Problem 1

A. Find values of $R_1$ and $R_2$ in the circuit at right so that its Thevenin equivalent (defined with respect to nodes $a$ and $b$) will have $V_{TH} = 22$ V and $R_{Th} = 5.5$ kΩ.

$$R_1 = _________________________ \quad R_2 = _________________________$$

B. Find values of $R_3$ and $R_4$ in the circuit at right so that its Norton equivalent (defined with respect to nodes $a$ and $b$) will have $I_N = 5$ mA and $R_N \ ( = R_{Th}) = 1$ kΩ.

$$R_3 = _________________________ \quad R_4 = _________________________$$
Problem 2

Find the over-all gain $G = v_o/v_s$ of the circuit shown below. (Hint: The first amp in the chain is a summing amp.)

$G =$ __________________________________________________________________________
Problem 3

At right is the graph of a transient response of some circuit. Note that the curve passes through 7.364 at \( t = 2 \, \mu \text{s} \).

A. If the units of the vertical scale are volts, design a circuit in which the voltage across a 10-nF capacitor has this response.

B. If the units on the vertical scale are amps, design a circuit in which the current through a 15-mH inductor has this response.

Your designs should specify the parameters of the source and any resistors that are connected to the source and the capacitor / inductor. You can use either a source that has a step change in value at \( t = 0 \) or a combination of constant source with a switch. Keep your designs simple!
In the circuit below, the switch has been to left “forever”. At $t = 0$, the switch flips to the right.

Calculate expressions for the capacitor voltage and inductor current as functions of time. Hint: The initial values for the capacitor voltage and inductor current are determined from the situation when the switch is to the left, i.e. for $t < 0$.

$$v_c(t) = \text{expression}$$

$$i_L(t) = \text{expression}$$