

## Midterm Examination

**Notice:** Please turn off any types of handheld devices, and leave them far from reach. Use only standalone calculators for calculation if it is needed. The examination takes 100 minutes. 只需繳答案紙，題目紙請同學保留。

1. (11%) For Fig. 1, the node voltages are  $v_a = 7V$  and  $v_b = 10V$ . Determine the values of the current source  $i_s$ , and the resistance  $R$ .

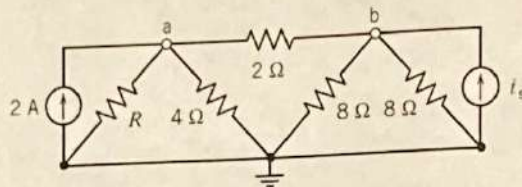


Fig. 1

2. (11%) Determine the values of node voltages  $v_1$ ,  $v_2$ , and  $v_3$  of the circuit shown in Fig.

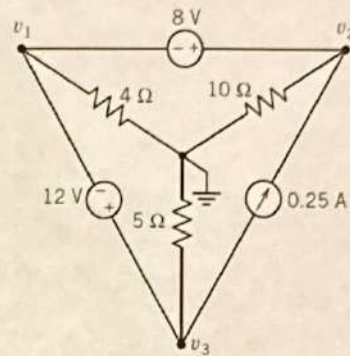


Fig. 2

3. (12%) The voltages  $v_1$ ,  $v_2$ ,  $v_3$ , and  $v_4$  in Fig. 3 are the node voltages corresponding to node ①, ②, ③, and ④. Determine the values of the gains of the dependent sources,  $A$  and  $B$ , and the resistance  $R_1$  while  $v_1 = 10V$ ;  $v_2 = 75V$ ;  $v_3 = 15V$ ; and  $v_4 = 22.5V$ .

4. (11%) Find the current of  $i_1$  of the circuit in Fig. 4.

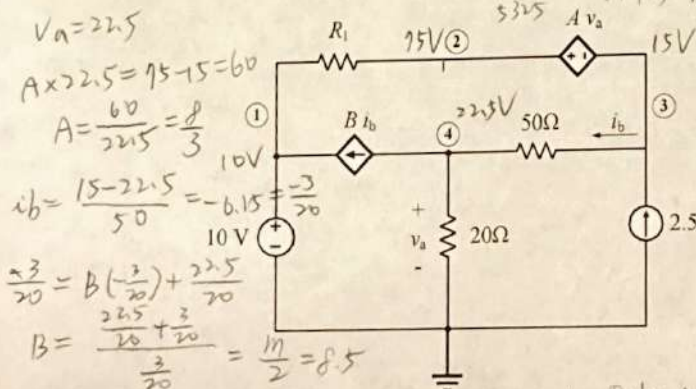


Fig. 3

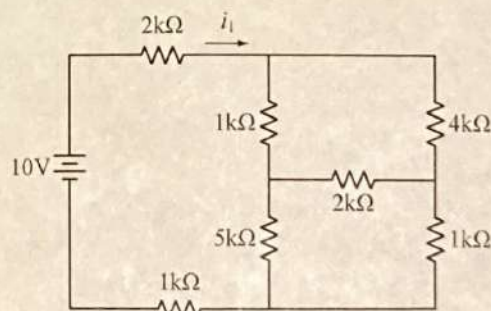


Fig. 4

5. (11%) Find the value of  $i_b$  of the circuit in Fig. 5.

6. (11%) Determine the values of node voltages  $v_1$  and  $v_2$  for the circuit in Fig. 6 by mesh analysis.

$$\frac{3.8}{13.95} = 0.2208$$

$$\frac{-2464}{31} = -79.4837$$

$$\frac{3.8}{93} = 0.0408$$

$$\begin{aligned} v_a &= 22.5 \\ A \times 22.5 &= 75 - 15 = 60 \\ A &= \frac{60}{22.5} = \frac{8}{3} \\ i_b &= \frac{15 - 22.5}{50} = -0.15 = -\frac{3}{20} \\ \frac{-3}{20} &= B \left( \frac{-3}{20} \right) + \frac{22.5}{20} \\ B &= \frac{\frac{22.5}{20} + \frac{3}{20}}{\frac{3}{20}} = \frac{17}{2} = 8.5 \\ \frac{15 - 10}{R} + \left( \frac{-3}{20} \right) &= 2.5 \\ \frac{5}{R} &= 2.65 \\ R &= \frac{1300}{65} \end{aligned}$$

$$\frac{-1}{14.01} = -0.07135 \text{ mA}$$

$$\begin{aligned}
 5 + 10\lambda b &= 20\lambda(x - 10\lambda b) \\
 20\lambda x - 210\lambda b &= 5 \\
 10\lambda(x - 9\lambda b) + 5 + 10\lambda b &= 10 \\
 10\lambda x - 90\lambda b + 5 + 10\lambda b &= 10 \\
 10\lambda x - 80\lambda b &= 5
 \end{aligned}$$

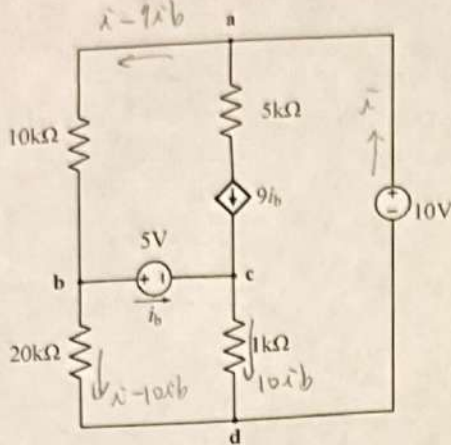


Fig. 5

$$\begin{aligned}
 9\lambda_1 + 5(\lambda_1 + \lambda_3) + 6(\lambda_1 - \lambda_2) &= 28 \\
 15\lambda_1 - 6\lambda_2 + 5\lambda_3 &= 28
 \end{aligned}$$

$$V_3 = 5\lambda_3 = 15V_1$$

$$\lambda_3 = 3V_1$$

$$V_2 = 6(-\lambda_2) = -24V_1 = -24 \times (15V_1) = -360V_1$$

$$\lambda_2 = 4V_3$$

$$= 60V_1$$

$$15\left(\frac{30 - V_1}{4}\right) = 6 \times 60V_1 + 5 \times 3V_1$$

$$105 - \frac{15}{4}V_1 = 360V_1 + 15V_1$$

$$129.5 = \frac{15}{4}V_1 + 375V_1$$

$$V_1 = 9.9$$

$$V_1 = \frac{308}{129.5}$$

$$0.22078$$

$$V_2 = -79.48V$$

$$V_3 = 3.0118$$

$$4\lambda_1 + V_1 = 28$$

$$\lambda_1 = \frac{28 - V_1}{4}$$

Fig. 6

7. (11%) Find the value of  $i_x$  in the circuit in Fig. 7.

8. (11%) Determine the values of the mesh currents  $i_1$ ,  $i_2$ , and  $i_3$  presented in Fig. 8 by mesh method.

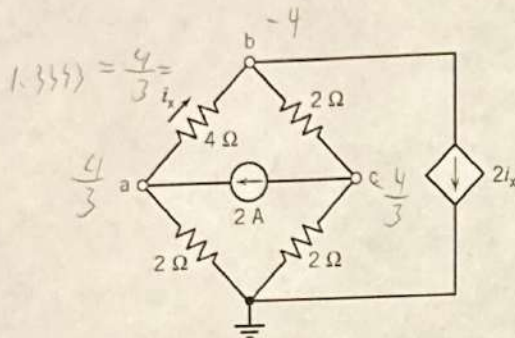


Fig. 7

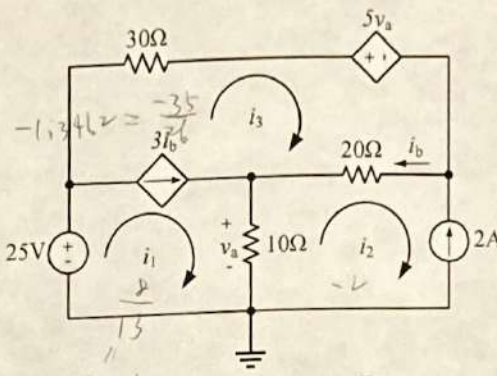


Fig. 8

9. (11%) Find  $v_o$  using source transformation if  $i = 0.5A$  in the circuit of Fig. 9.

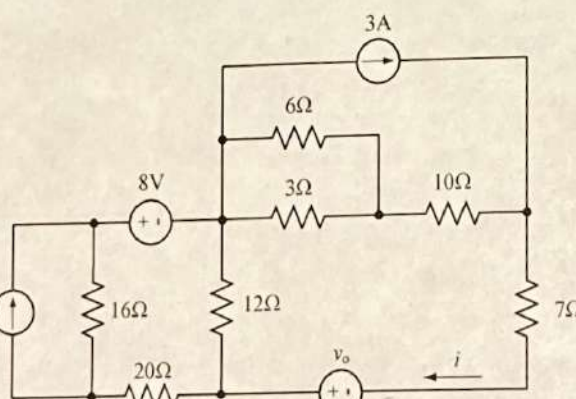
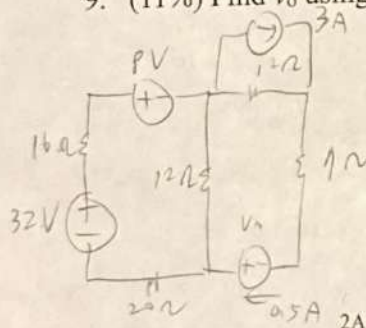


Fig. 9

$$\begin{aligned}
 19 \times 0.5 &= \frac{7}{2} + V_o + 36 \\
 \frac{19}{2} - \frac{3}{2} - 36 &= V_o \\
 2 \times 36 - V_o &= -28V
 \end{aligned}$$

$$V_o = -28V$$