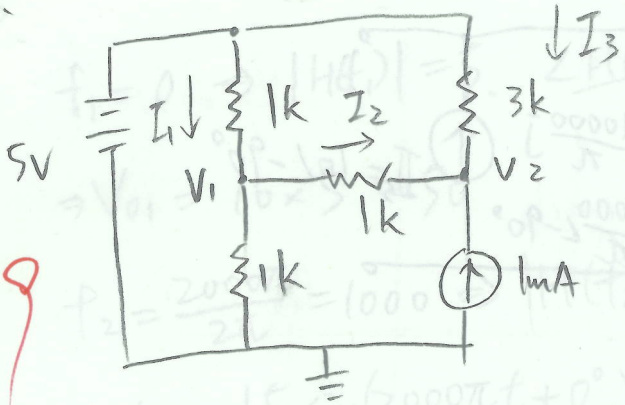
1.



$$9\ 3V_1 - \frac{13}{3} = 8\ 15\ 28$$

$$V_1 = \frac{28}{9}$$

$$\begin{cases} \frac{V_1-5}{1k} + \frac{V_1}{1k} + \frac{V_1-V_2}{1k} = 0 \\ \frac{V_2-V_1}{1k} + \frac{V_2-5}{3k} - 1m = 0 \end{cases} \Rightarrow \begin{cases} 3V_1 - V_2 = 5 \\ -3V_1 + 4V_2 = 8 \end{cases} \quad 1m \text{ 代入}$$

$$3V_2 = 13$$

$$3(V_2 - V_1) + V_2 - 5 = 3\ 8$$

$$\Rightarrow \begin{cases} V_1 = \frac{28}{9}\ V \\ V_2 = \frac{13}{3}\ V \end{cases} \quad \#$$

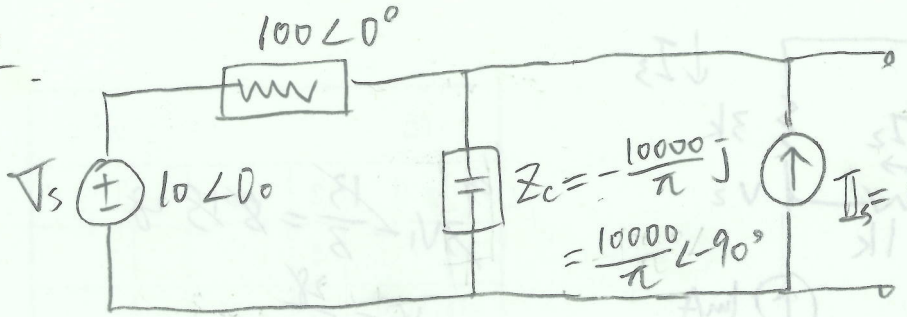
$$I_1 = \frac{5-V_1}{1k} = \frac{5-\frac{28}{9}}{1k} = \frac{17}{9}\ mA.$$

$$I_2 = \frac{V_1-V_2}{1k} = \frac{\frac{28}{9} - \frac{13\ 39}{3\ 39}}{1k} = -\frac{11}{9}\ mA$$

$$I_3 = \frac{5-V_2}{3k} = \frac{\frac{15}{3} - \frac{13}{3}}{3k} = \frac{2}{9}\ mA \quad \#$$

I_4 -1

2.



(1)

$\omega = 100\pi$

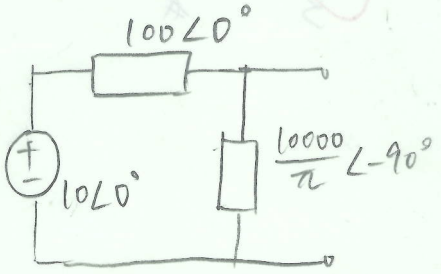
$$Z_C = \frac{1}{j\omega C} = \frac{1}{j \times 100\pi \times 10^{-4}} = -\frac{10000}{\pi}j = \frac{10000}{\pi}\angle -90°$$

$$Z_T = \frac{100\angle 0° \times \frac{10000}{\pi}\angle -90°}{100\angle 0° + \frac{10000}{\pi}\angle -90°} = \frac{\frac{10^6}{\pi}\angle -90°}{100 - \frac{10000}{\pi}j}$$

$$\sqrt{100^2 + \left(\frac{10000}{\pi}\right)^2} \doteq 3184.7$$

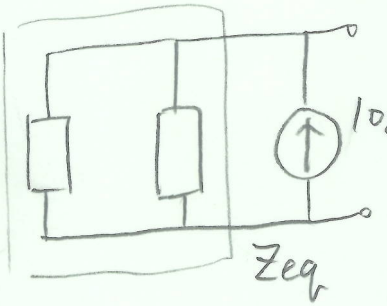
$$= \frac{\frac{10^6}{\pi}\angle -90°}{3184.7\angle -88.2°}$$

$$\doteq 99.95\angle -1.8° \#$$



$$V_{t1} = 10\angle 0° \times \frac{\frac{10^4}{\pi}\angle -90°}{3184.7\angle -88.2}$$

$$= 0.9995\angle -1.8°$$



$$V_{t2} = 10\angle -90° \times 99.95\angle -1.8°$$

$$= 999.5\angle -91.8°$$

$$V_T = 0.9995\angle -1.8° + 999.5\angle -91.8° \#$$

3.

$f_1 = 0 \Rightarrow |H(f_1)| = 5. \quad \angle H(f_1) = 60°$

$\Rightarrow V_{o1} = 10 \times 5 = 50$

10

$f_2 = \frac{2000\pi}{2\pi} = 1000 \Rightarrow |H(f_2)| = 3. \quad \angle H(f_2) = -30°$

$\Rightarrow V_{o2} = 15\sin(2000\pi t + 0°) = 15\cos(2000\pi t - 90°)$

$f_3 = \frac{3000\pi}{2\pi} = 1500 \Rightarrow |H(f_3)| = 2. \quad \angle H(f_3) = -15°$

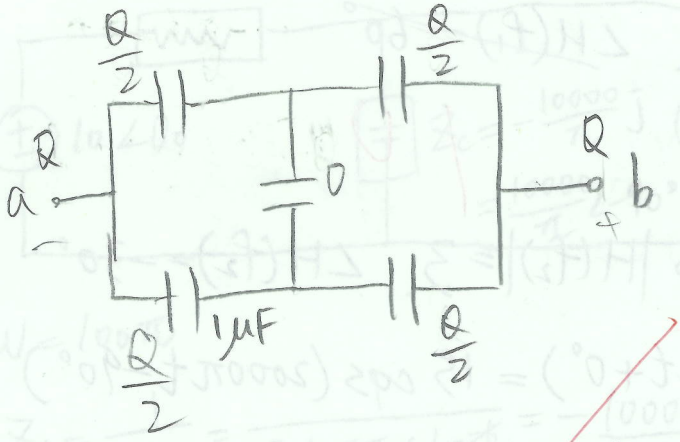
$\Rightarrow V_{o3} = 20\cos(3000\pi t - 60°)$

$f_4 = \frac{5000\pi}{2\pi} = 2500 > 2000 \Rightarrow |H(f_4)| = 0$

$\therefore V_{out}(t) = 50 + 15\cos(2000\pi t - 90°)$

$+ 20\cos(3000\pi t - 60°)$

4.



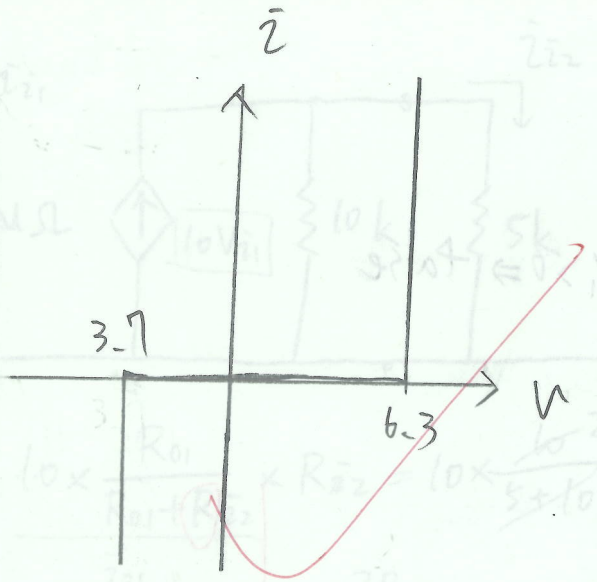
$$C = \frac{Q}{V} \Rightarrow V = \frac{Q}{C}$$

10

$$V_{ab} = \frac{Q}{2} \times \frac{1}{1\mu} + \frac{Q}{2} \times \frac{1}{1\mu} = \frac{Q}{1\mu}$$

$$C_{ab} = \frac{Q}{V_{ab}} = 1\mu F \quad \#$$

5.

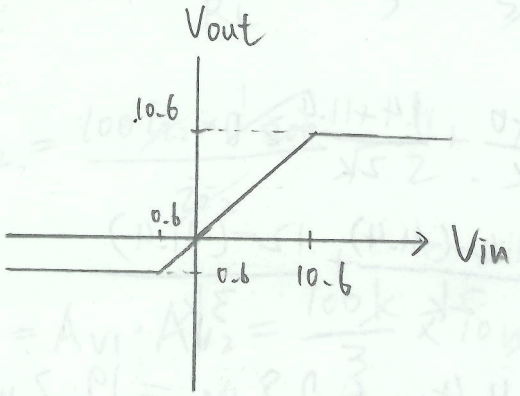


10

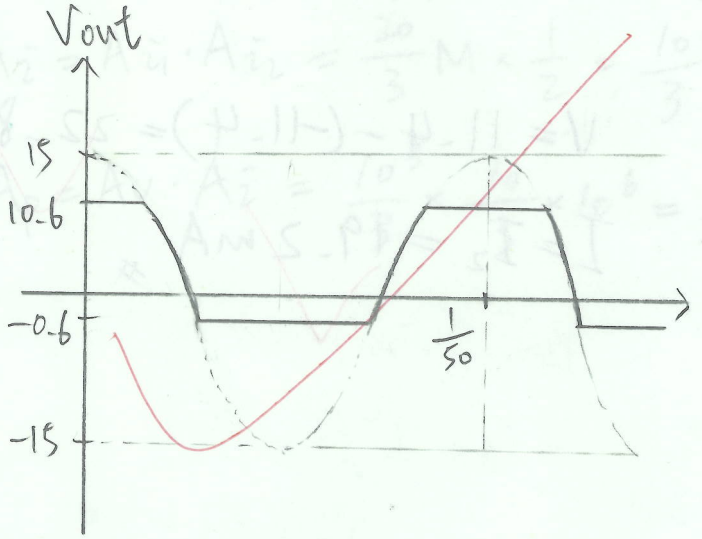
$3.1 + 0.6 = 3.7$

$5.7 + 0.6 = 6.3$

6.

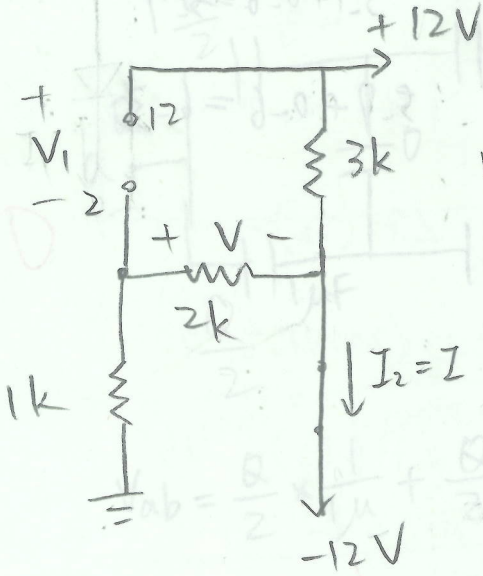


10



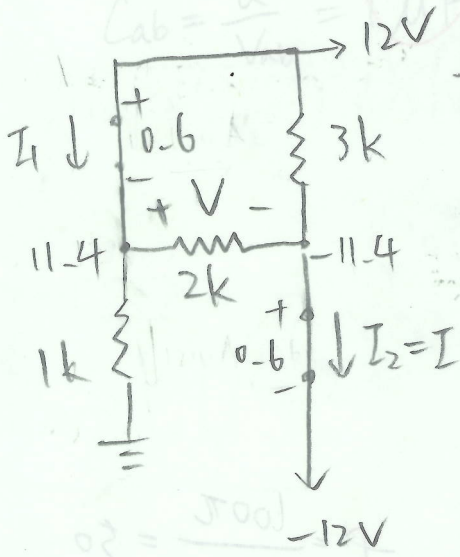
$f = \frac{100\pi}{2\pi} = 50$

7.



$V_1 > 0 \Rightarrow$ false

10



$$I_1 = \frac{11.4-0}{1k} + \frac{11.4+11.4}{2k} > 0$$

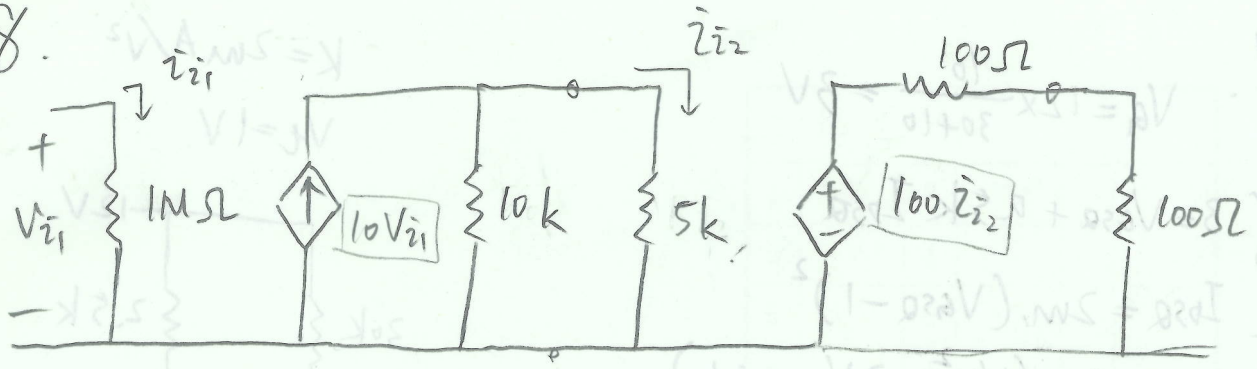
$$I_2 = \frac{11.4-(-11.4)}{2k} + \frac{12-(-11.4)}{3k}$$

$$= 11.4m + 7.8m = 19.2\,mA$$

$$V = 11.4-(-11.4) = 22.8\,V$$ #

$$I = I_2 = 19.2\,mA$$ #

8.



$$A_{V1} = 10 \times \frac{R_{O1}}{R_{O1}+R_{i2}} \times R_{i2} = 10 \times \frac{10}{5+10} \times 5k = \frac{100k}{3}$$

R_{O1}: i_{O1}, R_{i2}: i_{i2}

$$A_{i1} = A_{V1} \times \frac{R_i}{R_L} = \frac{100k}{3} \times \frac{1M}{5k} = \frac{20}{3}M$$

$$A_{i2} = \frac{100\,i_{i2} \times 1/200}{i_{i2}} = \frac{1}{2} \qquad A_{V2} = A_{i2} \times \frac{R_L}{R_i} = \frac{1}{2} \times \frac{100}{5k} = 10m$$

$$A_V = A_{V1} \cdot A_{V2} = \frac{100k}{3} \times 10m = \frac{1000}{3}$$

$$A_i = A_{i1} \cdot A_{i2} = \frac{20}{3}M \times \frac{1}{2} = \frac{10}{3}M$$

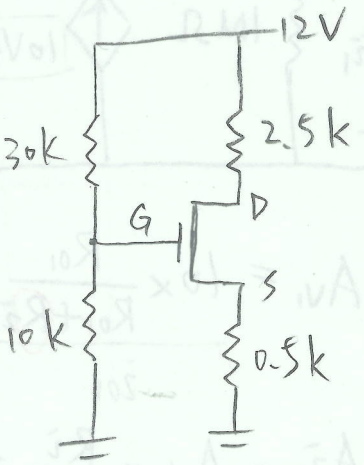
$$A_P = A_V \cdot A_i = \frac{10^3}{3} \times \frac{10}{3} \times 10^6 = \frac{10^{10}}{9}$$

9.

$V_G = 12 \times \frac{10}{30+10} = 3V$

$K = 2mA/V^2$

$V_t = 1V$



$$\begin{cases} 3 = V_{GSQ} + 0.5k\, I_{DSQ} \\ I_{DSQ} = 2m\,(V_{GSQ}-1)^2 \end{cases}$$

$= 2m\,(V_{GSQ}^2 - 2V_{GSQ} + 1)$

$\Rightarrow V_{GSQ} + 0.5k \times 2m\,(V_{GSQ}^2 - 2V_{GSQ} + 1)$

$= V_{GSQ}^2 - V_{GSQ} + 1 = 3$ (−2)

$\Rightarrow (V_{GSQ}-2)(V_{GSQ}+1) = 0$

$\Rightarrow V_{GSQ} = 2$ or -1

15

A.

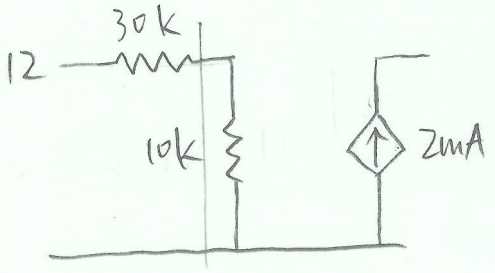
$I_{DSQ} = 2m\,(2-1)^2 = 2mA$ ※

$V_{GSQ} = 2V$ ※

$V_{DSQ} = 12 - 2m \times (2.5+0.5)k$

$= 6V$ ※

B.



Power dissipated on R_D & R_S

$= P_d = I^2 (R_D + R_S)$

$= (2m)^2 \times (0.5k + 2.5k)$

$= 4m \times 3 = 12mW$ ※