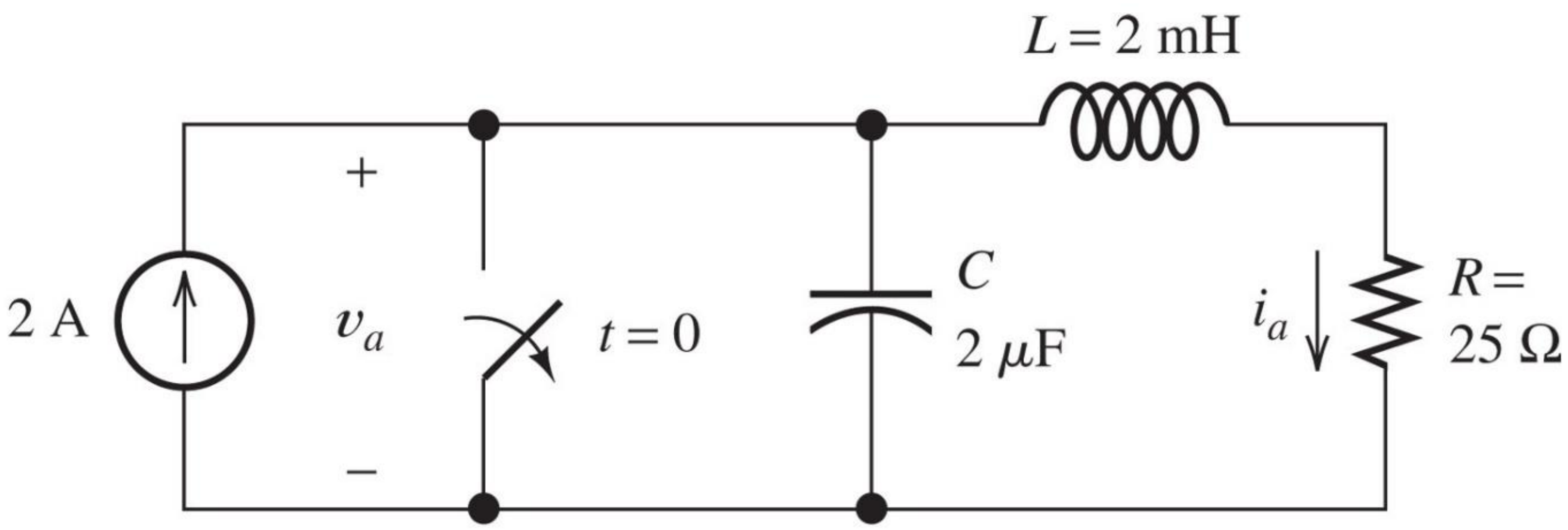


$i_x = V / (R_1 + R_2) = 1$ A

$v_x = R_2 / (R_1 + R_2) \times V = 5$ V (voltage division)

EXERCISE (1)

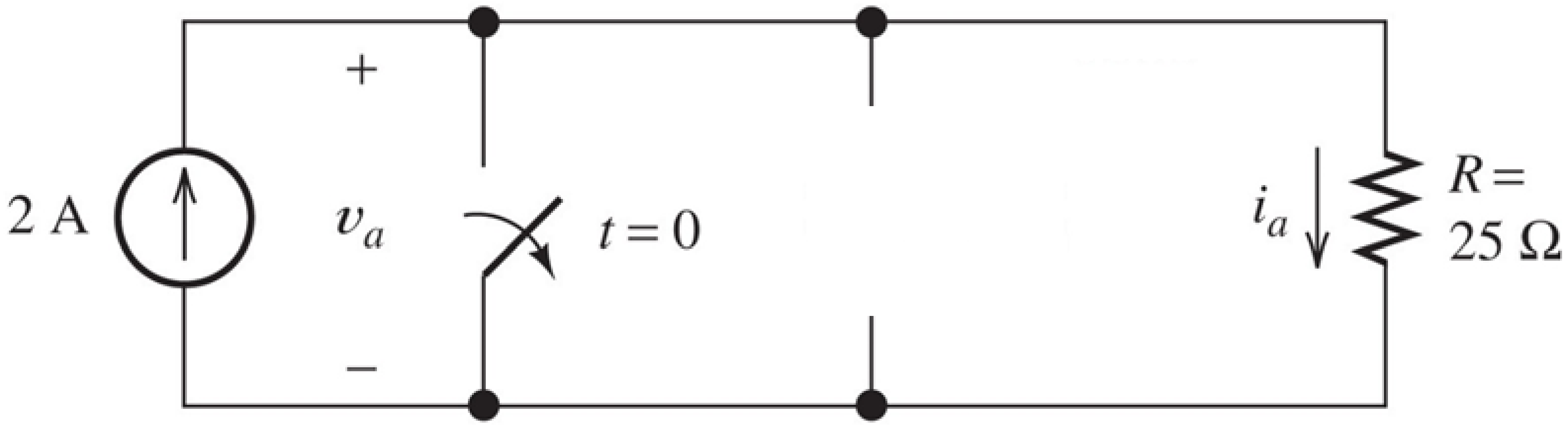
Find the DC Steady-state values of v_a and i_a:



(a)

EXERCISE (1) SOLVED

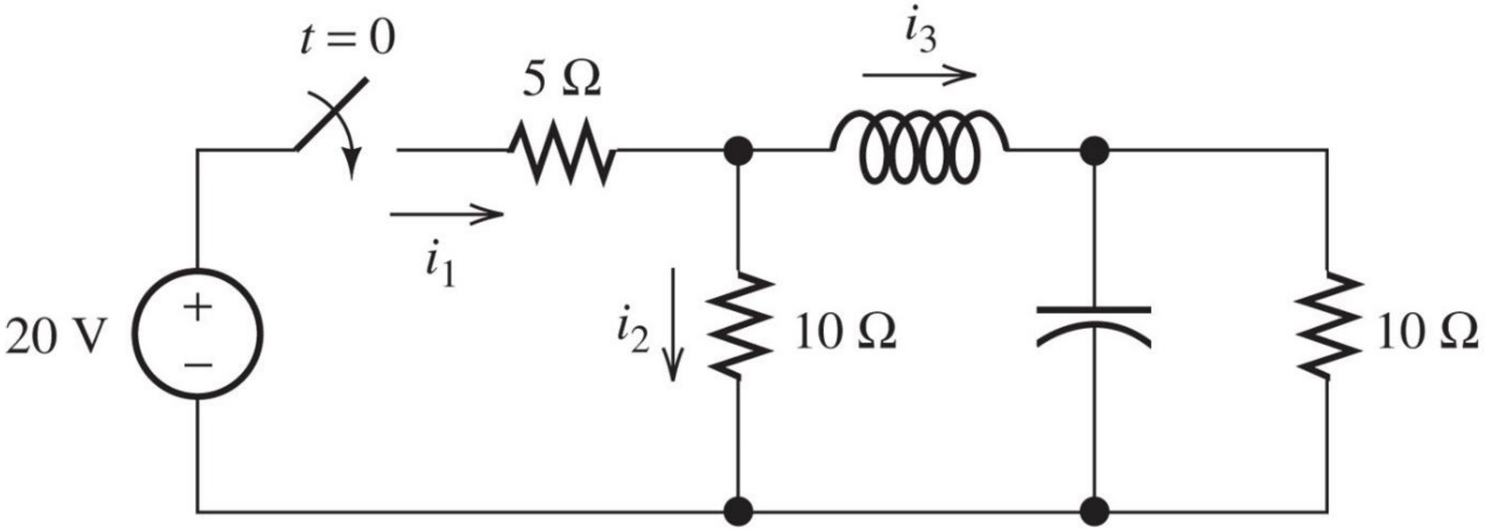
Find the DC Steady-state values of v_a and i_a:



(a)

EXERCISE (2)

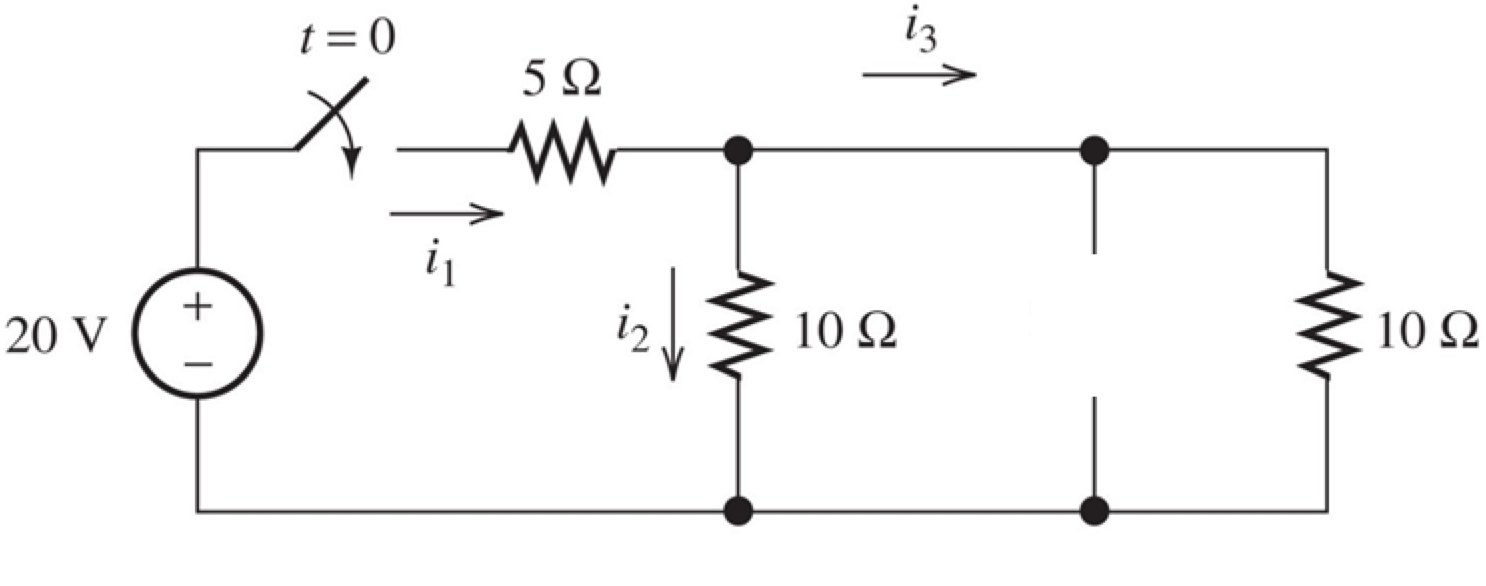
Find the DC Steady-state values of i_1 and i_2:



(b)

EXERCISE (2) SOLVED

Find the DC Steady-state values of i_1 and i_2:



(b)

PROBLEMS FOR THIS WEEK

- P4.22
- P4.23
- P4.25
- P4.28
- P4.30