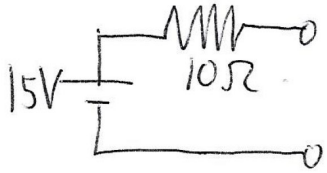
Problem 1

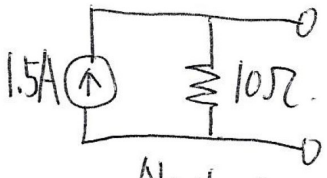
$V_{TH} = V_{OC} = 15\,V$

$I_N = I_{SC} = 1.5A$

$R_{TH} = R_N = \frac{15}{1.5} = 10\,\Omega.$



Thevenin



Norton.

Problem 2

$$\frac{20-10}{5+5+10} = 0.5A$$

$V_{TH} = V_{OC} = 0.5 \times 10 + 10 = 15V.$

$R_{TH} = (5+5) // 10 + 8 + 7. = 20\,\Omega.$

Problem 3

$$\frac{1}{\frac{1}{2}+\frac{1}{1}} = 0.667\ \mu F$$

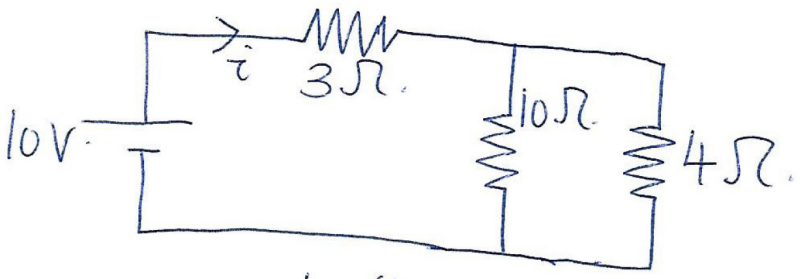
$$\frac{1}{\frac{1}{2}+\frac{1}{4}+\frac{1}{3}} = 0.923\ \mu F$$

$$0.667 + 0.923 = 1.590\ \mu F$$

$$20 \times \frac{\frac{1}{2}}{\frac{1}{1}+\frac{1}{1.590}+\frac{1}{2}} = 4.70\ (V)$$

Problem 4

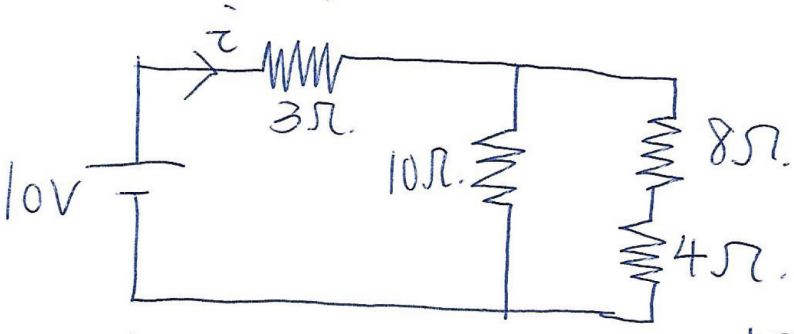
$t=0^+$ equivalent circuit:



$10 // 4 = 2.86\,\Omega$

$$i|_{t=0^+} = \frac{10}{3+2.86} = 1.71\,(A)$$

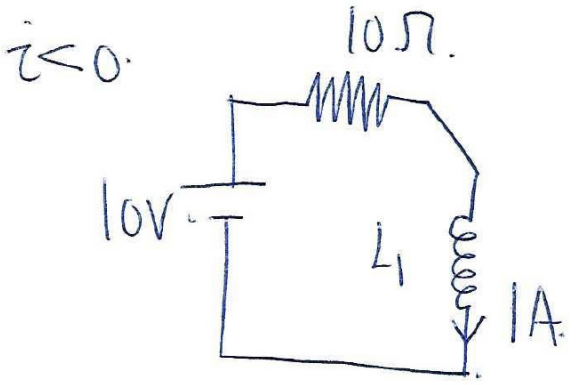
~~$t=0^-$~~ $t=\infty$ equivalent circuit:

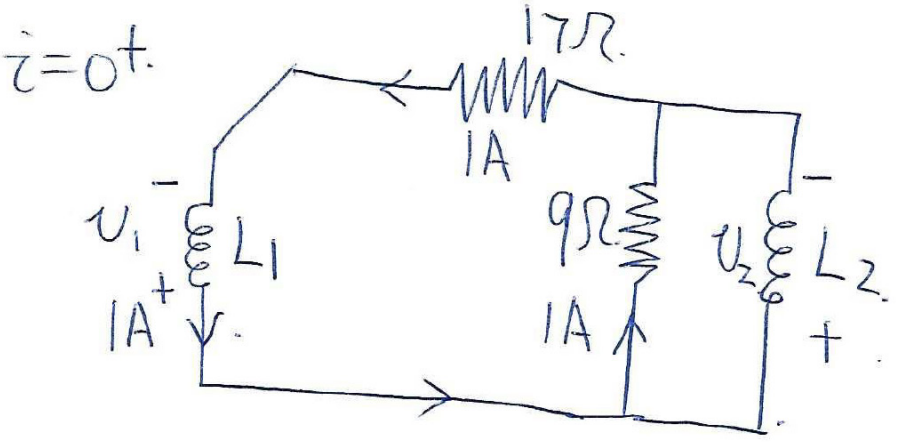


$12 // 10 = 5.45\,\Omega$

$$i|_{t=\infty} = \frac{10}{3+5.45} = 1.18\,(A)$$

Problem 5





$$v_1 = (17+9) \times 1 = 26\ V.$$

$$v_2 = 9 \times 1 = 9\ V.$$

Problem 6

(a)

$$Z_{eq} = \sqrt{2^2+8^2} \angle \tan^{-1}\left(\frac{-8}{2}\right) = 8.25 \angle -76^\circ$$

phase difference : -76°

Current leads voltage by 76°.

(b)

$$Z_R = 5\,\Omega \qquad Z_C = -\frac{j}{\omega C} = -j\ (\Omega)$$

$$Z_L = j\omega L = 2j\ (\Omega)$$

$$Z_{eq} = Z_L + \frac{Z_C \cdot Z_R}{Z_C + Z_R} = 2j + \frac{5(-j)}{5-j}$$

$$= 2j - \frac{5j(5+j)}{5^2+1}$$

$$= 0.192 + 1.039j$$

$$= 1.056 \angle 79.5^\circ$$