$V_T = 25mV$

$\beta = 255$

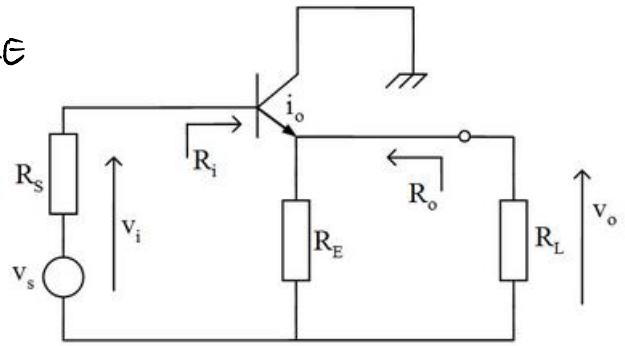
QUESTION 1

10 points | Save Answer

For the emitter follower circuit (EF) shown below, find the value for the input impedance R_{in} in (MΩ) if current I_C=1.4mA, given that R_E=10kΩ, R_S=0, $R_L = \infty$.

r_{be}

$R_{in} = \frac{V_T}{I_C} + (\beta + 1) \cdot R_E$



QUESTION 2

10 points | Save Answer

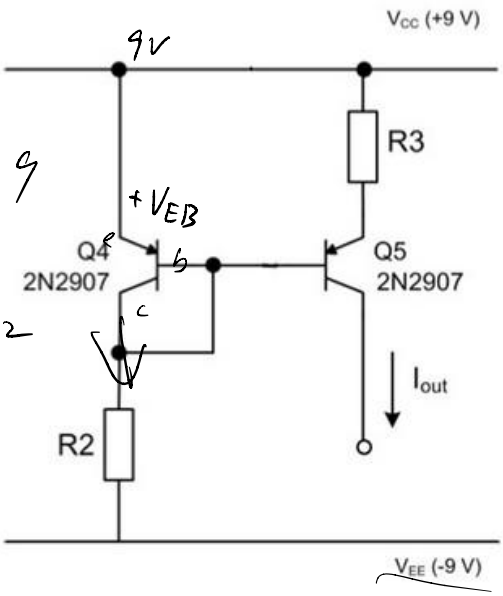
For the Widlar current mirror circuit shown below, design the circuit to provide a current I_{out}=100μA, if I_{R2}=612μA. Hence, find the value of R_2 (in kΩ).

KVL

$9V - V_{EB} - R_1 I_{R2} = 0$

0.6

$\frac{18 - V_{EB}}{I_{R2}} = R_2$

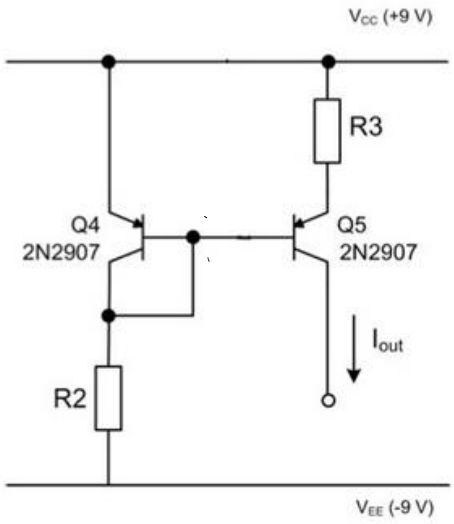


$I_o R_2 = \ln\left(\frac{I_{ref}}{I_o}\right)$

QUESTION 3

10 points | Save Answer

For the Widlar current mirror circuit shown below, design the circuit to provide a current I_{out}=100μA, if I_{R2}=685μA. Hence, find the value of R_3 (in Ω), given that V_T=25mV.



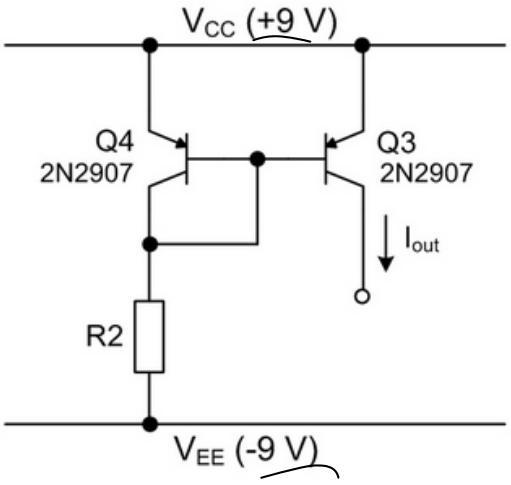
$= 250 \ln\left(\frac{I_{R2}}{I_{out}}\right)$

QUESTION 4

5 points | Save Answer

For the simple current mirror circuit shown below, find the value of R_2 in (kΩ) to provide the current I_{out}=3mA.

$R_2 = \frac{17.4}{I_{out}}$



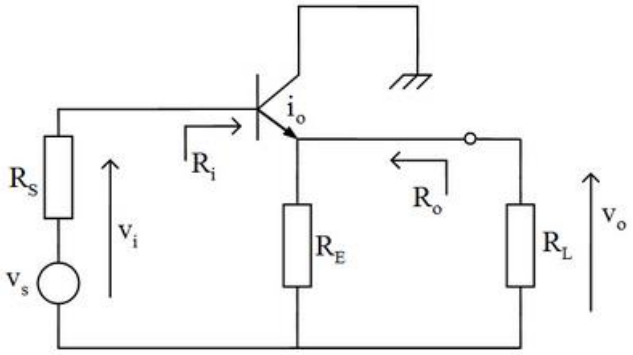
QUESTION 5

10 points | Save Answer

For the emitter follower circuit (EF) shown below, find the value for the output impedance R_{out} in (Ω) if current I_C=7.8mA, given that R_E=10kΩ, R_S=0, R_L= ∞ .

$$g_m = \frac{I_C}{V_T} \qquad r_b = \frac{\beta}{g_m}$$

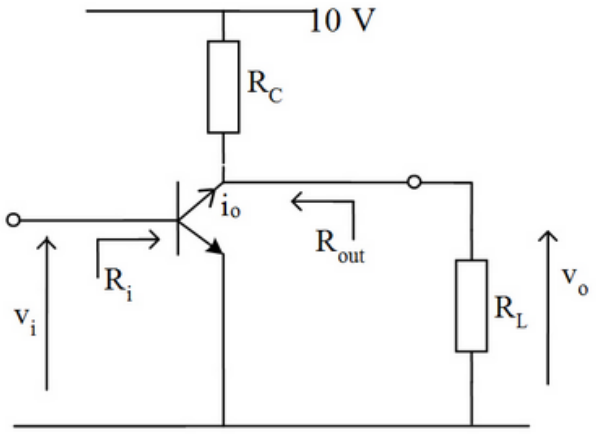
$$R_o = \frac{1}{\frac{1}{r_b} + \frac{1}{R_E} + g_m}$$



QUESTION 6

10 points | Save Answer

For the common emitter (CE) circuit shown below, find the value for the output impedance R_{out} in (kΩ) if current I_C=4mA, given that R_C=10kΩ, V_A=150 V, R_L= ∞ .



$$r_o = \frac{V_A}{I_C}$$

$$R_{out} = r_o \| R_L =$$

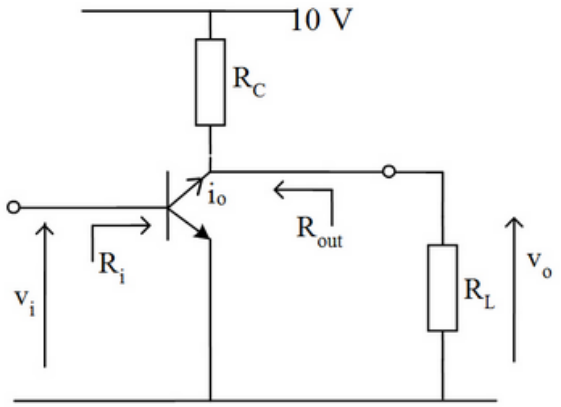
QUESTION 7

10 points | Save Answer

For the common emitter circuit (CE) shown below, find the value for the voltage gain A_V if the current I_C=4.6mA, given that R_C=10kΩ, V_A=150 V, R_L= ∞ .

$g_m = \frac{I_C}{V_T}$ $\quad r_o = \frac{V_A}{I_C}$

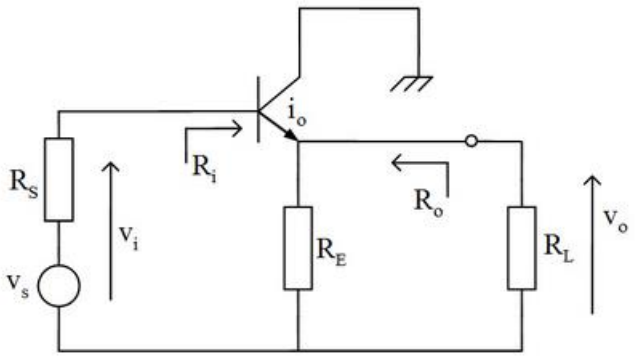
$A_V = -g_m (R_C \| r_o)$



QUESTION 8

5 points | Save Answer

For the emitter follower circuit (EF) shown below, find the value for voltage gain (A_V) if current I_C=2.7mA, given that R_E=10kΩ, R_S=0, R_L= ∞ .



$I_C \approx I_E = 2.7\,mA$

$V_o = I_E R_E$

$-V_i + 0.6 + I_E R_E = 0$

$\therefore V_i = 0.6 + I_E R_E$

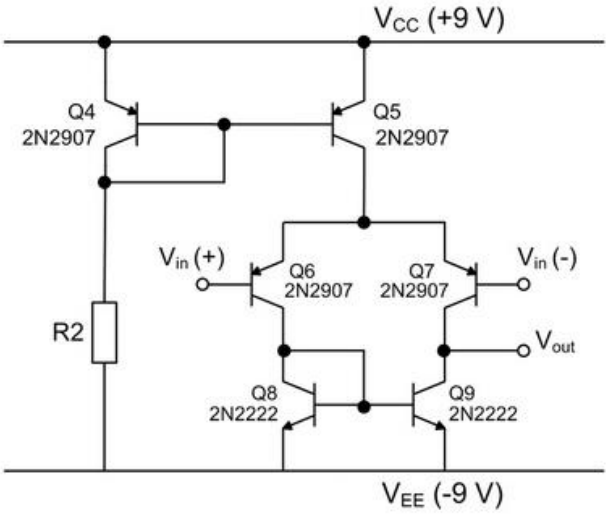
$= 0.6 + 27$

$A_V = \frac{V_o}{V_i} = \frac{27}{27.6}$

QUESTION 9

5 points | Save Answer

For the differential input stage shown below, the differential input impedance is required to be 100kΩ. Estimate the bias current in the differential amplifier to meet this specification. Hence calculate the value of R_2 (in kΩ) required to set this bias current. The Early voltage of the NPN transistor is 150 V and that for the PNP is 50 V.

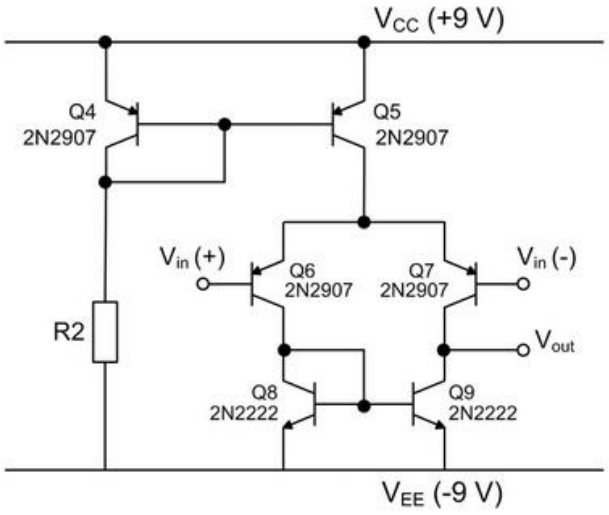


68.2

QUESTION 10

10 points | Save Answer

For the differential input stage shown below, the differential input impedance is required to be 100kΩ. Estimate the bias current in the differential amplifier to meet this specification. Hence calculate the value of the differential gain A_{Vd}. The Early voltage of the NPN transistor is 150 V and that for the PNP is 50 V.



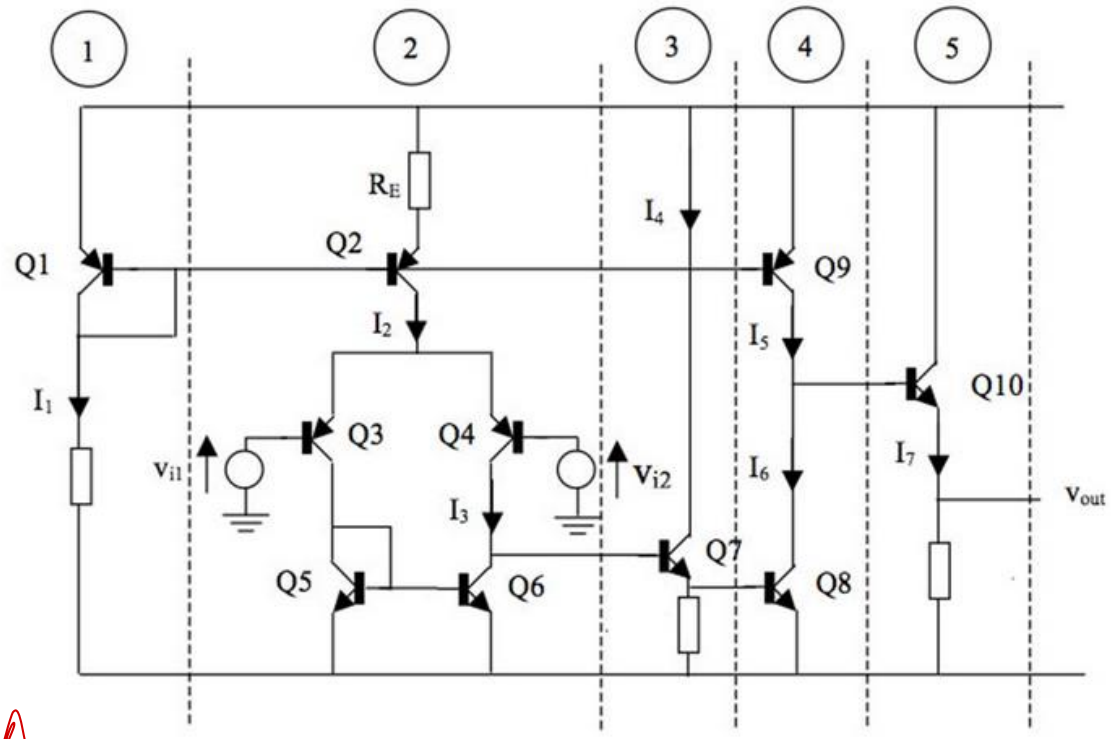
1500.001

$$r_e = \frac{V_T}{(\beta+1) I_B}$$

QUESTION 11

5 points | Save Answer

Match each of the stages shown in the circuit below with its purpose:



A

- Stage 1

C

- Stage 2/4

B

- Stage 3

D

- Stage 5

A. set the DC bias for all stages

B. 'match' the gain stages to avoid loading effects

C. provide high voltage gain

D. provide low output resistance

QUESTION 12

5 points | Save Answer

The emitter follower amplifier (EF) has high input impedance, low output impedance and low voltage gain. (Hint: use 'high' and 'low' to fill in the blanks)

QUESTION 13

5 points | Save Answer

The common emitter amplifier (CE) has high output impedance and high voltage gain. (Hint: use 'high' and 'low' to fill in the blanks)