HW2, Problem 2.47

Let $V_1 = V_{1.5}$; $V_2 = V_{2.5}$

For the circuit on top,

\[
\frac{V_1}{10} = (5 - 1) \quad V_1 = 40V
\]

For the circuit at the bottom,

\[
\frac{V_1}{10} = 2.4 \quad V_1 = 24V
\]

Overall,

\[
V_1 = 40V + 24V = 64V
\]

For the circuit on top,

\[
\frac{V_2}{20} = 1 \quad V_2 = 20V
\]

For the circuit at the bottom,

\[
\frac{V_2}{20} = 0.6 \quad V_2 = 12V
\]

Overall,

\[
V_2 = 20V + 12V = 32V
\]
HW2, Problem 2

2) Since the networks are in series, we will represent them with their theorem equivalent.

\[ V(V) \]

\[ \text{3000 ohm} \]

\[ \text{3500 ohm} \]

\[ 1 \text{ (mA)} \]

\[ \frac{2}{7} \]

\[ \cdot \frac{4}{7} \text{ mA} \]

HW2, Problem 3

Since there can be no current through the bottom branch, \( V_{R_2} = 0 \cdot R_2 = 0 \).

Thus \( V_{E_1} \) the dependent source will have \( \frac{1}{s} = (G_m \cdot 0) = 0 \).

\[ R_0 \] kcl \( v_{i1} - v_{i2} = 0 \).

So \( V_{E_1} = 0 \), \( R_1 = 0 \).

Thus \( V_{V_1} = V_{i1} \).

Since

\[ I_1 = -Gm \cdot V_{R_2} \]

\[ V_{R_2} = I_{sc} \cdot R_2 \]

\[ V_{R_2} + R_1(I_2 - I_1) - V_i = 0 \]

\[ V_{R_2} + R_1(I_{sc} + Gm \cdot V_{R_2}) - V_i = 0 \]

\[ I_{sc} \cdot R_2 + R_1(I_{sc} + Gm \cdot I_{sc} \cdot R_2) - V_i = 0 \]

\[ I_{sc} \cdot R_2 + I_{sc} \cdot R_1(1 + Gm \cdot R_2) - V_i = 0 \]

\[ I_{sc} \cdot (R_1 + R_2 + Gm \cdot R_1 \cdot R_2) = V_i \]

\[ I_{sc} = \frac{V_i}{(R_1 + R_2 + Gm \cdot R_1 \cdot R_2)} \]
\[ R_{th} = \frac{V_{oc}}{I_{sc}} = \frac{V_i}{V_1} = R_i + R_2 + Gm \cdot R_i \cdot R_2 \\
(\frac{1}{R_i + R_2 + Gm \cdot R_i \cdot R_2}) \]