The circuit shown in Figure B is a variation of the familiar inverting amplifier circuit shown in Figure A. Circuit B is often preferred over A because for identical input impedance and gain, circuit B requires much lower resistor values and, therefore, is less affected by (Johnson) noise.

Your task is to select appropriate resistor values for the circuits in Figure A and B that result in identical input impedances and gain for the two circuits, i.e., $Z_{in} = 100 \, \text{kOhm}$ and a (closed loop) gain $V_{out}/V_{in} = 10^4$.

(For all subsequent questions, you may assume that you are working with ideal op-amps.)

a) For the circuit in Figure A what should $R_1$ be if the $Z_{in} = 100 \, \text{k}$?

b) Based on your previous answer, calculate the value for $R_f$ if the gain, $V_{out}/V_{in}$, of this circuit is to be $-10^4$. Is this a “realistic” resistor value?

c) For the circuit in Figure B what should $R_1$ be if the $Z_{in} = 100 \, \text{k}$?

d) For the circuit shown in Figure B calculate $V_{out}/V_{in}$ in terms of $R_1$, $R_2$, and $R_3$. (Hint: you may want to express some of your equations using the voltage at the node formed by $R_2$ and $R_3$.)

e) If none of the resistors in Figure B can exceed 300k what are the values for $R_2$ and $R_3$ if $V_{out}/V_{in}$ of this circuit is to be $-10^4$ and $Z_{in} = 100 \, \text{k}$.