1.

$$V_{CC} = I_E R_C + I_B R_B + V_{BE(ON)} + I_E R_E$$

$$5 = I_E (10+2) \times 10^3 + 0.7 + I_B 20 \times 10^3$$

$$I_B = 4.61 \ \mu A$$

$$I_C = 0.346 \ mA$$

$$I_E = 0.350 \ mA$$

$$V_{CB} = 0.092 \ V$$

$$V_{CE} = 0.792 \ V$$

2.

$$I_C = \frac{0.5 \times \beta \times 10^{-3}}{(\beta+1)}$$

$$I_C = 0.493 \ mA$$

$$I_B = 6.58 \ \mu A$$

$$R_C = \frac{4}{I_C} = 8.11 \ K$$

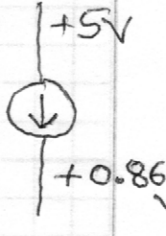
$$V_B = 0.165 \ V$$

$$V_E = V_B + 0.7 = 0.865$$

Given, $V_C = -1 \ V$

Thus, $V_{CE} = -1 - 0.865$

$= -1.865$



$P = 0.5 \times 10^{-3} \times 4.135$

$= 2.07 mW$

(absorbed)

$V_{CB} = V_C - V_B$

$= -1.165 \ V$

3.

$I_C = 0.8\,mA$

$I_E = \frac{(\beta+1)}{\beta} I_C = 0.81\,mA$

$I_B = 10\,\mu A$

By KVL

$2 - 0.7 = I_B R_B + I_E R_E$

or, $\boxed{R_B = 49K}$

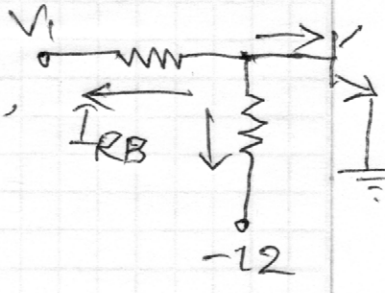
Again, $5 - 2 = I_C R_C + I_E R_E$

or, $\boxed{R_C = 2.74K}$

4. $V_B = 0.7$, $I_C = \frac{12-6}{R_C} = 2.73\,mA$

Thus, $I_B = 34.1\,\mu A$

$I_{R2} = \frac{V_B - (-12)}{R_2} = 127\,\mu A$



By KCL at base of Q1,

$I_{RB} + I_{B1} + I_{R2} = 0$

$I_{RB} = -161.1\,\mu A$

$-V_1 + V_B = I_{RB} R_B$ or $\boxed{V_1 = 3.117\,V}$

5. $\beta = 75$

a) For $V_1 = 0$, Q_1 is off ; $I_C = I_B = 0$

$$V_o = \frac{5 \times 10}{10+5} = 3.33\ V$$

b) For $V_2 = 2\ V$,

$$I_B = \frac{2 - 0.7}{50 \times 10^3}$$

$$\boxed{I_B = 26\ \mu A}$$

$$I_C = 1.95\ mA$$

$$V_{RC} = 9.75\ !$$

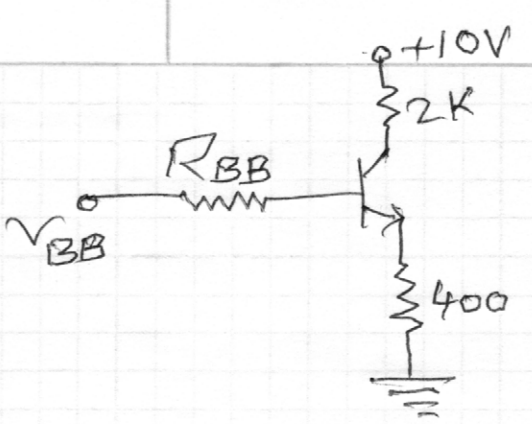
V_{RC} cannot be greater than V_{cc}.

Thus, Q_1 is in saturation.

$$V_o = V_{CE(sat)} = 0.2\ V$$

$$\boxed{V_o = 0.2\ V}$$

6.



$$V_{BB} = \frac{10 \times 12.2}{56 + 12.2} = 1.79\,V$$

$$R_{BB} = R_1 // R_2 = 10.02\,K$$

~~$I_B = V_{BB} - 0.7 - 400(B+1)I_B$~~

$$V_{BB} = I_B R_{BB} + 0.7 + (\beta+1) I_B \times 400$$

$$I_B = \frac{1.79 - 0.7}{R_{BB} + 40400}$$

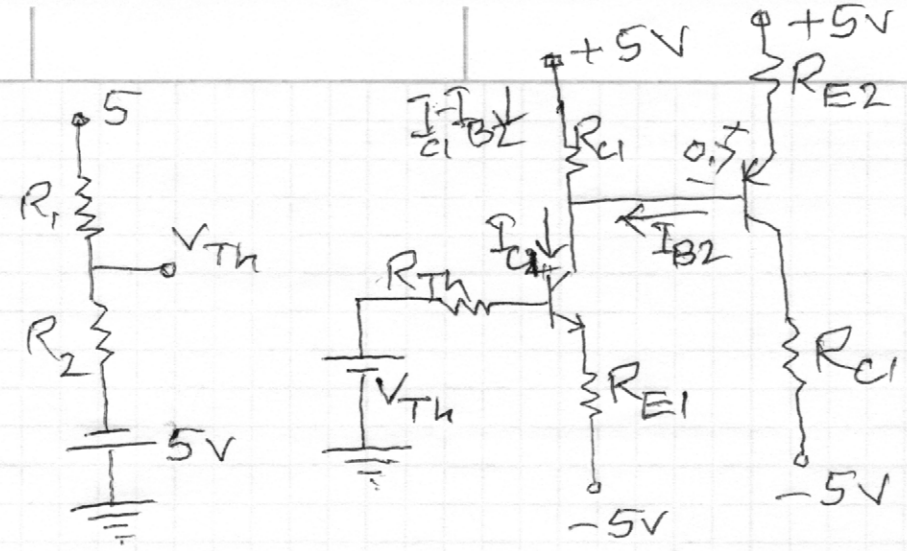
$$\boxed{I_B = 21.62\,\mu A}$$

$$\boxed{I_C = 2.16\,mA} \qquad \boxed{I_E = 2.18\,mA}$$

$$V_{CE} = V_{CC} - I_C R_C - I_E R_E$$

$$\boxed{V_{CE} = 4.81\,V}$$

7.



$R_{Th} = 33.33K$ $\quad V_{Th} = \frac{R_2 \times 10}{R_1 + R_2} - 5 = -1.67$

$$I_{B1} = \frac{V_{Th} - 0.7 + 5}{R_{Th} + (\beta+1) R_{E1}}$$

$\boxed{I_{B1} = 11.18\ \mu A}$ Thus, $\boxed{I_{C1} = 1.12\ mA}$ $\boxed{I_{E1} = 1.13\ mA}$

By KVL

$$I_{E2} R_{E2} + 0.7 - (I_{C1} - I_{B2}) R_{C1} = 0$$

or, $\left[(\beta+1) R_{E2} + R_{C1}\right] I_{B2} = I_{C1} R_{C1} - 0.7$

$$I_{B2} = \frac{I_{C1} R_{C1} - 0.7}{101 R_{E2} + R_{C1}} = \frac{4.9}{207 \times 10^3}$$

$\boxed{I_{B2} = 23.67\ \mu A}$ $\boxed{I_{C2} = 2.37\ mA}$ $\boxed{I_{E2} = 2.39\ mA}$

By KVL,

$$V_{CE2} = -10 + I_{E2} R_{E2} + I_{C2} R_{C2}$$

$\boxed{V_{CE2} = -1.67\ V}$