Problem 1:

For $A_\beta \gg 1$:

$$A_\beta = \frac{A}{1 + A\beta} \Rightarrow \frac{1}{\beta} = A \beta$$

Here, $\beta = \frac{V_f}{V} = \frac{R_{E2} \times R_{E1}}{I_0}$

$$I_0 = \frac{R_{E2} \times R_{E1}}{R_{E2} + R_{E1} + R_{E1}} = \frac{100 \times 100}{100 + 20 + 100} = 11.9 A$$

$$\frac{V_f}{V} = \frac{\beta}{\beta} = 84 \mu A$$

$$V_0 = -I_0 R_3 = -84 \times 0.6 = -50.4 V$$

Problem 2:

$$\beta = \frac{V_f}{V} = \frac{I_0 R_3}{V} = 84 \mu A$$

$$V_i = V_i' \frac{10}{10 + 10 + 10} = V_i' / 3$$

$$I_0 = G_m V_i, 100 \Rightarrow 30.28 V, mA$$

$$A = \frac{I_i}{V_i} = \frac{30.28 mA}{V}$$

$$A_\beta = \frac{A}{1 + A\beta} = 2.82 A$$

$$R_2 = R_5 + R_{10} + R_1 = 30 k\Omega$$

$$R_{14} = R_1 (1 + A \beta) = 120 \cdot R_{10}$$

$$R_{10} = R_{14} - R_5 = 110.8 k\Omega$$

$$R_0 = R_L + R_{ol} + R_2 = 110.1 k\Omega$$

$$R_{ol} = R_0 (1 + A \beta) = 145.4 k\Omega$$

$$R_{out} = R_{ol} - R_L = 433.4 k\Omega$$
Problem 5:

\[ i_{\text{out}} = \frac{V_{\text{REF}}}{900} b_1 + \frac{V_{\text{REF}}}{2200} b_2 + \frac{V_{\text{REF}}}{3600} b_3 \]

\[ i_{\text{out, expected}} = \frac{2V_{\text{REF}}}{1000} D \]

\[ V_{\text{out}} = -i_{\text{out}} R_f \]

\[ \text{error} = \frac{V_{\text{expected}} - V_{\text{out}}}{V_{\text{ref}}} \]

\[ V_{\text{ref}} = 1\text{V} \]

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\[ \text{error}(101) = 0.69444 - 0.625 = 69.44mV \]