1.

$$\frac{60\cdot 5}{1.602\cdot 10^{-19}} = 1.873\times 10^{21}$$ electrons

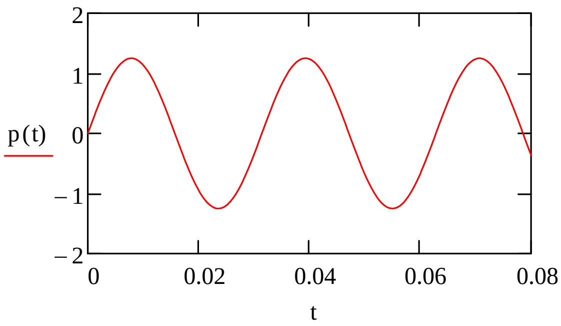
2. $L := 10^{-3}$ $\qquad v(t) := L\cdot\left[\frac{d}{dt}(5\cdot\sin(100\cdot t))\right] \to \frac{\cos(100\cdot t)}{2}$

$i(t) := 5\cdot\sin(100\cdot t)$

$p(t) := 5\cdot\sin(100\cdot t)\cdot\frac{\cos(100\cdot t)}{2} \to \frac{5\cdot\cos(100\cdot t)\cdot\sin(100\cdot t)}{2}$ $\qquad$ => $\quad \frac{5}{4}\cdot\sin(200\cdot t)$

The maximum value of the instantaneous power is $\frac{5}{4}$ W.

$t := 0, 0.0002 .. 0.08$

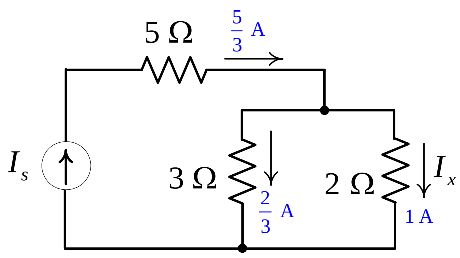


3. $R_1 := 10 + \frac{30\cdot 60}{30+60} + 30 = 60$

$$\left[\left(\frac{R_1\cdot 20}{R_1+20}+5\right)^{-1} + \frac{1}{20}\right]^{-1} = 10 \qquad \Omega$$

4. 本題除了傳統解法，亦可用「比例原則」求解。假設 I_x 為 1A, 則電路電流分佈如右圖所示，電路之總功率消耗為

$$1^2\cdot 2 + \left(\frac{2}{3}\right)^2\cdot 3 + \left(\frac{5}{3}\right)^2\cdot 5 \to \frac{155}{9} \qquad W$$



但已知實際功率消耗為 155 W，既然**功率與電流平方成正比**，故實際電流 I_x 為

$$\sqrt{\frac{155}{\frac{155}{9}}} = 3 \qquad I_x := 3 \quad A$$

I_s 也可依比例求得 $\qquad I_s := 3\cdot\left(\frac{5}{3}\right) = 5 \quad A$

5. $V_{AC} := 24 \quad V \qquad i := 4 \quad A$

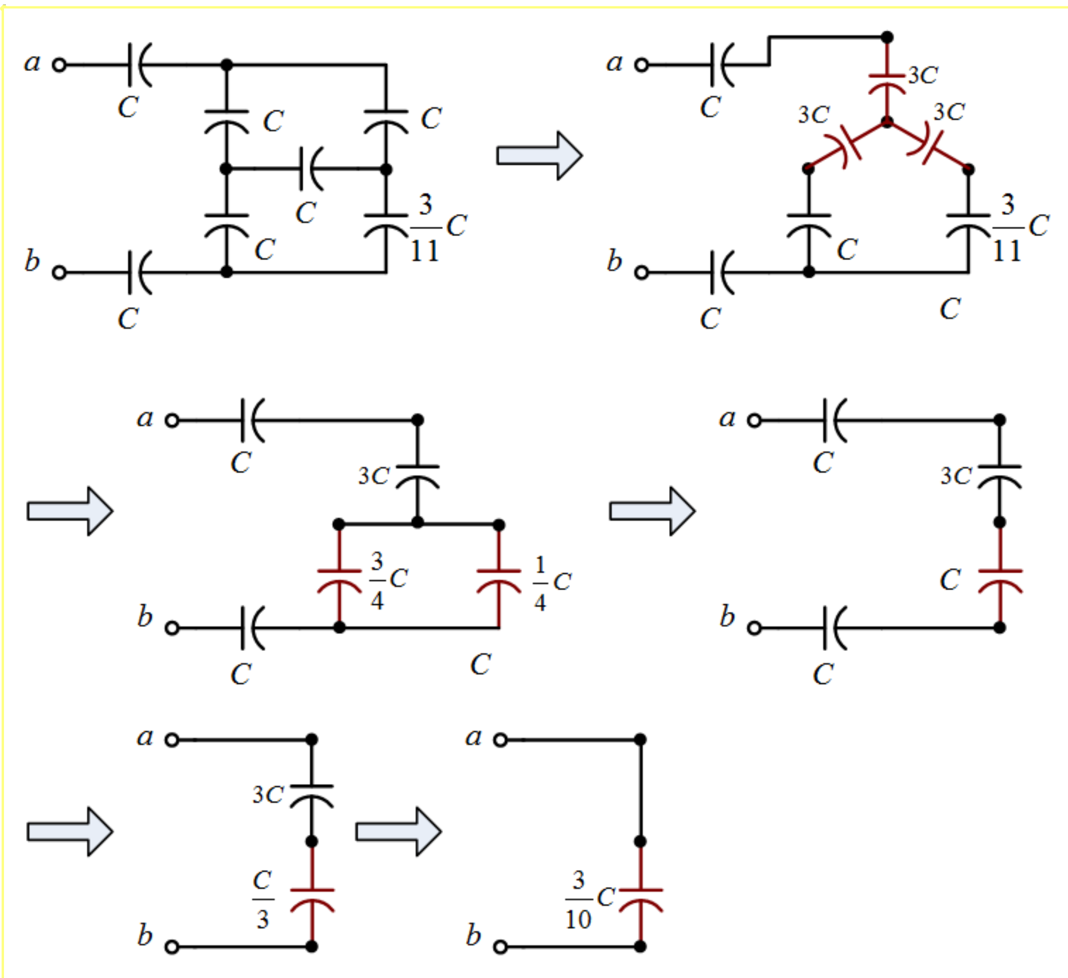
6.

Write the KCL equation for the upper node.

$$i_s - i_x + a\cdot i_x = i_s - \frac{V_s}{R} + a\cdot\frac{V_s}{R} = i_s - \frac{V_s}{R}(1-a) = 0$$

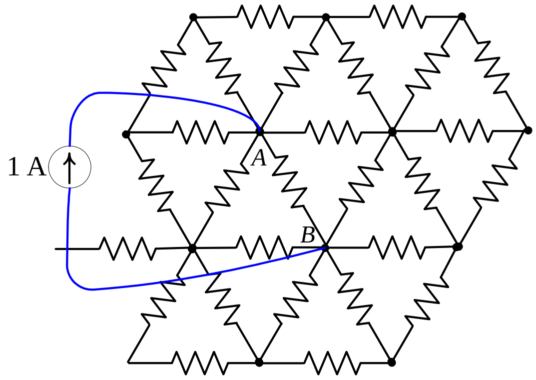
$$\frac{V_s}{i_s} = \frac{R}{1-a}$$

7.



8. $R + \frac{2R\cdot R_{eq}}{2R + R_{eq}} = R_{eq} \qquad R_{eq}^{2} - R\cdot R_{eq} - 2R^{2} = 0 \qquad R_{eq} = 2R$

9.



See the figure to the left (Fig. 9-1). We apply a 1A current source at nodes A and B, and try to find the voltage V_{AB}.

Fig. 9-1

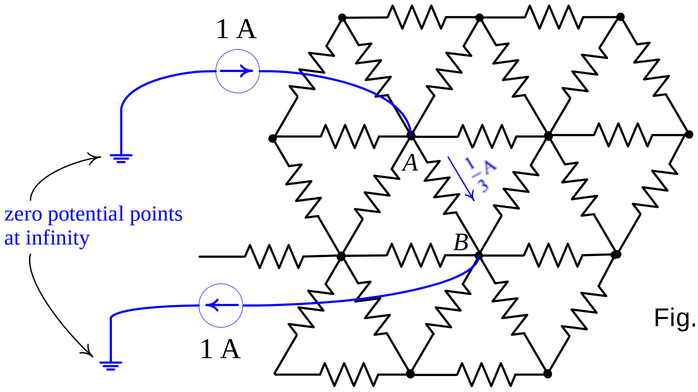


Fig. 9-2

The circuit in Fig. 9-1 is equivalent to that shown in Fig. 9-2 in which a 1-A current flows into node A and the other 1-A current flows out of node B. One of the two terminals of both current sources is connected to the infinity.

By **superposition**, we apply the current source one by one. When the upper current source is applied, the currents flowing in the six resistors connecting to node A must be the same **by symmetry** and are equal to 1/6 A. Similarly, when the lower current source is applied, the currents flowing in the six resistors connecting to node B are also identical and equal to 1/6 A. The result is that the current flowing in the resistor connecting nodes A and B must be 1/3 A. We can conclude that the resistance between nodes A and B is therefore 1/3 Ω.