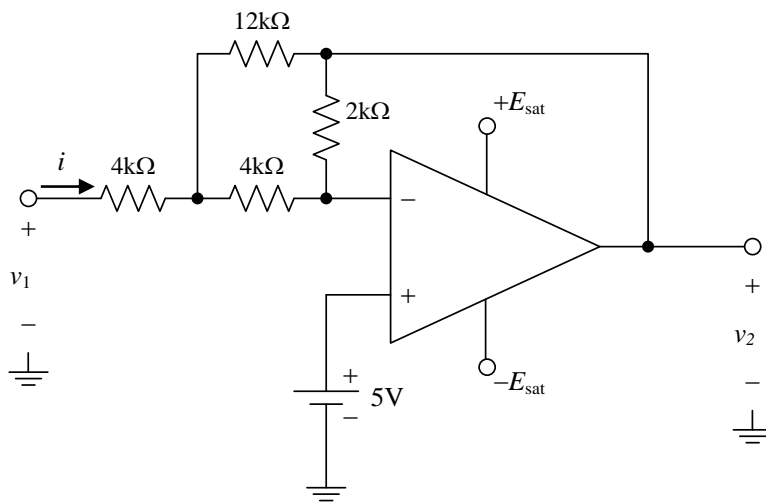


HOMWORK VI

Question 1 Obtain and plot the transfer and input characteristics for the circuit given below.

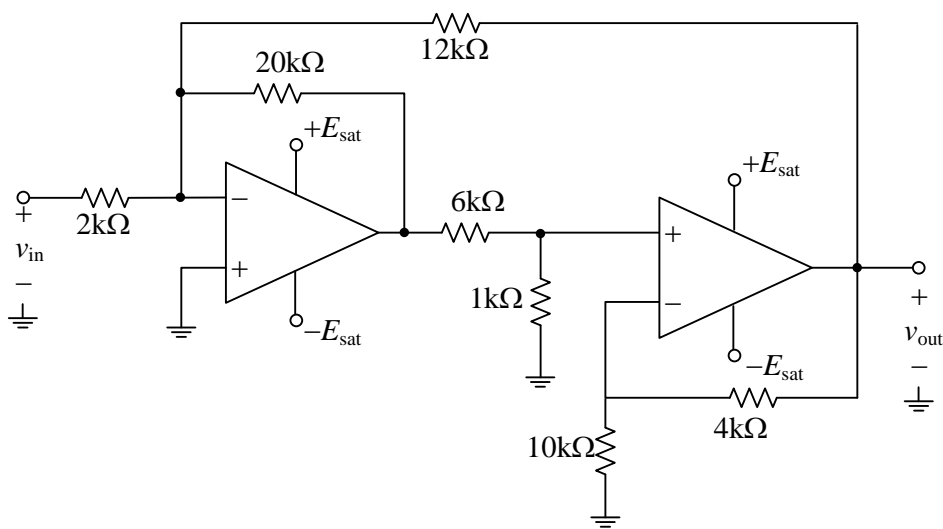


$$E_{sat} = 12 \text{ V.}$$

Answer Linear region: $v_2 = -0.2v_1 + 6 \text{ V}$; $i = 0.15v_1 - 0.75 \text{ mA}$.

Question 2 In the below circuit, both op-amps are in the linear region.

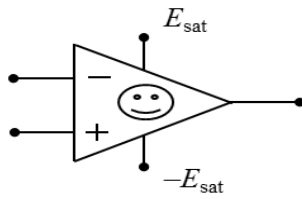
- Find the voltage gain $G_v = \frac{v_{out}}{v_{in}}$.
- Determine the range for v_{in} values so that both op-amps stay in the linear region.



$$E_{sat} = 15 \text{ V.}$$

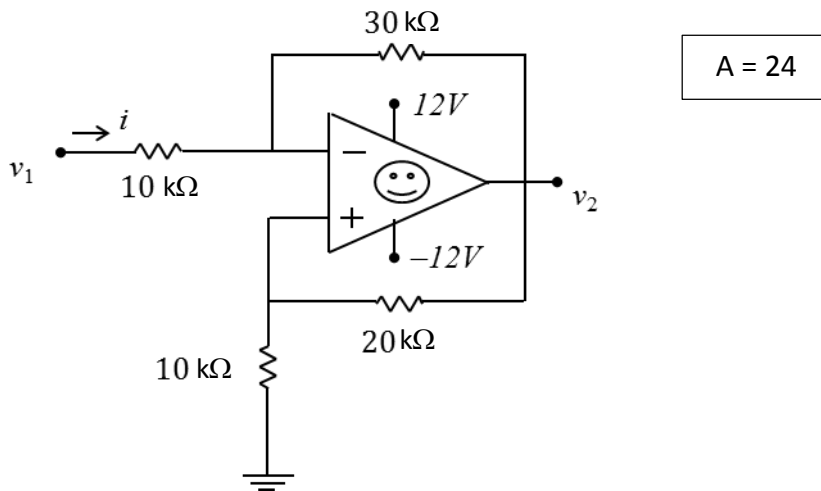
Answer a) $G_v = -1.5$.

Question 3 The lop-amp shown below is a circuit element similar to op-amp.



Its model is identical to the finite-gain ideal op-amp model (for which $R_{in} = \infty$, $R_{out} = 0$) except that the gain A has a low value.

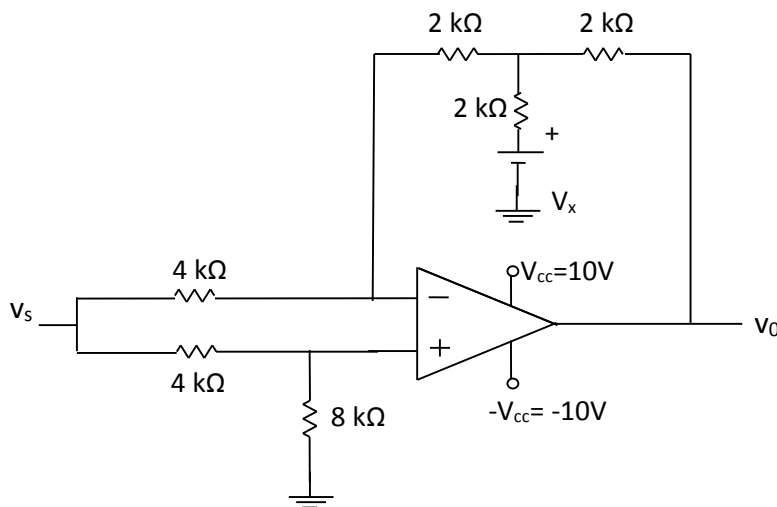
Obtain and plot the transfer and input characteristics for the circuit given below.



Answer Linear region: $v_2 = 18v_1$.

Question 4 Obtain and plot the transfer characteristic for the circuit given below.

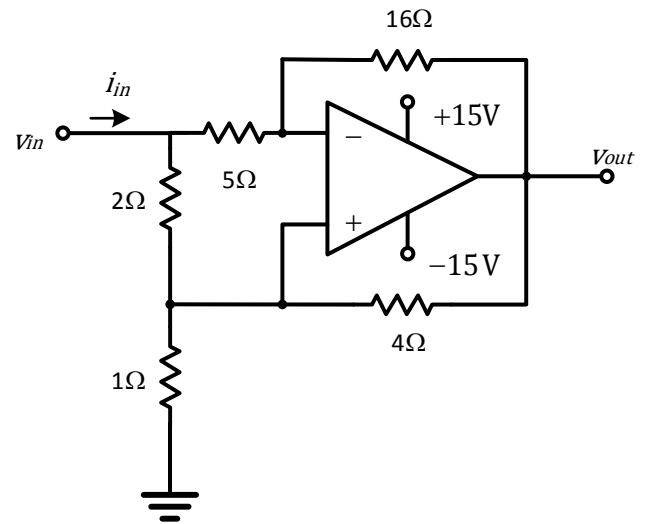
a) $V_x = 5$ V. b) $V_x = -10$ V.



Answer a) Linear region: $v_o = (5/6)v_s - 5$ V.

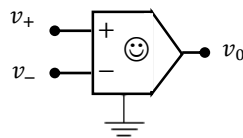
Question 5 Consider the circuit shown.

- a) Determine and plot the voltage transfer characteristic, v_{out} VS v_{in} .
 b) Determine and plot the input characteristic, i_{in} VS v_{in} .



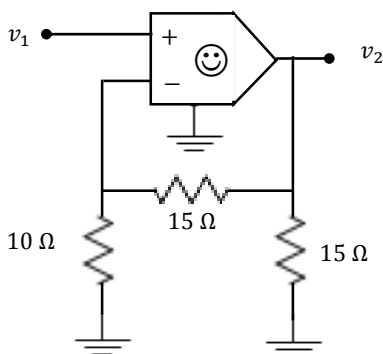
Answer a) Linear region: $v_{out} = -5v_{in}$.

Question 6 The element shown below is the gentle-amp (GE), which is an op-amp like element.



In the linear region, its input resistance is $30\ \Omega$, output resistance is $3\ \Omega$, and gain is $A = 5$. The GE is in the linear region as long as $|A(v_+ - v_-)| \leq 15\text{ V}$.

Consider the circuit below.



- a) Find the range of input (v_1) values so that the GE operates in the linear region.
 b) When the GE is operating in the linear region, find the range of output (v_2) values.

Answer a) $-90/11\text{ V} \leq v_1 \leq 90/11\text{ V}$. b) $-126/11\text{ V} \leq v_2 \leq 126/11\text{ V}$.