11a.

\[ KCL : \quad 12.5 - \frac{V}{0.57} - I = 0 \]

\[ I = -\frac{1}{0.57} V + 12.5 \]

11b.

I

slope = \frac{-1}{0.57}

R.

\[ V_+ = 0 \]

so \[ V_+ - V_- = 0 \]

\[ V_- = V_+ = 0 \]

\[ KCL : \quad \frac{V_B}{6000} + \frac{V_B}{4000} + \frac{V_B - 11}{2000} = 0 \]

\[ \frac{V_B}{6} + \frac{V_B}{4} + \frac{V_B - 11}{2} = 0 \]

\[ 2V_B + 3V_B + 6V_B - 66 = 0 \]

\[ 11V_B - 66 = 0 \]

\[ V_B = 6 V \]
13. \( I = \frac{11-6}{2000} = \frac{5}{2000} = 2.5 \text{ mA (left to right)} \) (+0.5)

4 kΩ: \( I = \frac{6 \text{ V}}{4000} = 1.5 \text{ mA (top to bottom)} \) (+0.5)

6 kΩ: using KCL \( I + 1.5 \text{ mA} = 2.5 \text{ mA} \)

\[ I = 1 \text{ mA (left to right)} \] (+0.5)

12 kΩ: \( I = 1 \text{ mA \ left to \ right \ (since \ } I_- = 0) \) (+0.5)

14. \( V_{out} = 1 \text{ mA \ \cdot \ 12 \text{ kΩ} = -12 \text{ V}} \)

\[ A = \frac{V_{out}}{V_{in}} = \frac{-12}{11} \]

\[ A = -1.09 \] (+1)

15a.

[Diagram of a circuit with annotations and calculations]
15b. Since I thru the 12 kΩ resistor is 1 mA
this also passes through the 30 kΩ resistor:

\[ V = I \cdot R = (1 \text{ mA}) \cdot 30 \Omega = 0.03 \text{ V} \]

16. Since \( V_{\text{out}} = -12 \) and there is a 0.03 V drop across the 30 kΩ resistor,

\[ 10,000 \cdot (V_-) = -12 - 0.03 = -12.03 \]

\[ V_- = \frac{-12.03}{10,000} = -0.0012 \text{ V} \]

\( V_- \approx 0 \), as expected.

\[ I_{\text{in}} = \frac{V_-}{R_{\text{in}}} = \frac{-0.0012 \text{ V}}{100,000} = -1.2 \cdot 10^{-6} \text{ A} \]

(bottom to top)
again \( I \approx 0 \) as expected.

17. \( I \) thru resistor := \[ \frac{-12 \text{ V}}{12 \Omega} = 1 \text{ A} \]

\( V_{\text{out}} = 1 \text{ A} \cdot 30 \Omega = 30 \text{ V} \) <- huge voltage drop across \( V_{\text{out}} \)

(can't be supported by op-amp)