Voc = \frac{-5V}{5\Omega} + \frac{Voc}{5\Omega} + I_s = 0 \text{ OR } Voc = \frac{5(1-I)}{2}

For I_s = 2A, \quad V_T = Voc = \frac{2(1-2)}{2} = -2.5V

Then the Thevenin equivalent is shown above.

3.13 See solution to prob. 3.12.

For I_s = 1A, \quad V_T = Voc = 0

The Thevenin equivalent is simply a 2.5Ω resistor. Note that the formula \( R_T = \frac{Voc}{I_{sc}} \) can still be used.

3.14 (a) At node A:
\[
\frac{11-5V}{5Ω} + \frac{V_A + 2A + V_A}{5Ω} = 0
\]
\Rightarrow V_A = -2V

Then \( I_0 = \frac{V_A}{10Ω} = -0.2A \)

(c) From the solution to problem 3.12.

The circuit becomes \ 2.5Ω:
\[
I_0 = \frac{-2.5}{2.5+10} = -0.2A
\]
An ideal voltmeter (ammeter) is an open (short) circuit. Thus from Fig 3.38, \( V_{oc} = 6V \) and \( I_{sc} = -0.19A \). It follows that the corresponding Thévenin Equivalent is characterized by \( V_T = V_{oc} = 6V \), \( R_T = -\frac{V_{oc}}{I_{sc}} = -\frac{6V}{-0.19A} \approx 31.6 \Omega \).

The I-V characteristic given by Eq. (3-6)

\[
I = \frac{V}{R_T} - \frac{V}{R_T} = \frac{V}{33\Omega} - 0.19A.
\]

The two characteristics shown do not agree because the battery is non-linear and hence no Thévenin equivalent; a Thévenin circuit is always represented by a linear I-V characteristic.

(3.16) For the 40Ω resistor, the I-V characteristic is

\[
I = \frac{V}{40\Omega}.
\]

By the graphical method portrayed above, we can find the voltage across the resistor and the current through it for both parts (a) & (b).
WE GET THE LOAD LINE. NOW THE INTERSECTION OF THE I-V CURVE AND THE LOAD LINE GIVES THE CURRENT FLOWING THROUGH N1 TO BE 3mA

\[ I = 0.002V^2 \]  
(3)

\[ V - V_0 + IR = 0 \]  
(6)

ELIMINATING I FROM THE TWO EQUATIONS RESULTS IN A QUADRATIC EQUATION FOR V:

\[ V^2 + \frac{500}{R_T}V - \frac{300V_0}{R_T} = 0 \]

FOR \( R_T = 1000 \Omega \), \( V_0 = 10V \):

\[ V = -10V, I = 0.2A \]

\[ V = 5V, I = 0.05A \]

THE CIRCUIT HAS TWO OPERATING POINTS.

(2) GRAPHICAL SOLUTION.
(3.31) \[ P_{AV} = \frac{1}{T} \int_{0}^{T} V_i(t) I(t) \, dt \]

\[ = \frac{1}{0.002} \left[ \frac{0.5^2 \times (0.2 \times 0.002)}{60} \right]_{0.002}^{0.002} \]

\[ = \frac{1}{0.002} \left[ \frac{0.5^2 \times (0.2 \times 2)}{150} \right] \]

\[ = 0.2 \, \text{mW} \]

(3.32) \[ P_{AV} = P_{V1} + P_{V2} + P_{V3} \]

\[ = [5 \times (10) + (15) \times (-10) + (20) \times (50)] \, \text{mW} \]

\[ = 9.5 \, \text{mW} \]

Note that current flowing into the op-amp is considered positive.

(3.34) \[ I_e = \frac{-9 \times (-0.8)}{R_8} \]

\[ = \frac{-8.2}{400} \, \text{mA} = -20 \, \text{mV} \]

\[ I_c = \frac{-20 \times (-50)}{R_0} \, \text{mA} = 1000 \, \text{mV} \]

\[ I_e = I_8 - I_e = 5.8 \times 50 \, \text{mA} \]

\[ = 254.7 \, \text{mW} \]

(2.35) \[ I_1 = \frac{V_A - V_B}{R_1} \]

\[ I_2 = \frac{V_A - 0}{R_2} \]

(2.36) \[ \text{From Eqn. 3.16} \]

Power dissipated in the network:

\[ = V_1 I_1 + V_2 I_2 + (V_3) I_3 \]

\[ = \frac{R_0}{R_1} \times \left( \frac{V_A - V_B}{R_1} \right) \times \left( \frac{V_A - V_B}{R_2} \right) \]

\[ = \frac{V_A - V_B}{R_1} \times \frac{V_A - V_B}{R_2} \]

(2) \[ P_{R_1} = \frac{(V_B - V_a)^2}{R_1} \]

\[ P_{R_2} = \frac{(V_B - 0)^2}{R_2} \]