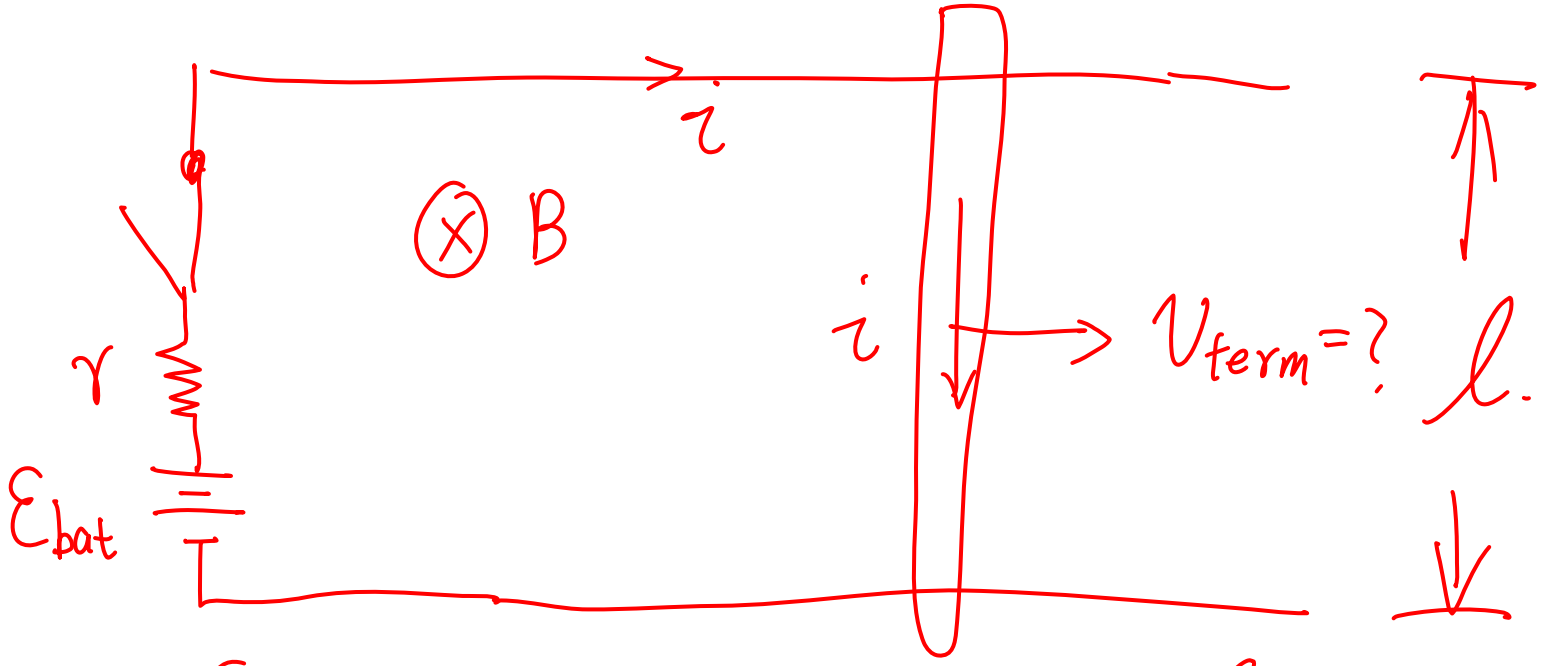
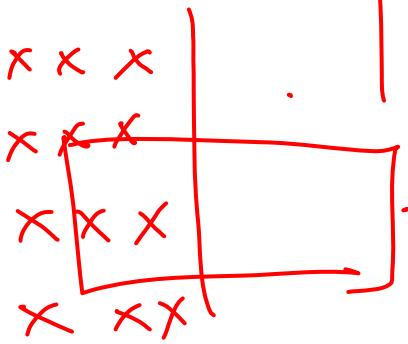


$\mathcal{E}_{batt} = 1.0\ V$ $\quad r = 0.1\ \Omega$ $\quad l = 6.0\ cm$

$B = 0.5\ T$ $\quad$ At $t = 0$, switch closed

$v_{term} = ?$

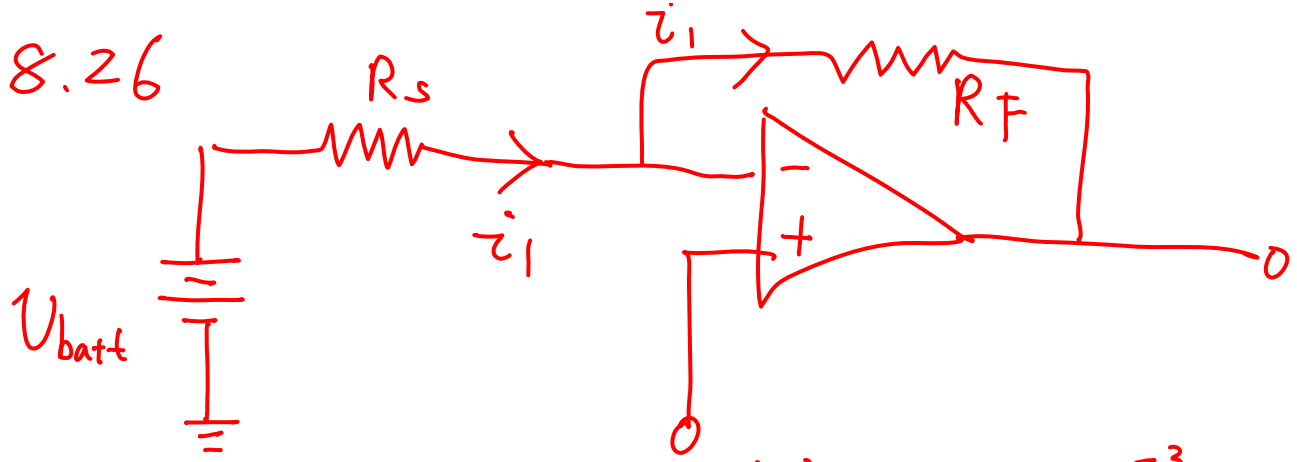


$$|\mathcal{E}_{induced}| = \boxed{B l v_{term}} = \mathcal{E}_{batt}$$

$$v_{term} = \frac{\mathcal{E}_{batt}}{B l} = \frac{1.0}{0.5 \times 0.06}$$

$$= 33.3\ m/s$$

8.26



$R_F = 10\,k\Omega$

$R_S = ?$

$v_1(t) = 10 + 10^{-3}\sin\omega t \quad (V)$

$$\begin{cases} i_1 = \dfrac{V_{batt} - v_1(t)}{R_S} \\ i_1 = \dfrac{v_1(t) - V_{out}}{R_F} \end{cases}$$

$$\begin{cases} V_{batt} - i_1 R_S - v_1(t) = 0 \\ v_1(t) - i_1 R_F - V_{out}(t) = 0 \end{cases}$$

$$V_{out}(t) = v_1(t)\left(1 + \frac{R_F}{R_S}\right) - \frac{R_F}{R_S} V_{batt}$$

$$= 10\left(1 + \frac{R_F}{R_S}\right) + 10^{-3}\sin\omega t\left(1 + \frac{R_F}{R_S}\right) - \frac{R_F}{R_S} V_{batt}$$

$$10\left(1+\frac{R_F}{R_S}\right)-\frac{R_F}{R_S}V_{batt}=0$$

$$11$$

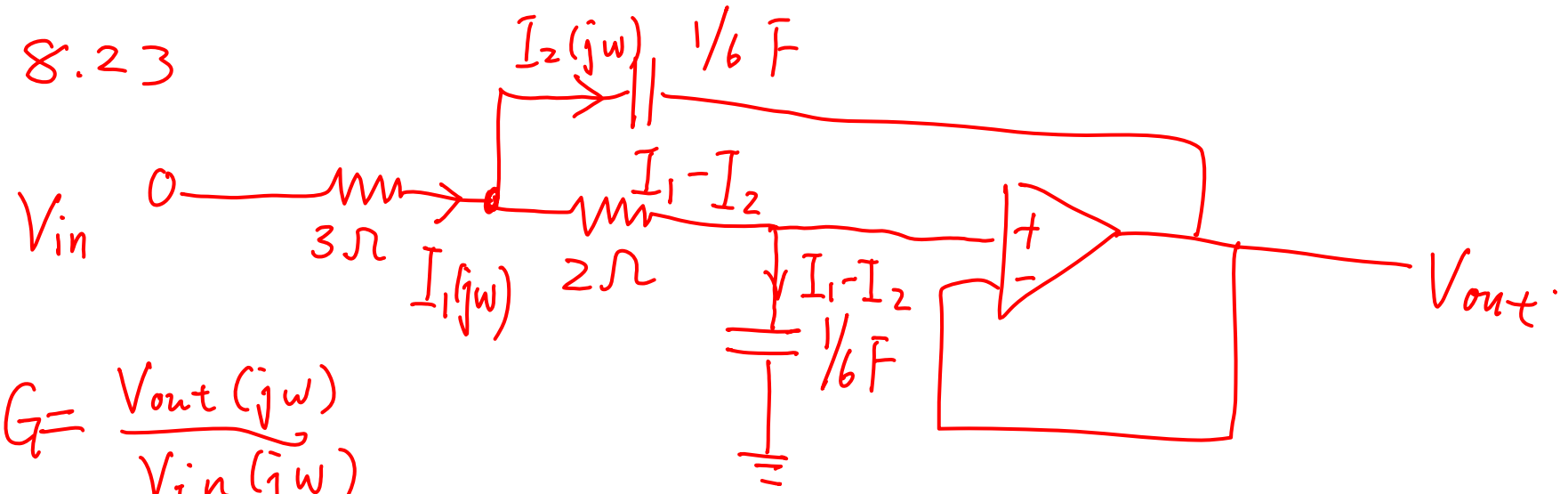
$$20$$

$$1-\frac{R_F}{R_S}=0$$

$$R_S=R_F=10k\Omega$$

b. $V_{out}=2\times10^{-3}\sin\omega t \quad (V)$

8.23



$$G=\frac{V_{out}(jw)}{V_{in}(jw)}$$

$$Z_C=\frac{1}{jwC}=\frac{1}{jw\frac{1}{6}}=-\frac{6j}{w}\ (\Omega)$$

$$\begin{cases} V_{in}-3I_1-2(I_1-I_2)-\left(-\frac{6j}{w}\right)(I_1-I_2)=0 & ① \\ (I_1-I_2)\left(-\frac{6j}{w}\right)-V_{out}=0 & ② \\ V_{in}-3I_1-\left(-\frac{6j}{w}\right)I_2-V_{out}=0 & ③ \end{cases}$$

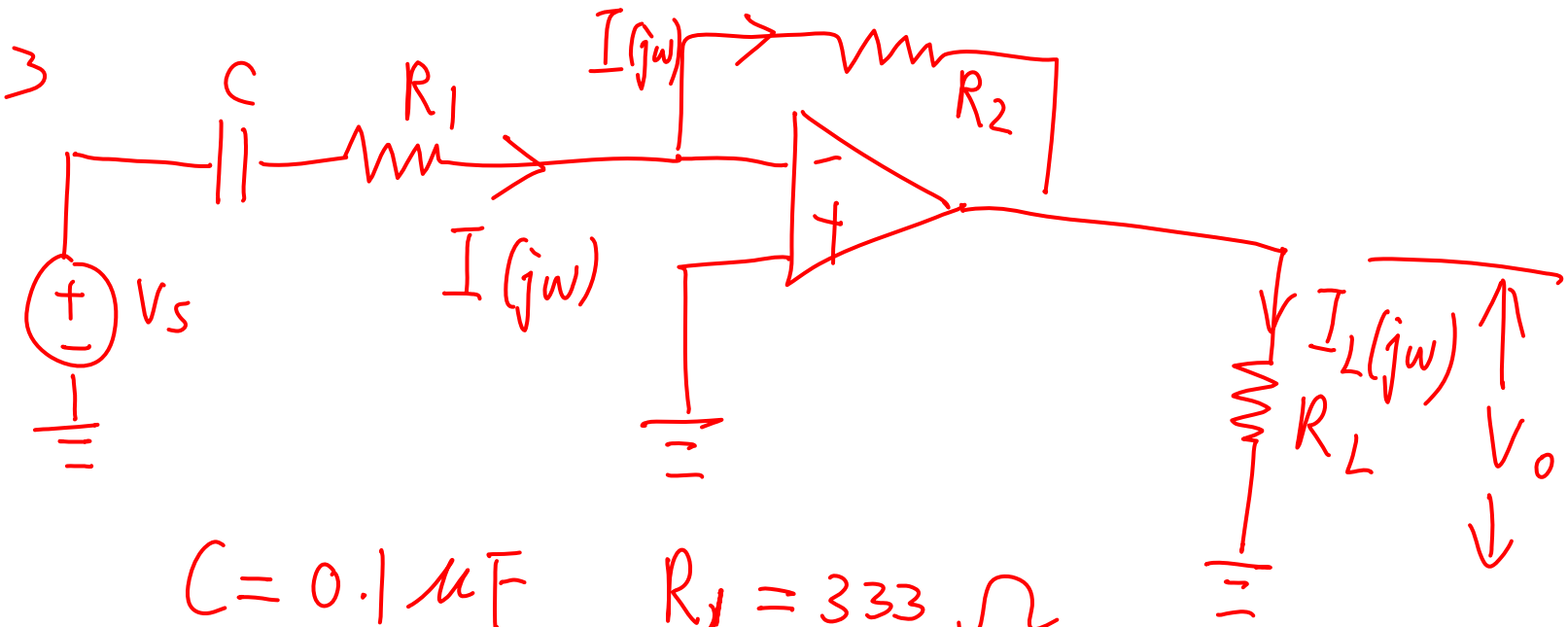
② − ③ $\quad I_1=\dfrac{V_{in}}{3\left(1-\frac{2j}{w}\right)}$

① $$I_2 = \frac{2 V_{in}}{\left(\frac{6j}{\omega} - 3\right)\left(\frac{6j}{\omega} - 2\right)}$$

$$V_{out} = -\frac{6j}{\omega}(I_1 - I_2) = -\frac{6 V_{in}}{\omega^2 - 5j\omega - 6}$$

$$G = \frac{V_{out}}{V_{in}} = -\frac{6}{\omega^2 - 5j\omega - 6}$$

8.53



$C = 0.1\,\mu F \qquad R_L = 333\,\Omega$

$R_1 = 1.8\,k\Omega \qquad R_2 = 8.2\,k\Omega.$

$$\begin{cases} I(jw) = \dfrac{V_s - 0}{R_1 + \dfrac{1}{jwC}} \\ I(jw) = \dfrac{0 - V_o}{R_2} \end{cases}$$

$$\frac{V_o}{V_s} = -\frac{R_2}{R_1}\,\frac{1}{1 + \dfrac{1}{jwCR_1}}$$

high pass

$w \to 0 \quad G_T \to 0$

$w \to \infty \quad G_T = -\dfrac{R_2}{R_1}$

$$20 \log_{10} \left| \frac{V_o}{V_s} \right| = dB$$

$$\hookrightarrow \frac{R_2}{R_1}$$

$$|dB|_{w \to \infty} = 20 \log_{10} \frac{R_2}{R_1} \left(\frac{8.2}{1.8} \right) = 13.17 \, dB$$

C. Cut-off.

$$\frac{1}{w_0 C R_1} = 1 \qquad w_o = \frac{1}{C R_1}$$

U