Problem 1.
For $L = 2$ H, $C = 500$ nF, and $R = 1$ kΩ determine the sinusoidal steady-state output current $i_2(t)$ for $i_1(t) = 5\cos 1000t$. Repeat for $i_1(t) = 10\sin 500t$.

Problem 2.
The step response of a circuit is $g(t) = [2e^{-at} - 1]u(t)$ where $a > 0$ is a real number.
(a) Find the circuit transfer function. Is the circuit stable?
(b) For a certain input $x(t)$, the output is $y(t) = [2e^{-at}]u(t)$. Find one possible input $x(t)$.

Problem 3.
A ladder network has a voltage gain of
$$H(\omega) = \frac{10}{(1 + j\omega)(10 + j\omega)}$$
Sketch the Bode plots for the gain.

Problem 4.
Sketch the Bode plots for
$$H(\omega) = \frac{10 + j\omega}{j\omega(2 + j\omega)}$$

Problem 5.
Sketch the Bode plots for
$$T(s) = \frac{s+1}{s(s+10)}$$

Problem 6.
Construct the Bode plots for
$$G(s) = \frac{s+1}{s^2(s+10)}, \quad s = j\omega$$

Problem 7.
Sketch Bode magnitude and phase plots for
$$H(s) = \frac{40(s+1)}{(s+2)(s+10)}; \quad s = j\omega$$

Problem 8.
Sketch the Bode plots for
$$G(s) = \frac{s}{(s+2)^2(s+1)}, \quad s = j\omega$$
Problem 9.
Sketch the asymptotic Bode plots of the magnitude and phase for
\[ H(s) = \frac{100s}{(s+10)(s+20)(s+40)}, \quad s = j\omega \]

Problem 10.
Find the transfer function \( H(\omega) \) with the Bode magnitude plot shown below

![Bode magnitude plot](image)

Problem 11.
The Bode magnitude plot of \( H(\omega) \) is shown below. Find \( H(\omega) \).

![Bode magnitude plot](image)

Problem 12.
The magnitude plot in the figure below represents the transfer function of a preamplifier. Find \( H(s) \).

![Magnitude plot](image)