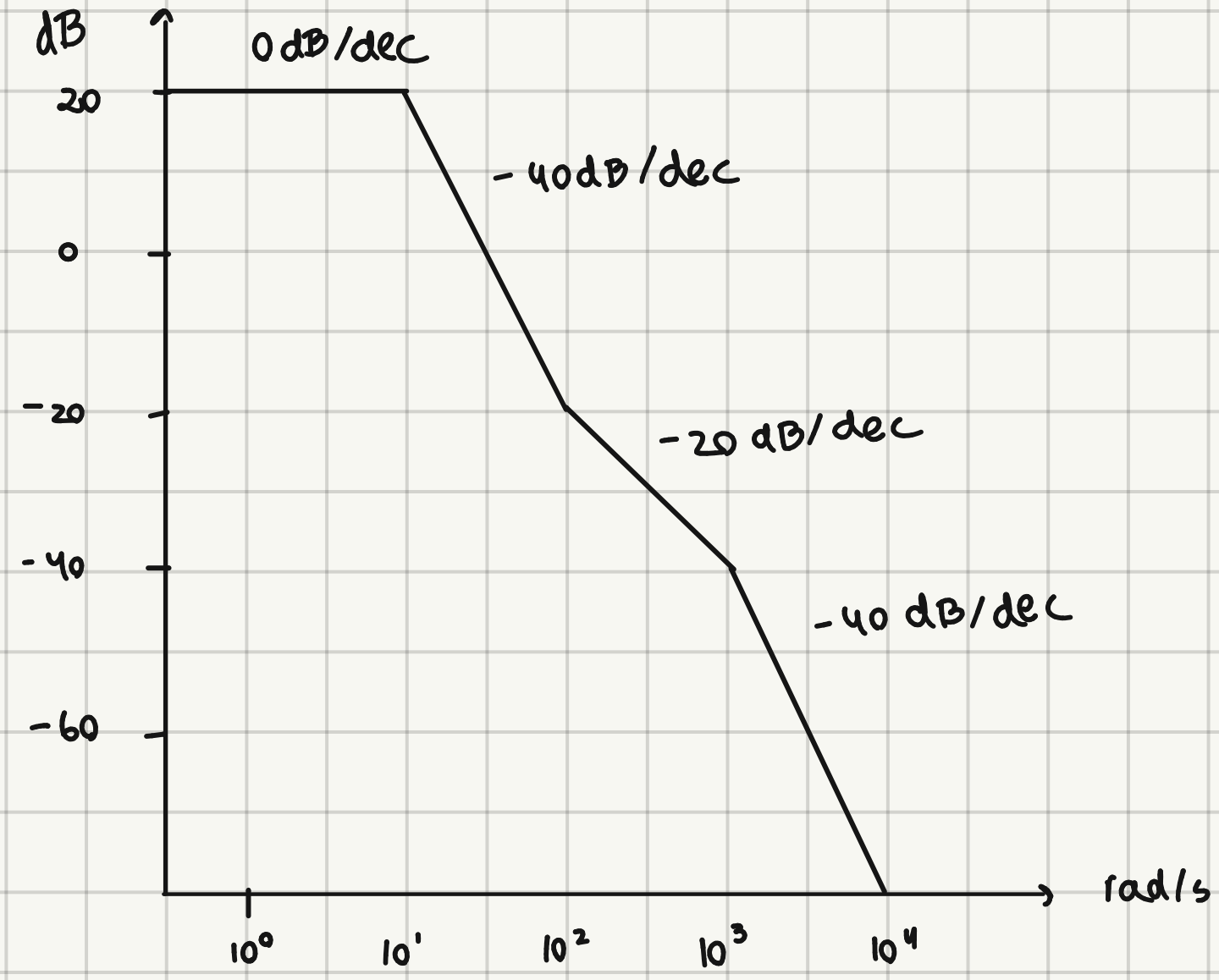
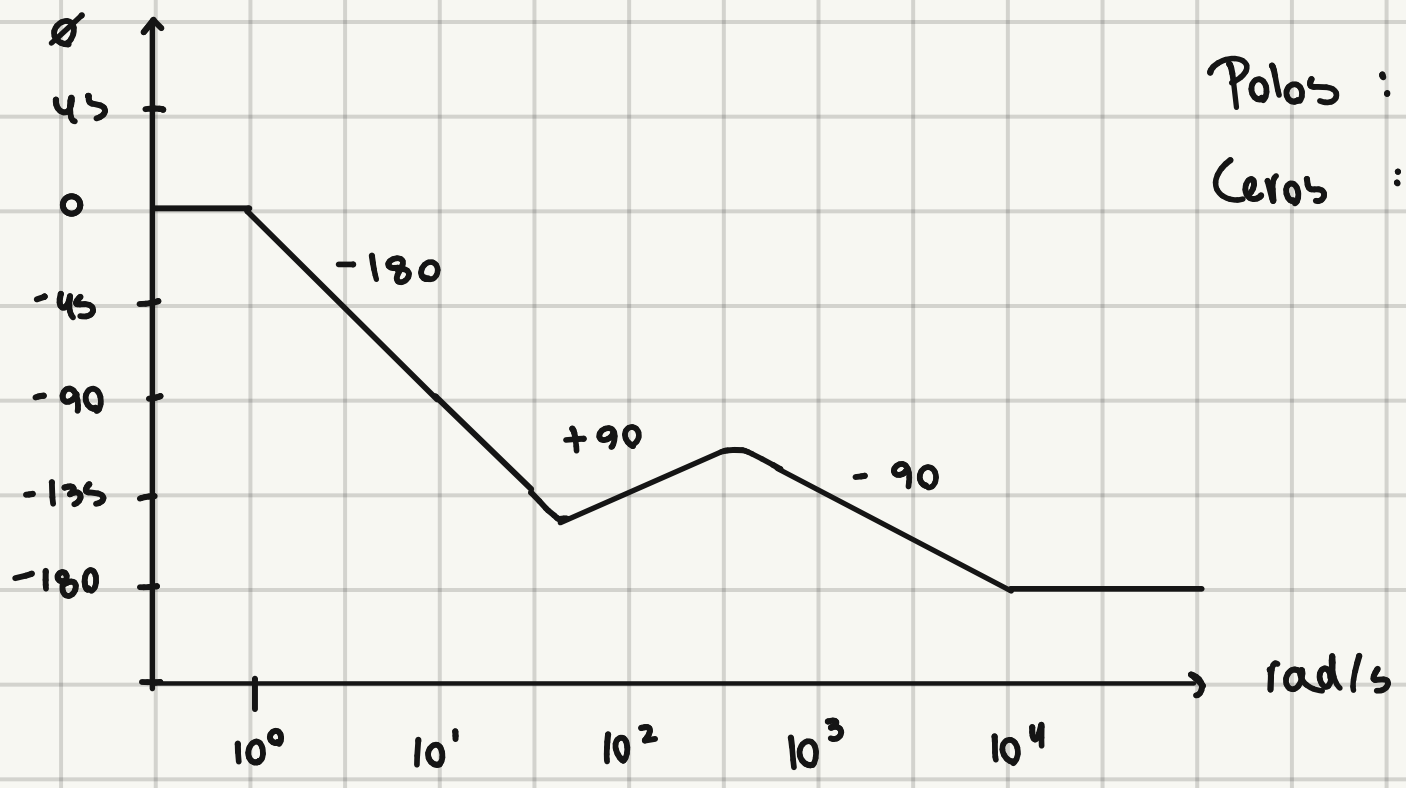
Ayudantía 15

2. Polos : $10, 10, 10^3$ rad/s (bajan 20 dB/dec, bajan 90°)

b) Ceros : 10^2 rad/s (suben 20 dB/dec, suben 90°)



Magnitud inicial : $20 \log 10 = 20$ dB ↑



Polos : $10, 10, 10^3$ rad/s

Ceros : 10^2 rad/s

1.

a.1) $I_a(\omega) = \dfrac{V_i(\omega)}{R + j\omega L}$

$V_o(\omega) = \dfrac{1}{j\omega C} \cdot A \cdot I_a(\omega)$

$\Bigg\} \quad \dfrac{V_o(\omega)}{V_i(\omega)} = \dfrac{A/CR}{j\omega\left(1 + j\omega L/R\right)}$

a.2) $V_c(\omega) = \dfrac{1/j\omega C}{R_1 + 1/j\omega C} \cdot V_i(\omega) = \dfrac{1}{1 + j\omega C R_1} V_i(\omega)$

$V_o(\omega) = \dfrac{R_3}{R_2 + R_3} \cdot A V_c(\omega) = \dfrac{2}{3} A V_c(\omega) = \dfrac{2/3\ A}{1 + j\omega(R_1} V_i(\omega)$

$\therefore \quad \dfrac{V_o(\omega)}{V_i(\omega)} = \dfrac{2/3\ A}{1 + j\omega C R_1}$

2. a)

Considerando cc virtual:

$$\frac{0-V_S}{R_1} + 0 + \frac{0-V_a}{R_2} = 0 \rightarrow V_a = -R_2/R_1 \cdot V_S$$

$$i_o = \frac{0-V_a}{R_2} + \frac{0-V_a}{R_3} = -\frac{R_2+R_3}{R_2R_3} \cdot V_a = \frac{(R_2+R_3)}{R_1R_3} V_S$$

$$\frac{V_a-0}{R_3} + 0 = \frac{0-V_o}{R_4} \rightarrow V_o = -R_4/R_3 \cdot V_a = \frac{R_2R_4}{R_1R_3} \cdot V_S$$

b) Haciendo mallas:

$$-i_o \cdot 10k - i_o \cdot 20k + 5 = 0 \rightarrow i_o = 1/6 \text{ mA}$$

V_a: ? $\quad V_a = 10k\, I_o = 10/6\, V$

Aplicando nodos:

$$\frac{V_a-0}{10K} + \frac{V_a-V_b}{20K} = 0 \rightarrow V_o = 3V_a = 5\, V$$

3.

a) Los voltajes vienen dados por:

$$V_1 = j6I_1 - j2(I_1 - I_2) - j4I_2 = j4I_1 - j2I_2$$

$$V_2 = j4(I_1 - I_2) - j2I_1 + j2I_2 = j2I_1 - j2I_2$$

$$V_3 = j8I_2 - j4I_1 + j2(I_1 - I_2) = -j2I_1 + j6I_2$$

$$V = -j5 \cdot I_2$$

El sistema ecc. para las corrientes es:

· Malla 1:

$$5I_1 + V_1 + 6(I_1 - I_2) + V_2 = 10\angle 0°$$

$$5I_1 + j4I_1 - j2I_2 + 6(I_1 - I_2) + j2I_1 - j2I_2 = 10\angle 0°$$

· Malla 2:

$$-V_2 + 6(I_2 - I_1) + 2I_2 + V_3 - j5I_2 = 0$$

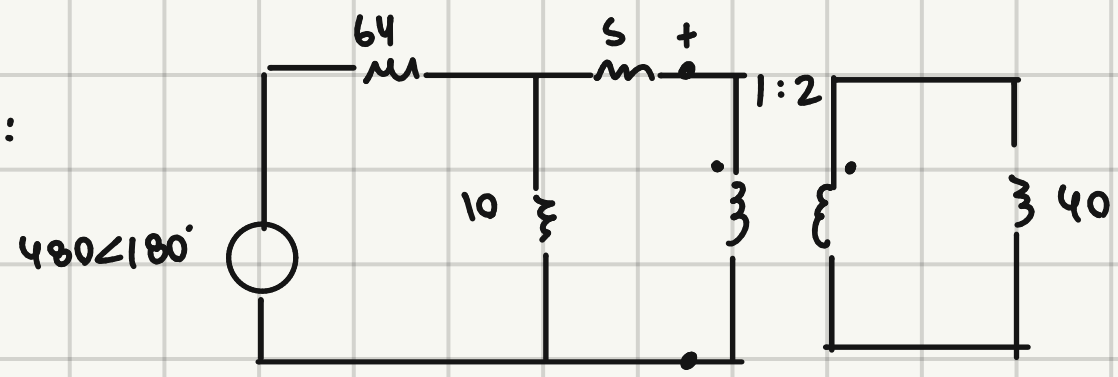
$$-[j2I_1 - j2I_2] + 6(I_2 - I_1) + 2I_2 - j2I_1 + j6I_2 - j5I_2 = 0$$

b) Refiere al secundario:

$$Z_{4\Omega} : 4 \cdot (4/1)^2 = 64\,\Omega$$

$$V_{120\angle 0°} : 120\angle 0° \cdot (4/1) \cdot (-1) = 480\angle 180°$$

Ckt eq:



Reduciendo lado primario: $V_{th}: \dfrac{480\angle 180° \cdot 10}{64 + 10} = 64.86 \angle 180\ V$

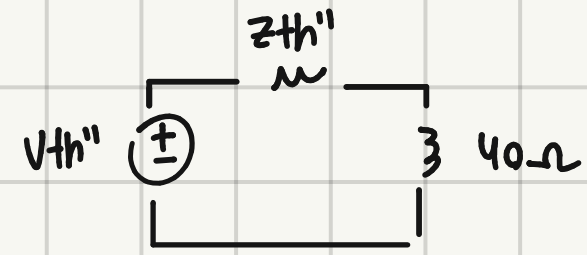
$$R_{th}: 64 \,//\, 10 + 5 = 13{,}64\,\Omega$$

Refiere al secundario:

$Zth'' = 13,648 \cdot (2/1)^2 = 54,59\,\Omega$

$Vth'' = 64,86 \angle 180 \cdot (2/1) = -129,729 \angle 0°$

Ckt:



$\therefore \quad I = \dfrac{Vth''}{Zth'' + 40}$

$P = R \cdot |I|^2 = 40 \cdot \left| \dfrac{-129,73}{54,59 + 40} \right|^2$

$\boxed{P = 75,24W}$

c) Saca eq th parte izq:

$Vth: \quad V_1 \cdot \dfrac{1/j\omega C}{R_1 + 1/j\omega C} + V_2 = \dfrac{1}{1 + j\omega R_1 C} V_1 + V_2$

$Zth: \quad (R_1 \,//\, 1/j\omega C) + R_2 = \dfrac{R_1}{1 + j\omega R_1 C} + R_2$

Se refiere a la derecha:

$Vth' = Vth \cdot (n/1) \cdot (-1)$

$Rth' = Rth \cdot (n/1)^2$

$\therefore \quad Vo = \dfrac{Vth' \cdot R_4}{Rth' + R_3 + R_4}$

4. · Colocando fuente V_1 y dejando salida en c.a:

$$I_1 - m V_2 - I = 0 \quad (1)$$

$$V_1 = 4 I_1 + 5 I \quad (2)$$

Como $V_2 = 3I$, $I = V_2/3$ en (1):

$$I_1 = m V_2 + V_2/3 = (m + 1/3) V_2$$

$$\therefore \quad z_{21} = \frac{V_2}{V_1} = 1\,\Omega$$

Luego, $I = V_2/3$ en (2):

$$V_1 = 4 I_1 + \frac{5 V_2}{3} = 4 I_1 + \frac{5}{3} I_1$$

$$\therefore \quad z_{11} = \frac{V_1}{I_1} = \frac{17}{3}\,\Omega$$

· Para z_{22} y z_{12} conecta V_2 salida y los terminales de la entrada se dejan en c.a.

Por mallas: $$V_1 + 5 I_4 - 3 I_2 = 0 \quad (3)$$

$$V_2 + 3 I_4 - 3 I_2 = 0 \quad (4)$$

Como $I_4 = m V_2$, sustituyendo en (4):

$$V_2 + 3m V_2 - 3 I_2 = 0$$

$$V_2 = 3/3\ I_2$$

$$\therefore \quad z_{22} = \frac{V_2}{I_2} = 1\,\Omega$$

Sustituyendo $I_4 = m V_2$ en (3):

$$V_1 + 5m V_2 = 3 I_2$$

$$V_1 + 5m I_2 = 3 I_2$$

$$\therefore \quad z_{12} = \frac{V_1}{I_2} = 3 - 5m = -\frac{1}{3}$$