

# 华东交通大学 2019 — 2020 学年第二学期考试卷

(B) 卷

课程名称: 电路原理 I 考试时间: 120 分钟 考试方式: 开卷 开卷范围: 教材

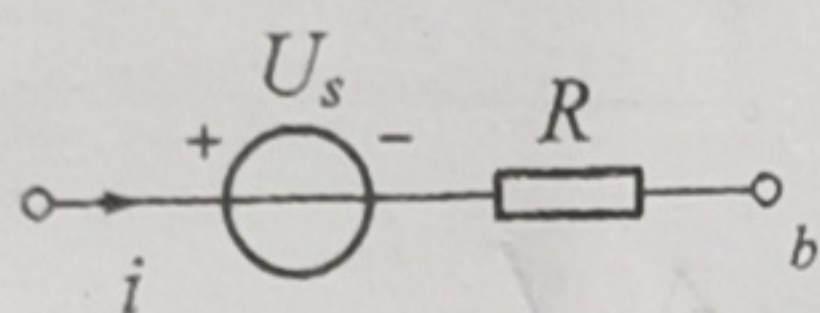
学生姓名: \_\_\_\_\_ 学号: \_\_\_\_\_ 教学班级: \_\_\_\_\_ 教学小班序号: \_\_\_\_\_

| 题号  | 一 | 二 | 三 | 四 | 五 | 六 | 七 | 八 | 九 | 十 | 总分 |
|-----|---|---|---|---|---|---|---|---|---|---|----|
| 得分  |   |   |   |   |   |   |   |   |   |   |    |
| 阅卷人 |   |   |   |   |   |   |   |   |   |   |    |

## 一、 计算题(每题 4 分, 共 24 分)

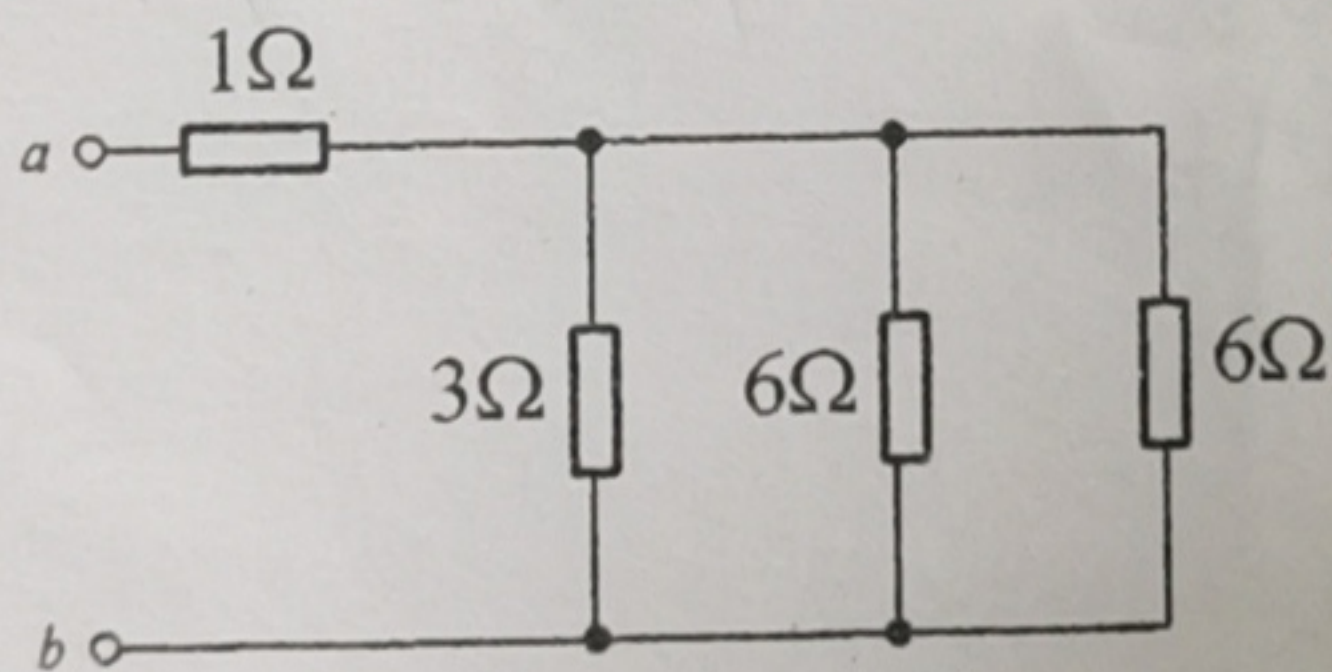
得分

1. 电路如图, 已知  $U_s=10V$ ,  $R=1\Omega$ ,  $i=1A$ , 求  $a$ 、 $b$  两点的电压。



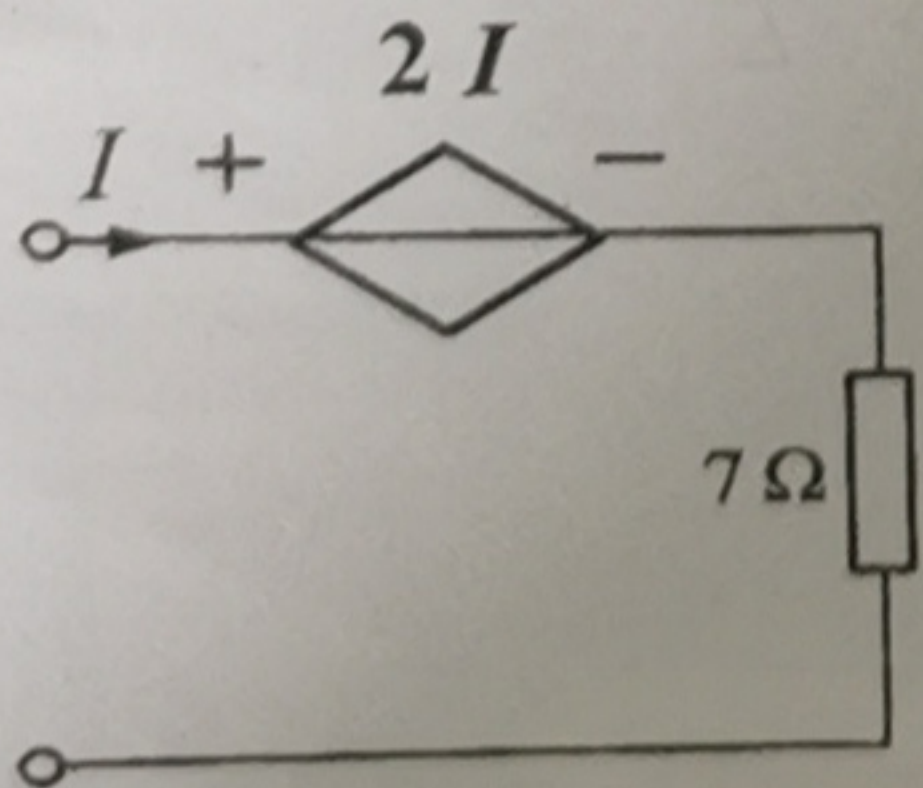
$$U_{ab} = U_s + Ri = 10 + 1 \times 1 = 11V$$

2. 电路如图, 求  $a$ 、 $b$  两端等效电阻。



$$R_{ab} = 1 + 3 \parallel 6 \parallel 6 = 2.5 \Omega$$

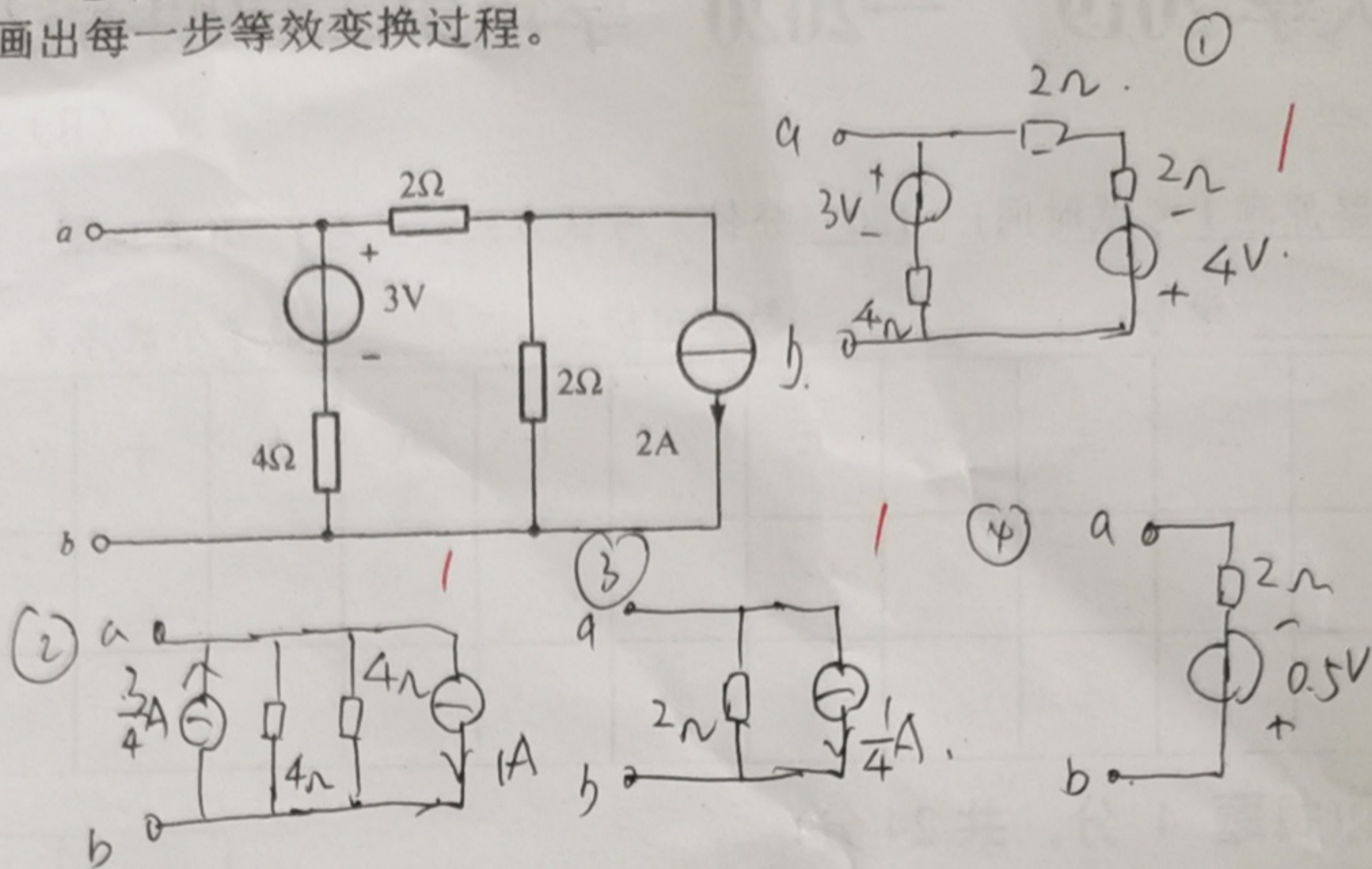
3. 电路如图, 求  $a$ 、 $b$  两端等效电阻。



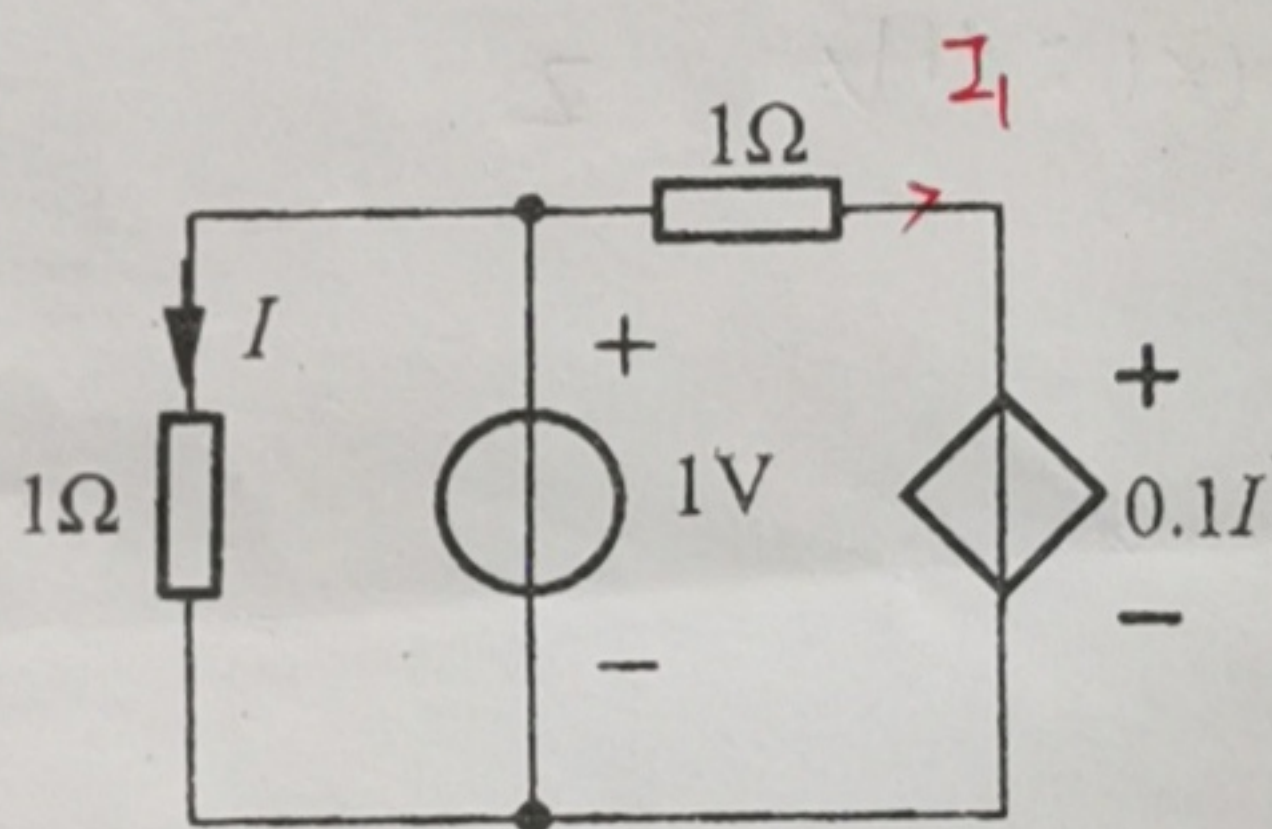
$$U_{ab} = 2I + 7I = 9I$$

$$R_{ab} = \frac{U_{ab}}{I} = 9 \Omega$$

4. 电路如图所示，将电路化简为一个电压源与一个电阻相串联的组合。  
要求画出每一步等效变换过程。



5. 电路如图，求受控电压源功率，（说明是吸收还是发出）。

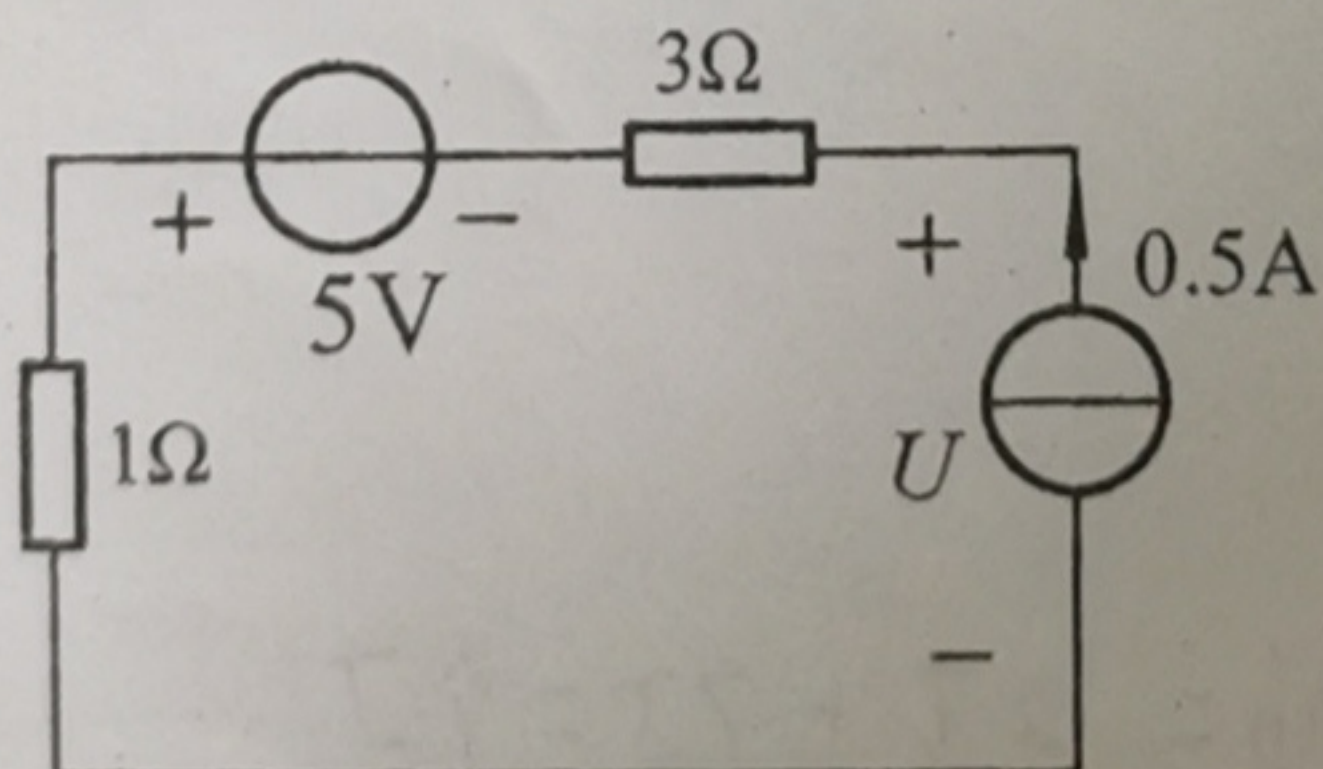


$$1 \times I = 1 \quad I = 1 \text{ A}$$

$$1 \times I_1 + 0.1I = 1 \quad I_1 = 0.9 \text{ A}$$

$$P = 0.1I \times I_1 = 0.9 \times 0.1 = 0.09 \text{ W (absorbed)}$$

6. 电路如图，求电压  $U$ 。



$$U = 3 \times 0.5 - 5 + 1 \times 0.5 = -3 \text{ V}$$

## 二、计算题(每题 5 分, 共 25 分)

得分

1. 已知  $i_1 = 4\sqrt{2} \cos(314t + 30^\circ) A$ ,  $i_2 = 6\sqrt{2} \cos(314t + 60^\circ) A$ 。

若  $i = i_1 + i_2$ , 求  $i$ 。

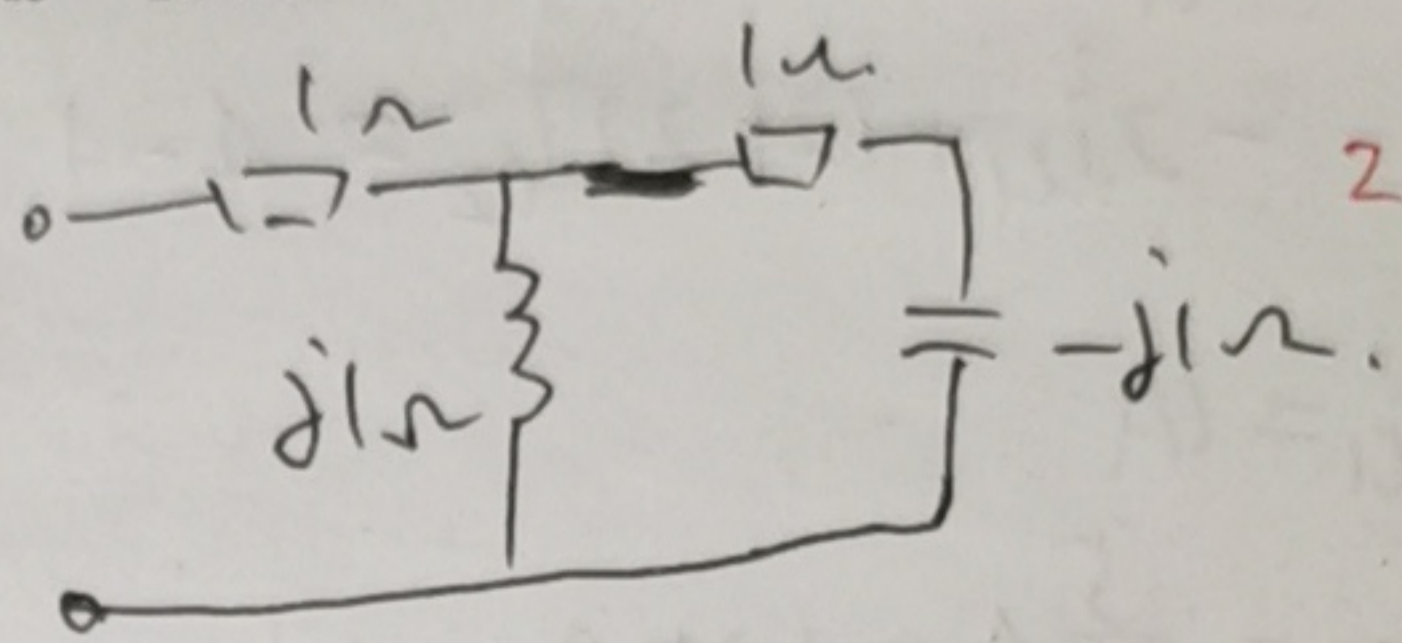
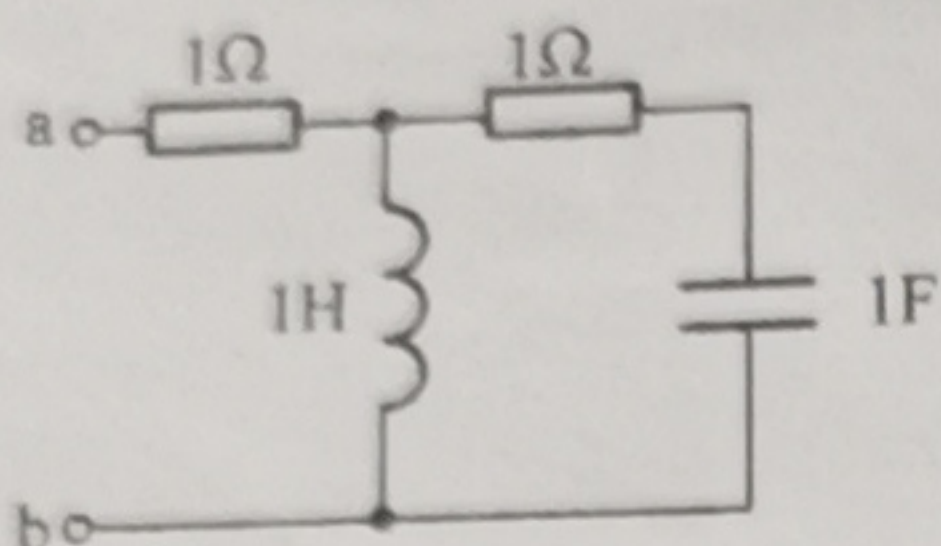
$$\dot{I}_1 = 4 \angle 30^\circ A \quad \dot{I}_2 = 6 \angle 60^\circ A$$

$$\dot{I} = \dot{I}_1 + \dot{I}_2 = 4 \angle 30^\circ + 6 \angle 60^\circ = 6.464 + j7.196 = 9.67 \angle 48.07^\circ A$$

$$i = 9.67\sqrt{2} \cos(314t + 48.07^\circ) A$$

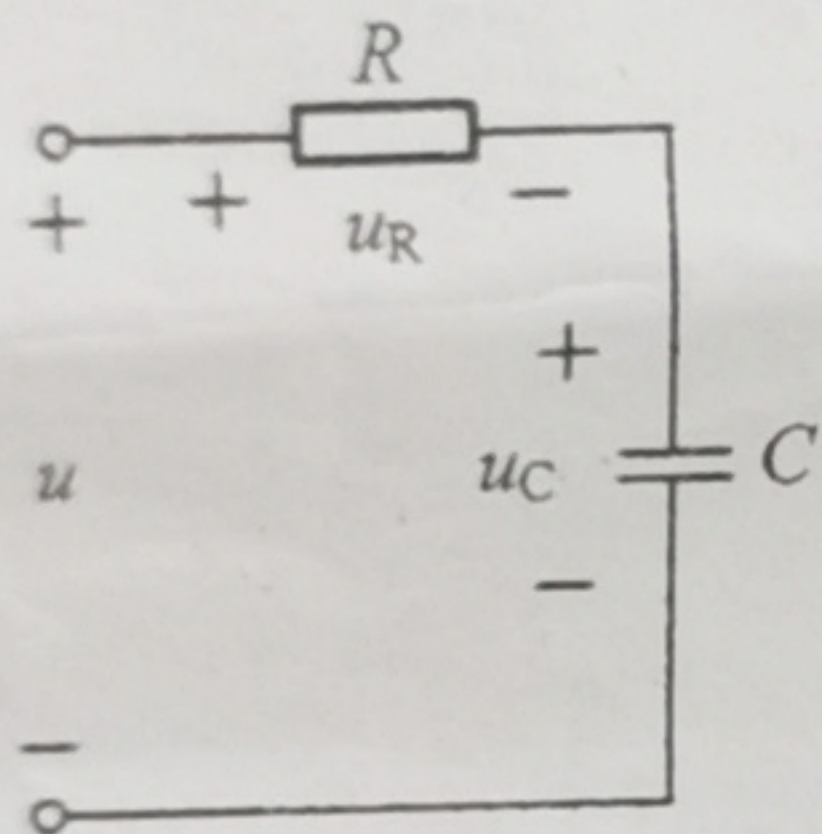
$$= 13.68 \cos(314t + 48.07^\circ) A$$

2. 求图示电路的输入阻抗,  $\omega = 1 \text{ rad/s}$ 。



$$Z = 1 + \frac{j1(1-j1)}{j1+1-j1} = 2 + j1$$

3. 在图示电路中, 已知  $U_R = 3V$ ,  $U_C = 4V$ , 求  $U$ 。



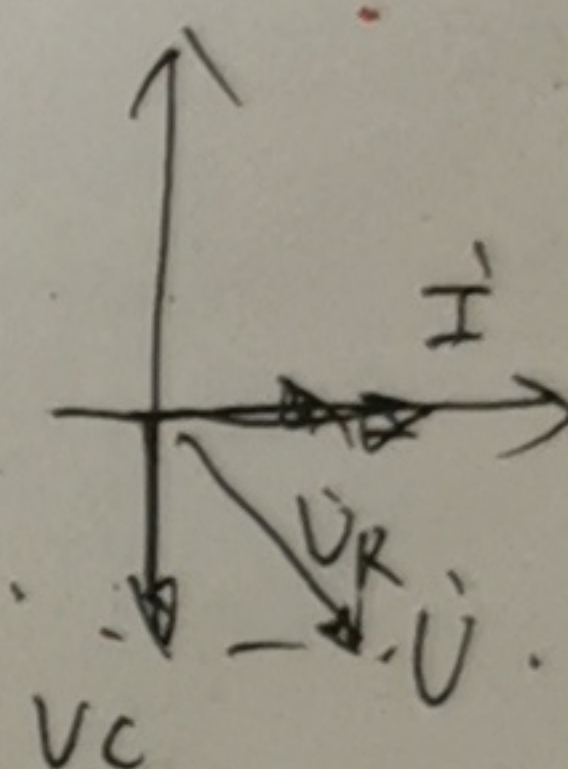
$$\dot{I} = I \angle 0^\circ A$$

$$\dot{U}_R = 3 \angle 0^\circ V$$

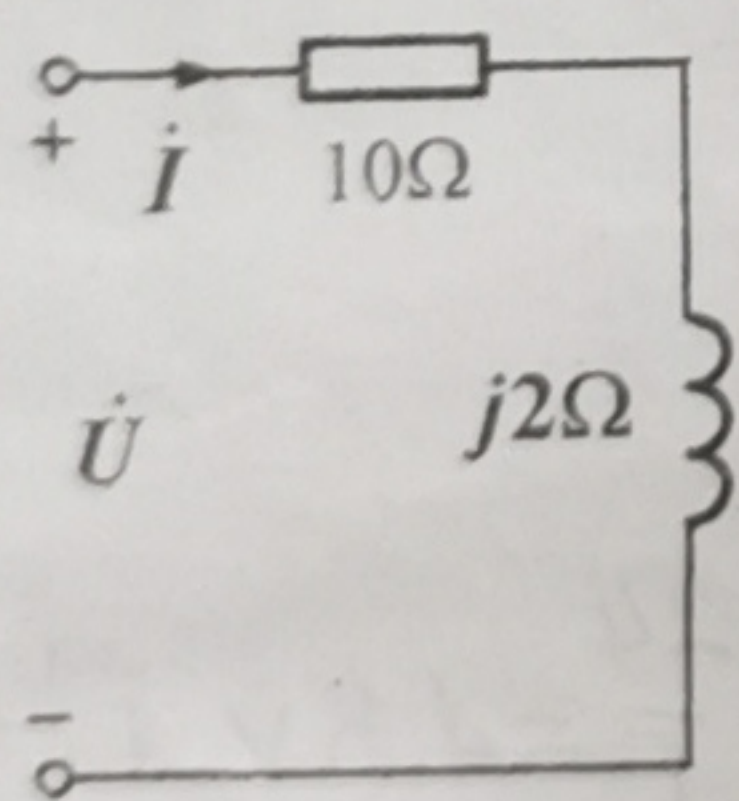
$$\dot{U}_C = 4 \angle -90^\circ V$$

$$U = \sqrt{U_R^2 + U_C^2}$$

$$= \sqrt{3^2 + 4^2} = 5V$$



4. 图示电路中, 已知  $i = 2 \angle 30^\circ A$ , 求电路的有功功率  $P$ 、无功功率  $Q$ 。



$$P = R I^2 = 10 \times 2^2 = 40W$$

$$Q = X I^2 = 2 \times 2^2 = 8 \text{ Var}$$

$$\dot{U} = 2 \dot{I} = (10 + j2) \times 2 \angle 30^\circ = 20.4 \angle 41.31^\circ V$$

$$P = UI \cos \phi = 40W$$

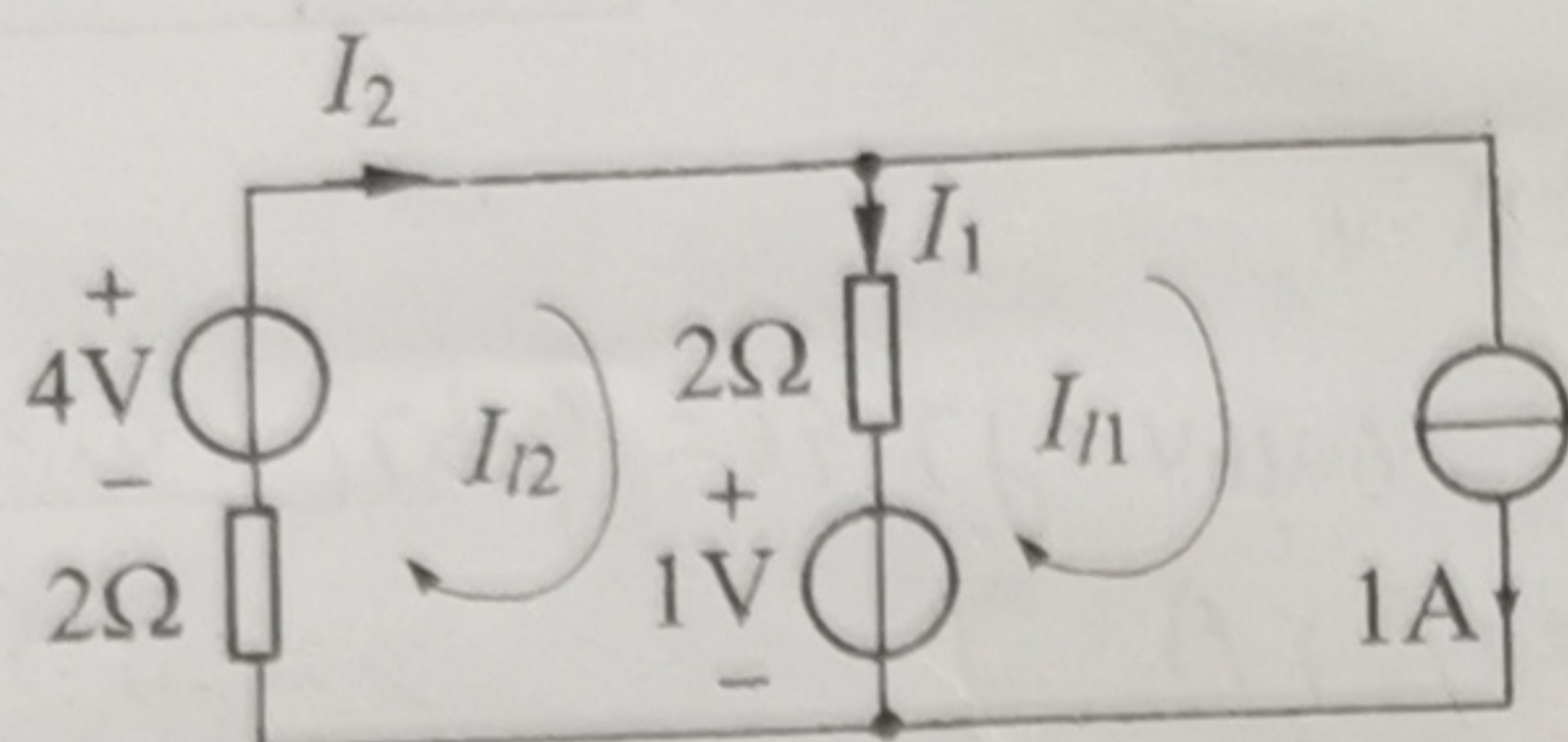
$$Q = 8 \text{ Var}$$

5. RLC 串联电路, 已知  $R = 10\Omega$ ,  $L = 0.1H$ ,  $C = 10\mu F$ , 求谐振频率  $f_0$ 。

$$f_0 = \frac{1}{2\pi \sqrt{LC}} = \frac{1}{2\pi \sqrt{0.1 \times 10 \times 10^{-6}}} = 159 \text{ Hz}$$

三. 用回路电流法求图示电路中的电流  $I_1$ 、 $I_2$ 。(8分)

得分



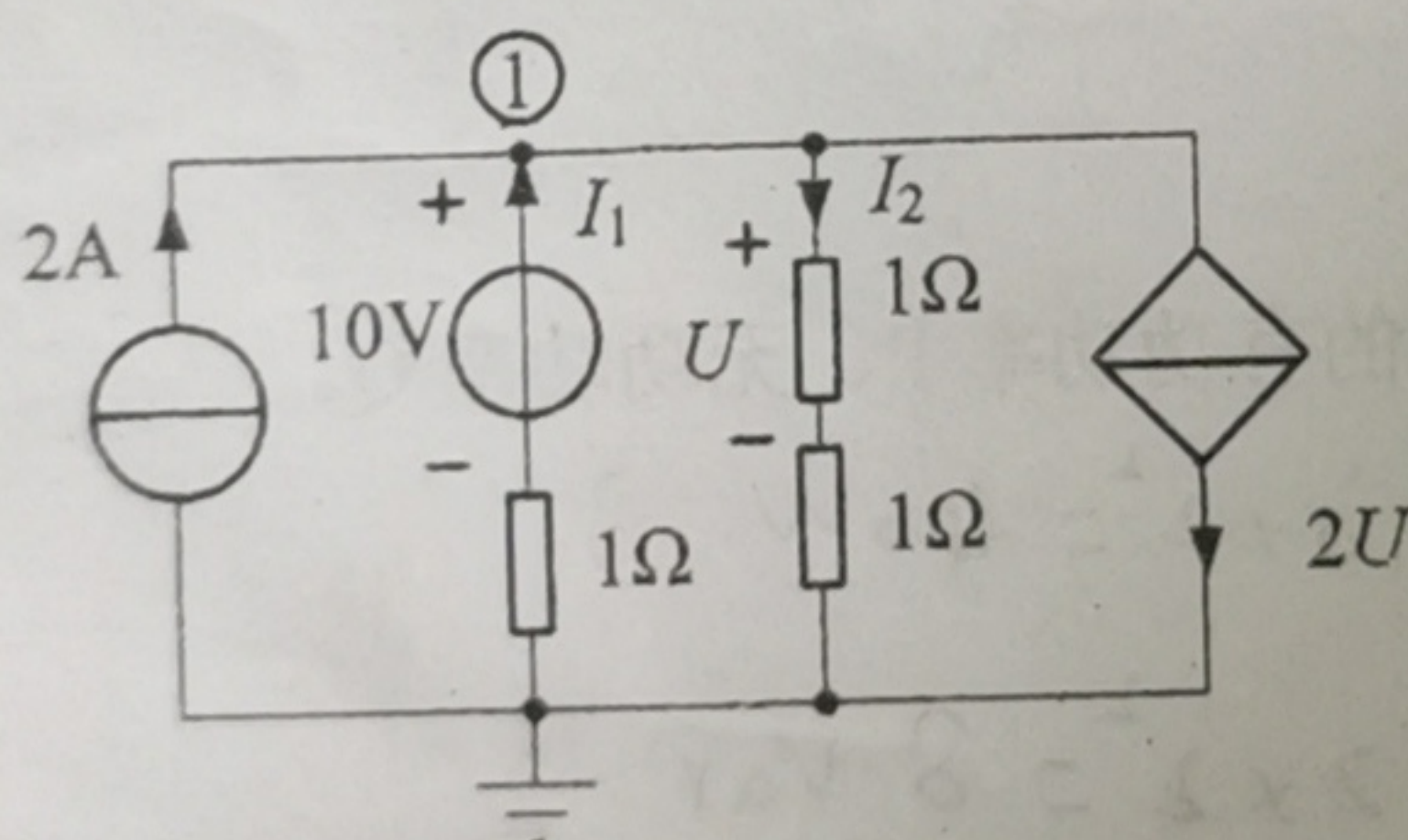
解: 回路1:  $I_{L1} = 1A$  2'  
 回路2:  $-2I_{L1} + (2+2)I_{L2} = 4-1$  3'

解得  $I_{L1} = 1A$   
 $I_{L2} = \frac{5}{4}A = 1.25A$  1'

$\therefore I_1 = I_{L2} - I_{L1} = 0.25A$  1'

$I_2 = I_{L2} = 1.25A$  1'

四. 用结点电压法求结点电压  $U_{n1}$ 、电流  $I_1$ 、 $I_2$ 。(8分)



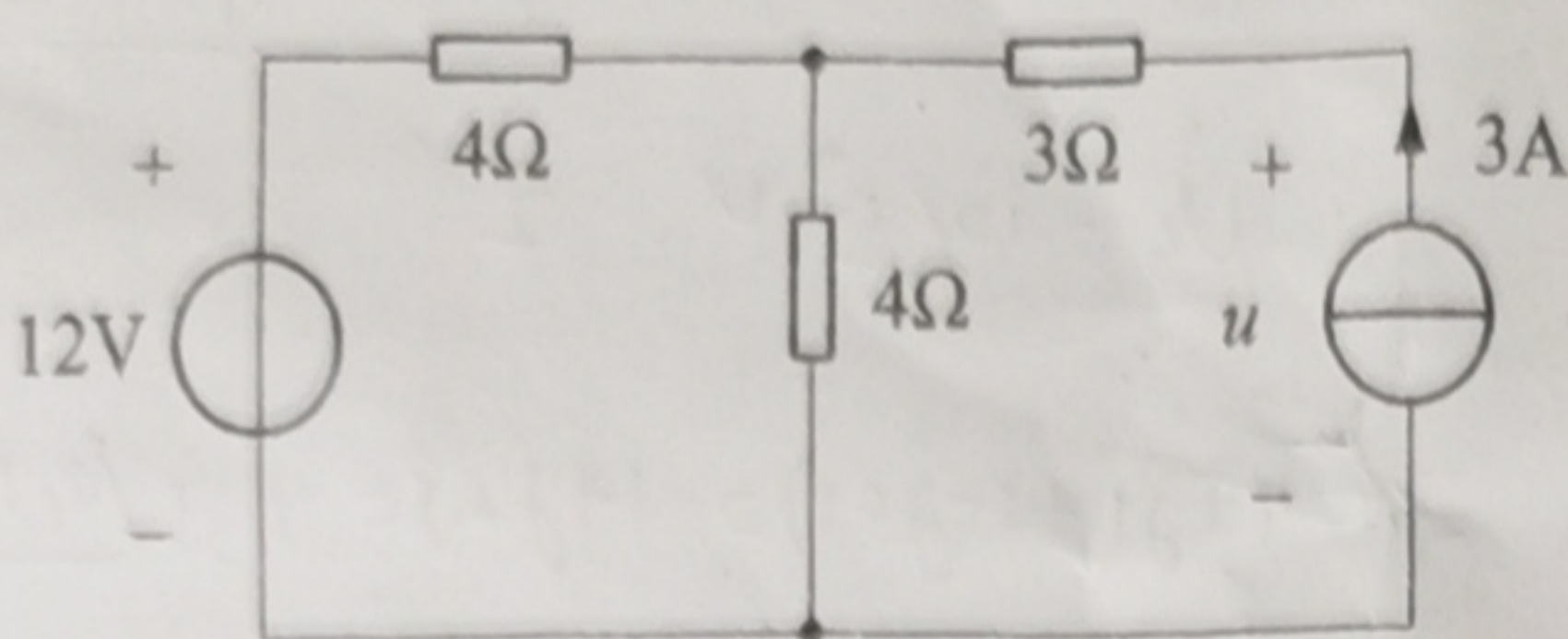
解:  $(\frac{1}{1} + \frac{1}{1+1})U_{n1} = 2 + \frac{10}{1} - 2U$  2'  
 补充:  $U = \frac{1}{1+1}U_{n1}$  2'  $\Rightarrow U_{n1} = \frac{24}{5} = 4.8V$  1'

$U_{n1} = 10 - 1 \times I_1 \Rightarrow I_1 = \frac{10 - U_{n1}}{1} = 5.2A$  1'

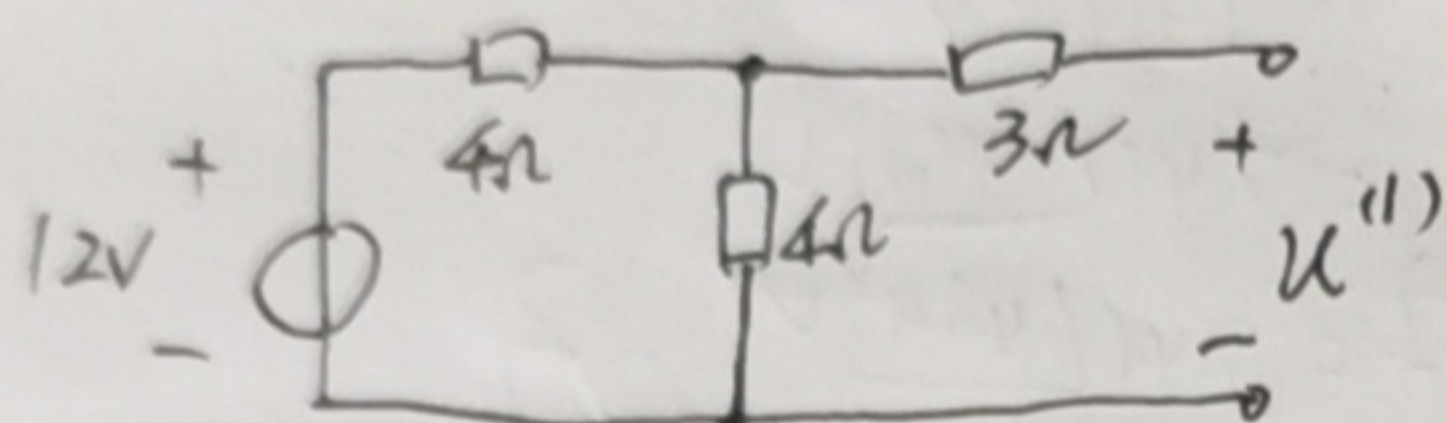
$I_2 = \frac{U_{n1}}{2} = 2.4A$  1'

五. 电路如图, 用叠加定理求电压  $u$ 。(8分)

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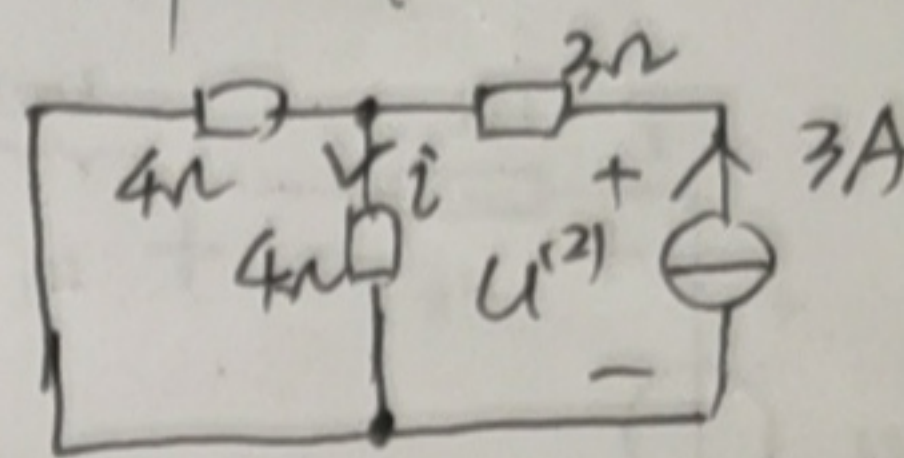


解: ① 12V 单独作用的分电路



$$u' = \frac{4}{4+4} \times 12 = 6V \quad (2')$$

② 3A 单独作用的分电路



$$i = \frac{4}{4+4} \times 3 = 1.5A \quad (1')$$

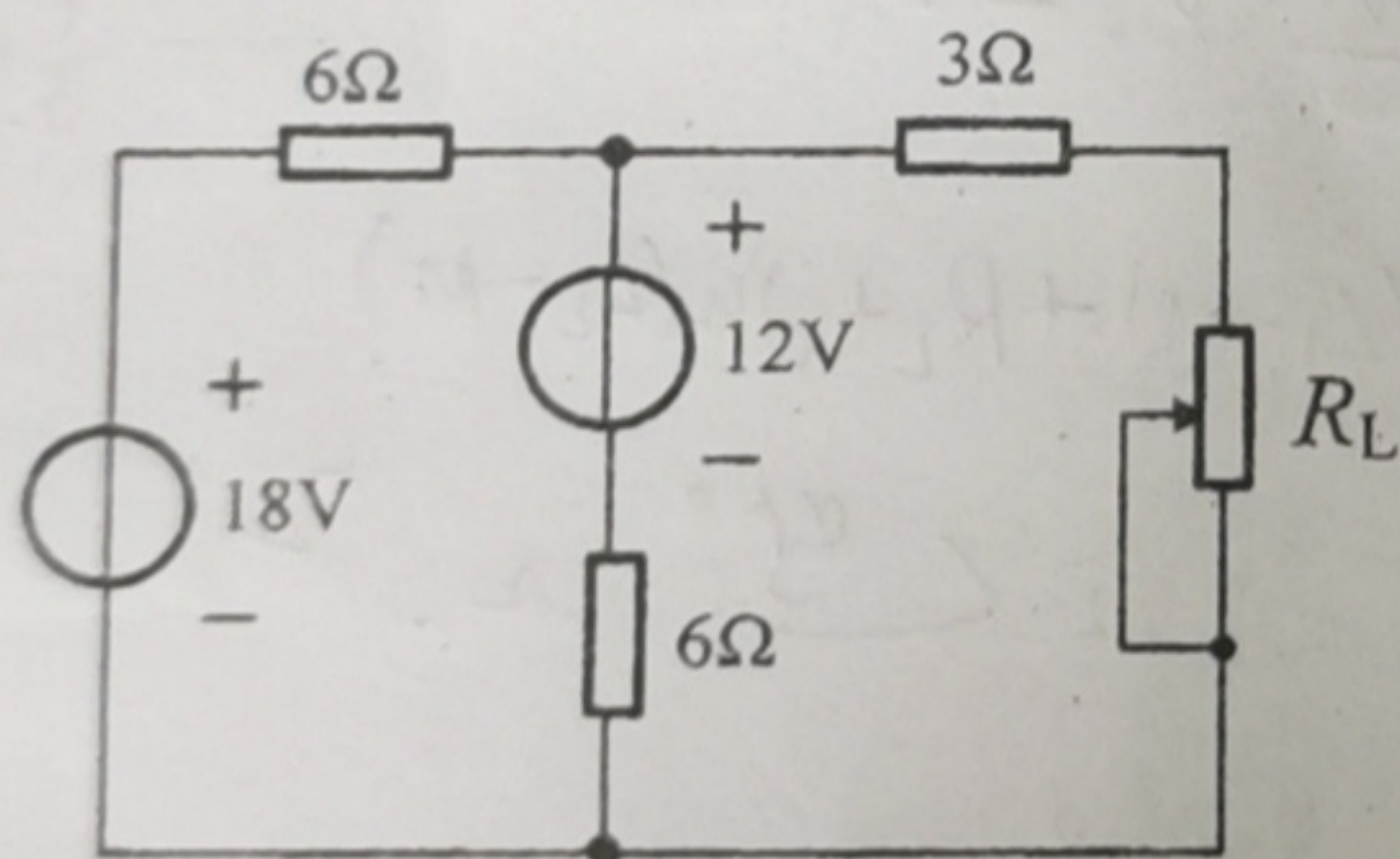
$$u'' = 3 \times 3 + 4 \times 1.5 = 15V \quad (2')$$

$$③ u = u' + u'' = 6 + 15 = 21V$$

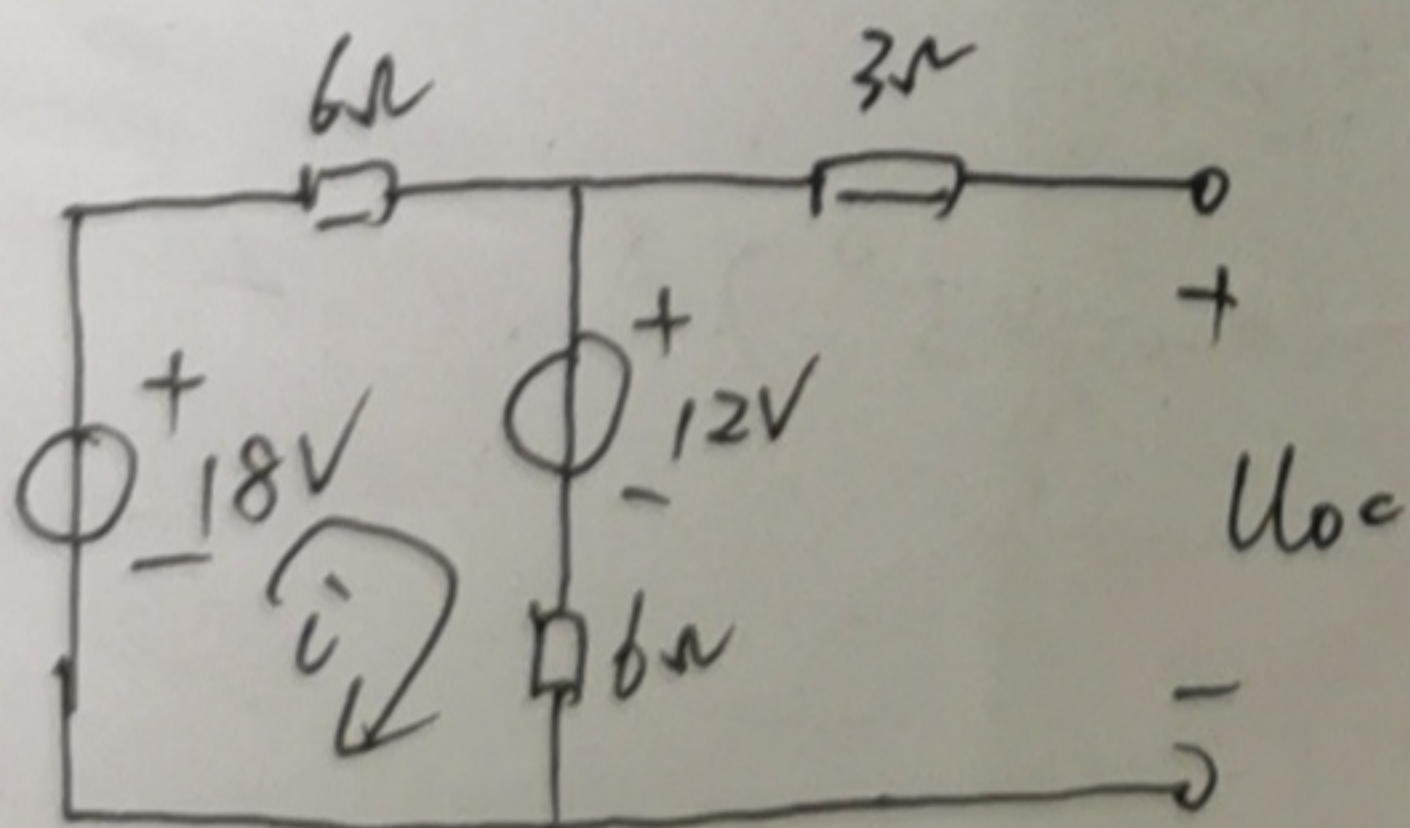
(1')

六. 图中  $R_L$  可变, 问当  $R_L$  为多大时可获得最大功率, 并求此最大功率。(8分)

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解: ① 求  $U_{oc}$



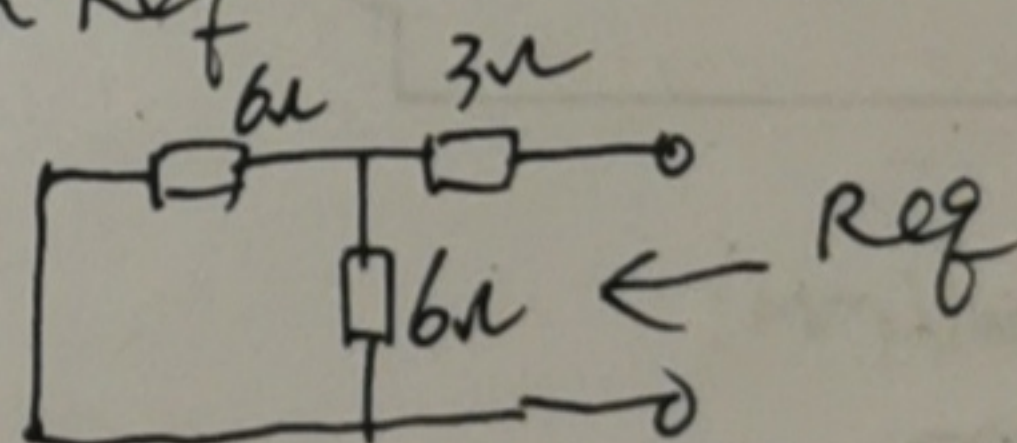
$$-18 + 6i + 12 + 6i = 0$$

$$12i - 6 = 0$$

$$i = 0.5A \quad (1')$$

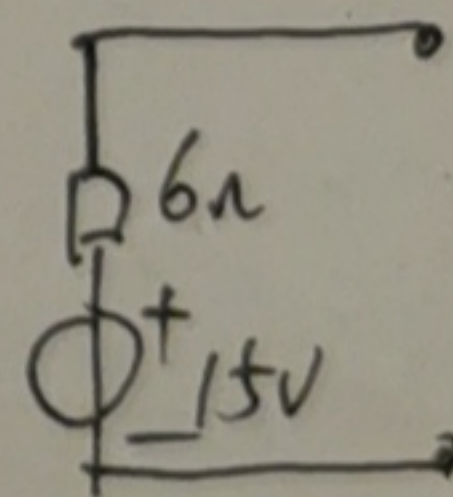
$$U_{oc} = 12 + 6i = 12 + 6 \times 0.5 = 15V \quad (1')$$

② 求  $R_{eq}$



$$R_{eq} = 3 + 6 \parallel 6 = 6\Omega \quad (1')$$

③ 戴维宁等效电路

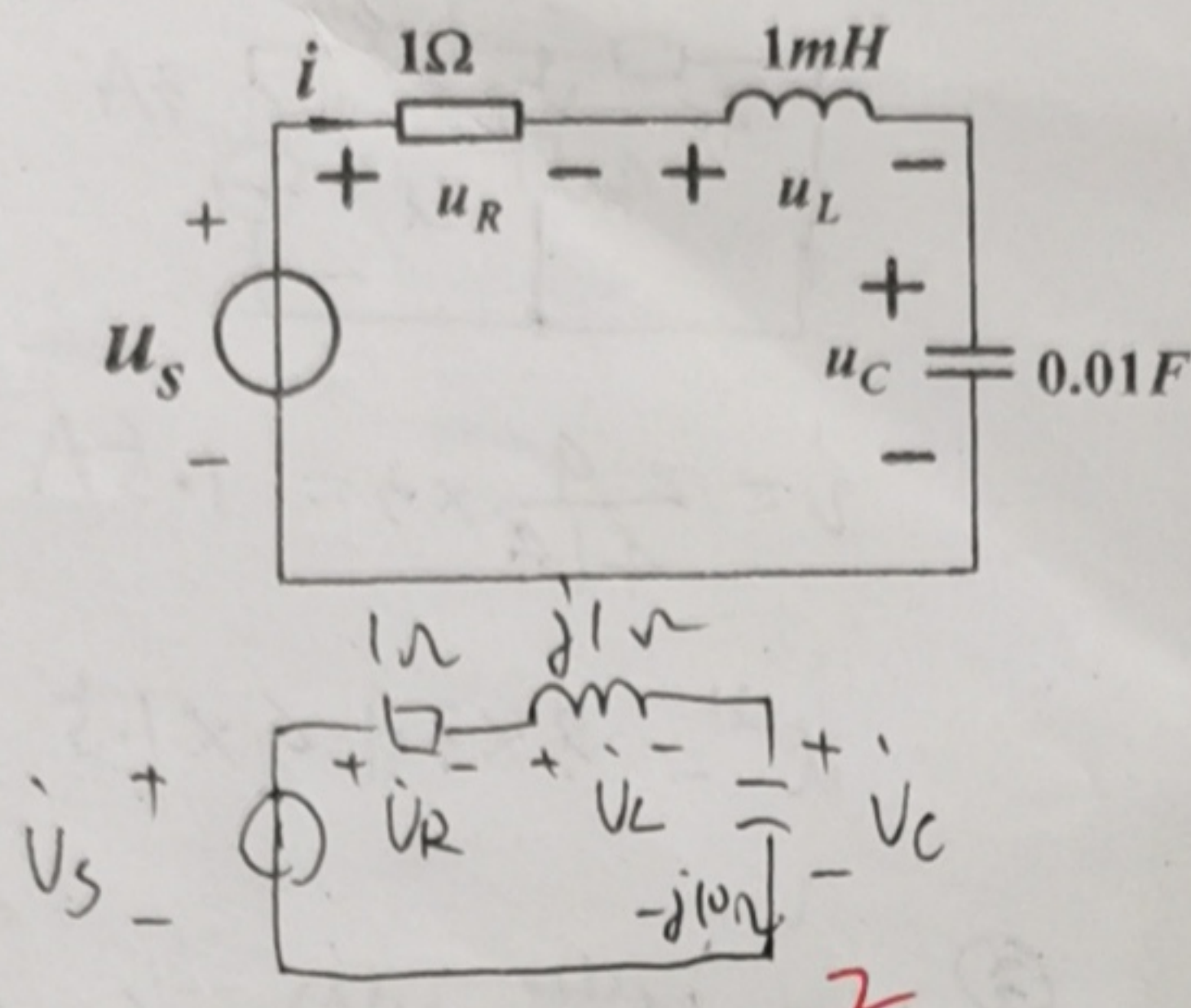


④ 当  $R_L = R_{eq} = 6\Omega$  时,  $R_L$  获最大功率

$$P_{max} = \frac{U_{oc}^2}{4R_{eq}} = \frac{15^2}{4 \times 6} = 9.375W \quad (1')$$

七. 如图所示电路, 正弦稳态电路, 已知  $u_s = 10\sqrt{2} \cos 1000t \text{ V}$ ,  
试求电流  $i$ 、 $u_R$ 、 $u_L$ 、 $u_C$  (10 分)

得分



$$\dot{U}_s = 10 \angle 0^\circ \text{ V} \quad 2$$

$$Z = 1 + j1 + (-j0.1) = 1 + j0.9 = 1.35 \angle 4.99^\circ \quad 1$$

$$\dot{I} = \frac{\dot{U}_s}{Z} = \frac{10 \angle 0^\circ}{1.35 \angle 4.99^\circ} = 7.41 \angle -4.99^\circ \text{ A} \quad 2$$

$$\dot{U}_R = R\dot{I} = 7.41 \angle -4.99^\circ \text{ V}$$

$$\dot{U}_L = j\omega L\dot{I} = 7.41 \angle 48.01^\circ \text{ V} \quad 3$$

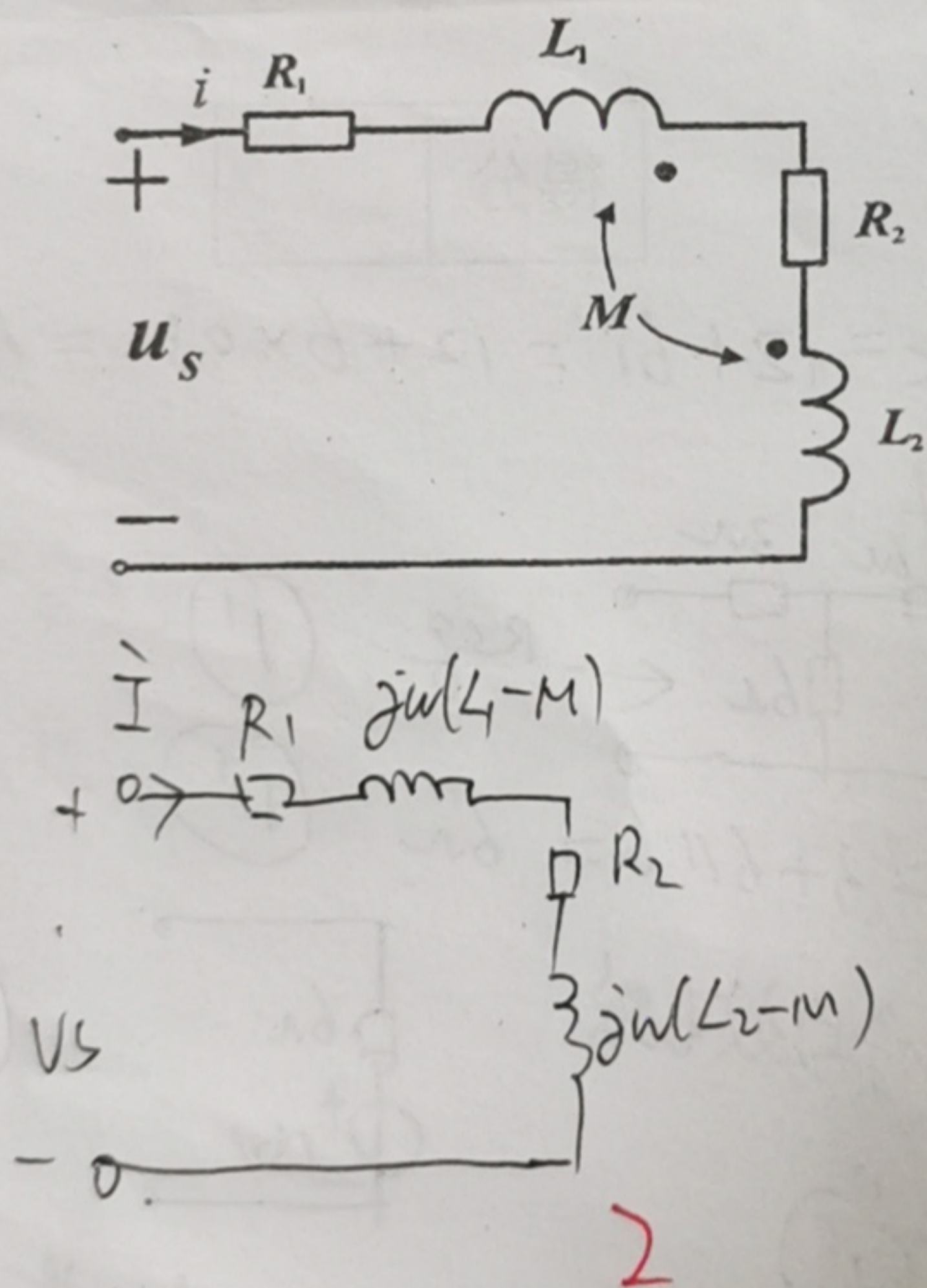
$$\dot{U}_C = \frac{1}{j\omega C}\dot{I} = 0.741 \angle -131.99^\circ \text{ V}$$

$$u_R = 7.41\sqrt{2} \cos(1000t - 4.99^\circ) \text{ V}, \quad u_L = 7.41\sqrt{2} \cos(1000t + 48.01^\circ) \text{ V}, \quad u_C = 0.741\sqrt{2} \cos(1000t - 131.99^\circ) \text{ V}$$

八. 电路如图, 正弦稳态电路, 已知  $u_s = 100\sqrt{2} \cos(10t + 30^\circ) \text{ V}$ ,  $L_1 = 1 \text{ H}$ ,  $L_2 = 2 \text{ H}$ ,

$M = 1.4 \text{ H}$ ,  $R_1 = R_2 = 1 \Omega$ , 求电流  $i$ . (9 分)

得分



$$\dot{U}_s = 100 \angle 30^\circ \text{ V} \quad 2$$

$$Z = R_1 + j\omega(L_1 - M) + R_2 + j\omega(L_2 - M)$$

$$= 2 + j2 = 2\sqrt{2} \angle 45^\circ \quad 2$$

$$\dot{I} = \frac{\dot{U}_s}{Z} = \frac{100 \angle 30^\circ}{2\sqrt{2} \angle 45^\circ} = 25\sqrt{2} \angle -15^\circ \text{ A} \quad 2$$

$$i = 50 \cos(10t - 15^\circ) \text{ A} \quad 2$$