Problem Set #4: Solutions

2.

(a) \[ R_C = 2 \times R_1 \]

(b) \[ R_{BC} = \frac{R_2}{R_1} \]

(c) \[ A_v = \frac{A_v}{A_m} \]

3.

(a) \[ V_{in} = 1 \times B \]

(b) \[ I_{out} = \frac{1}{8} \times 100 \text{ mA} \]

(c) \[ V_{out} = 10 \text{ V} \]

4.

(a) \[ V_C = \frac{1}{8} \times 100 \text{ V} \]

(b) \[ I_{out} = \frac{1}{8} \times 100 \text{ mA} \]

(c) \[ V_{out} = 10 \text{ V} \]

5.

(a) \[ V_C = \frac{1}{8} \times 100 \text{ V} \]

(b) \[ I_{out} = \frac{1}{8} \times 100 \text{ mA} \]

(c) \[ V_{out} = 10 \text{ V} \]
\[ V_o = V_{in} + I_{out}R_2 \]

\[ I_{out} = \frac{V_o}{R_2} = \frac{V_{in} + I_{out}R_2}{R_2} \]

\[ V_{in} = \frac{V_o - I_{out}R_2}{R_2} \]

**Analysis:**

1. **Open-Circuit Analysis:**
   - **Problem:** Consider the circuit with an ideal source and a short-circuit load.
   - **Solution:**
     - Since the output due to the source \( I_{out} \) is independent of the input, the output voltage is determined by the load resistance.

2. **Short-Circuit Analysis:**
   - **Problem:** Consider the circuit with a short-circuit load.
   - **Solution:**
     - The output voltage is determined by the source voltage and the load resistance.

3. **Load Analysis:**
   - **Problem:** Consider the circuit with a load resistance.
   - **Solution:**
     - The output voltage is determined by the source voltage and the load resistance.

4. **Full-Circuit Analysis:**
   - **Problem:** Consider the complete circuit.
   - **Solution:**
     - The output voltage is determined by the sum of the input voltage and the product of the output current and load resistance.

**Final Analysis:**

- **Output Voltage:**
  - \( V_{out} = V_in + I_{out}R_2 \)
  - \( I_{out} = \frac{V_{out} - V_in}{R_2} \)
  - \( V_{in} = \frac{V_{out} - I_{out}R_2}{R_2} \)

**Note:**

- The analysis assumes ideal components and neglects any parasitic effects.
- The actual output voltage may differ due to component tolerances and environmental factors.