

Mid-session exam

1)



$$= 6 \parallel 3 = 2$$

$=$



$$= 5 + 2 + 4 \parallel 6 = 9.4 \Omega$$

2)

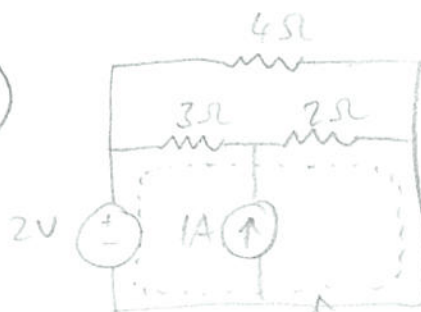
$$\frac{v_1}{2} + \frac{v_1 - v_2}{4} = 1 \quad (\text{node 1})$$

$$\frac{v_2 - v_1}{4} + \frac{v_2}{1} + \frac{v_3}{5} + \frac{v_3 - v_4}{3} = 0 \quad (\text{supernode})$$

$$v_2 - v_3 = 1$$

(supernode voltage equation)

3)



supermesh

$$3(i_1 - i_3) + 2(i_2 - i_3) = 2 \quad (1) \quad (\text{supermesh})$$

$$i_2 - i_1 = 1 \quad (2) \quad (\text{KCL bottom node})$$

$$4i_3 + 2(i_3 - i_2) + 3(i_3 - i_1) = 0 \quad (\text{top mesh})$$

$$9i_3 - 2i_2 - 3i_1 = 0 \quad (3)$$

$$(1) \rightarrow 3i_1 + 2i_2 - 5i_3 = 2 \quad (4)$$

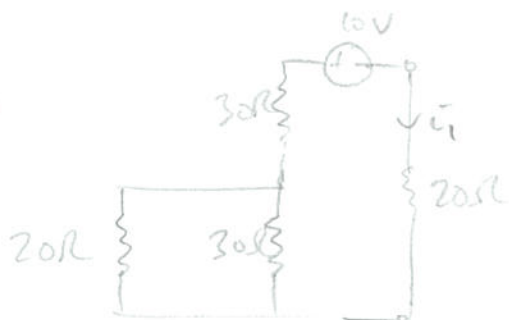
$$(3) + (4) \rightarrow 4i_3 = 2 \quad i_3 = 0.5 \text{ A}$$

$$(3) \rightarrow 2i_2 + 3i_1 = 4.5 \quad (5)$$

$$(5) + 3 \times (2) \rightarrow 5i_2 = 7.5 \quad i_2 = 1.5 \text{ A}$$

$$(2) \rightarrow i_1 = i_2 - 1 = 0.5 \text{ A}$$

4) a)



$$-i_1 = \frac{10}{30 + 20 \parallel (30 + 20)} = \frac{10}{62} \quad i_1 = -0.16$$

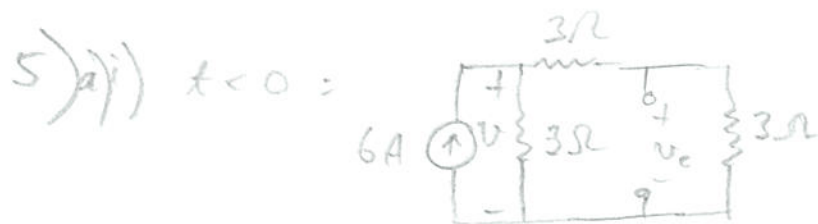
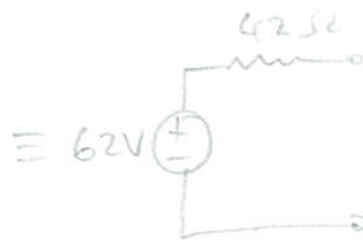
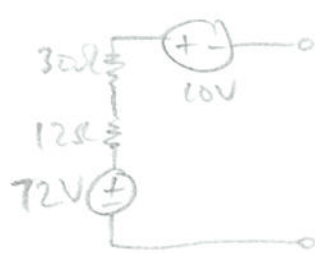


$$v = 6 \text{ A} \cdot (20 \parallel 30 \parallel (30 + 20)) = 6 \times 9.68$$

$$i_2 = \frac{v}{30 + 20} = 1.16 \text{ A}$$

$$i = i_1 + i_2 = 1 \text{ A}$$

4) b)



$$v_c(0^+) = 6V$$

$$v = 6A \cdot 3 \parallel (3+3)$$

$$= 12V$$

$$v_c = \frac{3}{3+3} \cdot 12 = 6V$$

ii) $t \rightarrow \infty$: $v_c(t) \rightarrow 0$

b) $v_c(t) = v_{c,final} + (v_{c,initial} - v_{c,final})e^{-\frac{t}{\tau}}$

$$\tau = 3 \parallel (3+3) \cdot (0.1F) = 0.2$$

$$v_c(t) = 0 + (6 - 0)e^{-\frac{t}{0.2}} V$$

$$= 6e^{-\frac{t}{0.2}} V$$