Benha University | **1st Term 2014-2015** تخلفات

Benha Faculty of Engineering | **Electrical Department**

Electrical Engineering and Circuit Analysis(a) (E1101) | **1st Year Electrical**

Dr.Wael Abdel-Rahman Mohamed | **Time: 3 Hrs**

Exam with model Answer

Question (1): [10 Marks]

Find the resistance seen by the ideal voltage source in the circuit in Fig.1.

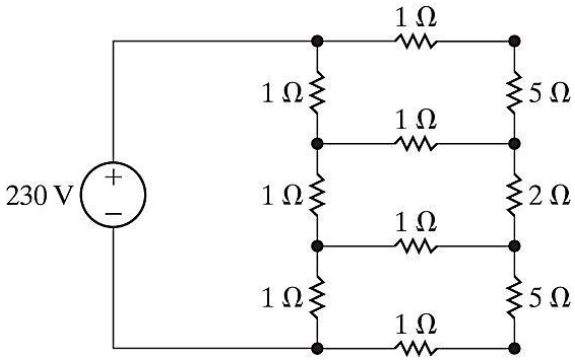


Fig.1

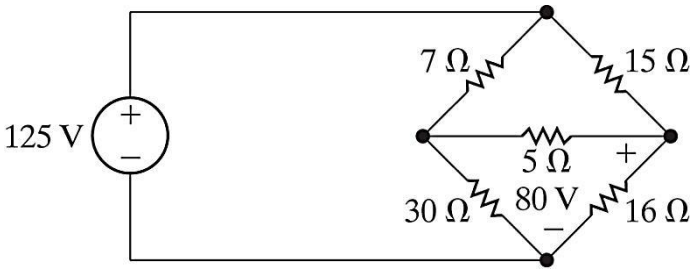
Use delta to star transformation then parallel and series combinations to find the total resistance.

Final answer is R_{eq}= 2.42 Ω.

Question (2): [10 Marks]

The voltage across the 16 Ω resistor in the circuit in Fig.2 is 80 V, positive at the upper terminal. Find the voltage across the 15 Ω resistor.

Fig.2→



The two terminal voltages of 15 Ω resistor are known, they are 125 V and 80 V. the voltage drop on 15 Ω resistor is 125 – 80 = 45 V

Question (3): **[10 Marks]**

Use the node-voltage method to find v_1 , v_2 and v_3 in the circuit in Fig.3.

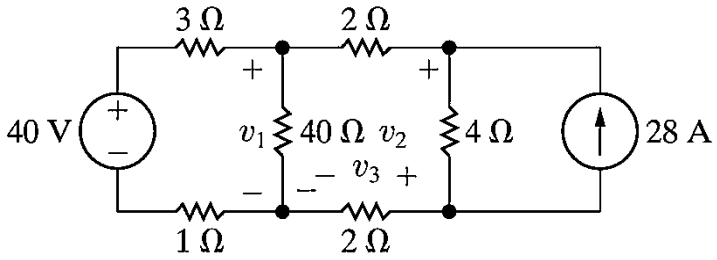
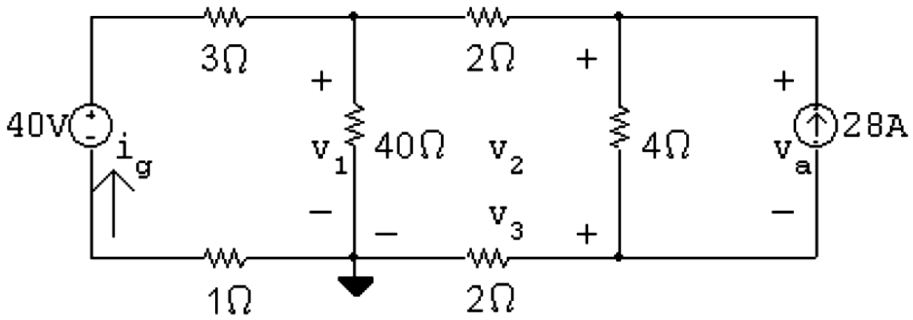


Fig.3



$$\frac{v_1}{40} + \frac{v_1 - 40}{4} + \frac{v_1 - v_2}{2} = 0 \qquad \text{so} \qquad 31v_1 - 20v_2 + 0v_3 = 400$$

$$\frac{v_2 - v_1}{2} + \frac{v_2 - v_3}{4} - 28 = 0 \qquad \text{so} \qquad -2v_1 + 3v_2 - v_3 = 112$$

$$\frac{v_3}{2} + \frac{v_3 - v_2}{4} + 28 = 0 \qquad \text{so} \qquad 0v_1 - v_2 + 3v_3 = -112$$

Solving, $v_1 = 60$ V; $\quad v_2 = 73$ V; $\quad v_3 = -13$ V,

Question (4): [10 Marks]

Use the mesh-current method to find the power developed in the dependent voltage source.

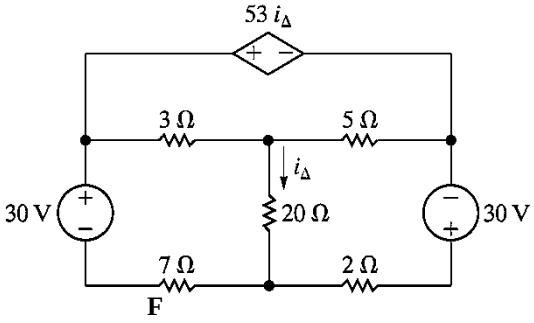
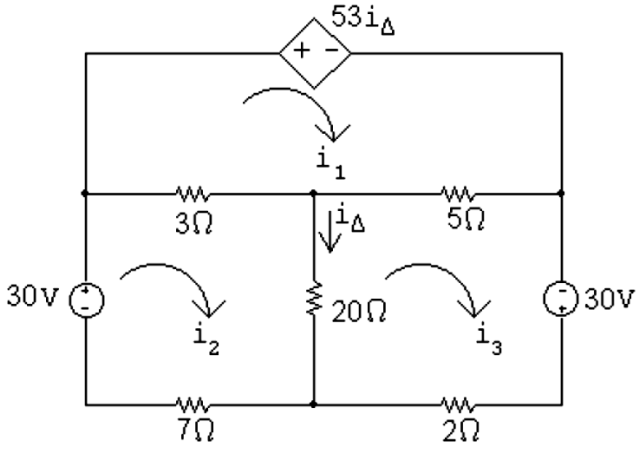


fig.4



Mesh equations:

$$53i_\Delta + 8i_1 - 3i_2 - 5i_3 = 0$$

$$0i_\Delta - 3i_1 + 30i_2 - 20i_3 = 30$$

$$0i_\Delta - 5i_1 - 20i_2 + 27i_3 = 30$$

Constraint equations:

$$i_\Delta = i_2 - i_3$$

Solving, $i_1 = 110$ A; $i_2 = 52$ A; $i_3 = 60$ A; $i_\Delta = -8$ A

$$p_{\text{depsource}} = 53i_\Delta i_1 = (53)(-8)(110) = -46{,}640 \text{ W}$$

Therefore, the dependent source is developing 46,640 W.

Question (5): **[10 Marks]**

Use the principle of superposition to find the current i_o in the circuit shown in Fig.5.

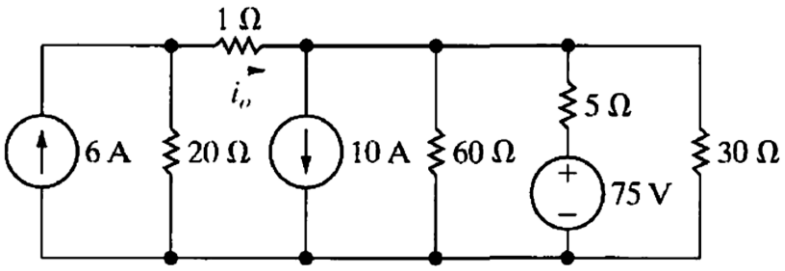
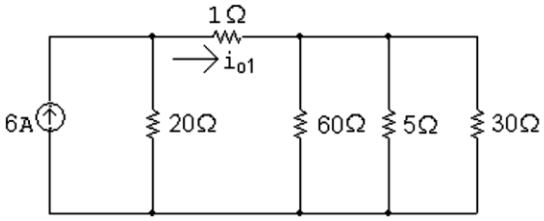


Fig.5

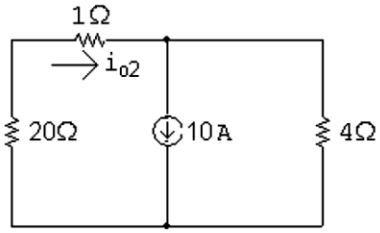
6 A source:



$$30\,\Omega \| 5\,\Omega \| 60\,\Omega = 4\,\Omega$$

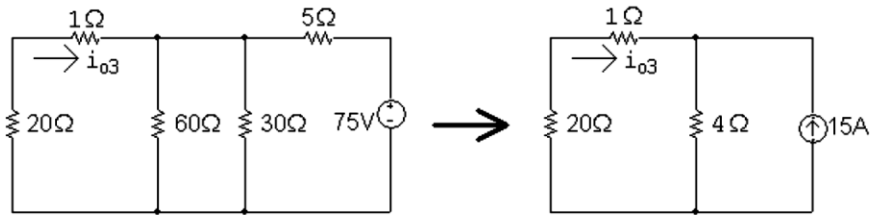
$$\therefore \quad i_{o1} = \frac{20}{20+5}(6) = 4.8 \text{ A}$$

10 A source:



$$i_{o2} = \frac{4}{25}(10) = 1.6 \text{ A}$$

75 V source:



$$i_{o3} = -\frac{4}{25}(15) = -2.4 \text{ A}$$

$$i_o = i_{o1} + i_{o2} + i_{o3} = 4.8 + 1.6 - 2.4 = 4 \text{ A}$$

Question (6): **[10 Marks]**

In the circuit shown in Fig.6, find v_o when v_g equals 4v.

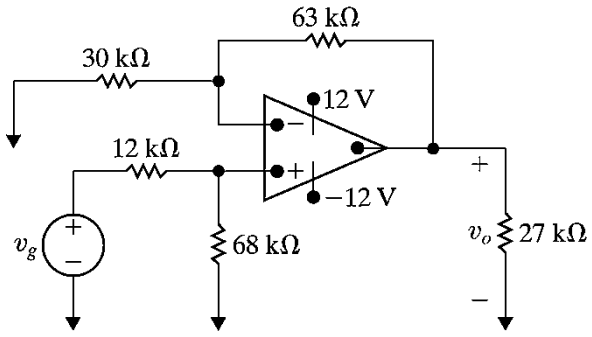


Fig.6

$$v_p = v_n = \frac{68}{80} v_g = 0.85 v_g$$

$$\therefore \quad \frac{0.85 v_g}{30{,}000} + \frac{0.85 v_g - v_o}{63{,}000} = 0;$$

$$\therefore \quad v_o = 2.635 v_g = 2.635(4), \quad v_o = 10.54 \text{ V}$$

With best wishes