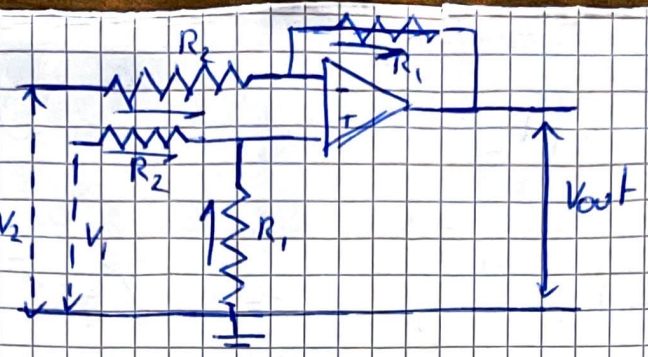
Q3 Ans6



$V_{out} = A(V^+ - V^-)$

show: $\frac{R_1}{R_2}(V_1 - V_2) = V_{out}$

$$I_2 = \frac{V^- - V_2}{R_2} \qquad I_1 = \frac{V_{out} - V^-}{R_1} \qquad I_1 R_1 + V^- = V_{out}$$

$$I_2 = \frac{V^+ - V_1}{R_2} \qquad I_1 = \frac{V^+ - 0}{R_1}$$

$$\frac{V^- - V_2}{R_2} = \frac{V_{out} - V^-}{R_1} \qquad \frac{V^+ - V_1}{R_2} = \frac{V^+}{R_1}$$

$$\Rightarrow V^- - V_2 = \frac{R_2}{R_1}(V_{out} - V^-) \qquad \Rightarrow V^+ - V_1 = \frac{R_2}{R_1} V^+$$

$$\Rightarrow V^- - V_2 - \frac{R_2}{R_1} V_{out} + \frac{R_2}{R_1} V^- = 0 \qquad \Rightarrow V^+\left(1 + \frac{R_2}{R_1}\right) = V_1$$

$$\Rightarrow V^-\left(1 + \frac{R_2}{R_1}\right) = V_2 + \frac{R_2}{R_1} V_{out} \qquad \Rightarrow V^+ = \frac{1}{1 + \frac{R_2}{R_1}} V_1$$

$$\Rightarrow V^- = \frac{1}{\left(1 + \frac{R_2}{R_1}\right)} \cdot \left(V_2 + \frac{R_2}{R_1} V_{out}\right)$$

$$V^- = \frac{1}{1+\frac{R_2}{R_1}} \cdot \left(V_2 + \frac{R_2}{R_1} \cdot V_{out}\right) \qquad U = I R$$

$$V^+ = \frac{1}{1+\frac{R_2}{R_1}} \cdot V_1 \qquad V_{out} = A\left(V^+ - V^-\right)$$

$$V_{out} = A \cdot \frac{1}{1+\frac{R_2}{R_1}} \left[V_1 - V_2 - \frac{R_2}{R_1} V_{out} \right]$$

$$\Rightarrow V_{out} + A \frac{1}{1+\frac{R_2}{R_1}} \frac{R_2}{R_1} V_{out} = A \cdot \frac{1}{1+\frac{R_2}{R_1}} \left[V_1 - V_2 \right]$$

$$V_{out} \left[1 + A \frac{1}{1+\frac{R_2}{R_1}} \frac{R_2}{R_1} \right] = A \cdot \frac{1}{1+\frac{R_2}{R_1}} \left[V_1 - V_2 \right]$$

$$V_{out} \left[1 + A \cdot \frac{1}{1+\frac{R_1}{R_2}} \right] = A \frac{1}{1+\frac{R_2}{R_1}} \left[V_1 - V_2 \right]$$

$$\Rightarrow V_{out} = \frac{A \cdot \frac{1}{1+\frac{R_2}{R_1}}}{1 + A \cdot \frac{1}{1+\frac{R_1}{R_2}}} \left(V_1 - V_2 \right) \Rightarrow \lim_{A \to \infty} \frac{A + \frac{1}{1+\frac{R_2}{R_1}}}{1 + A \frac{1}{1+\frac{R_1}{2}}} (V_2 - V_1$$

$$\frac{R_1}{R_2}(V_1 - V_2) = \frac{\frac{1}{1+\frac{R_2}{R_1}}}{\frac{1}{1+\frac{R_1}{R_2}}} (V_2 - V_1) = \frac{1+\frac{R_1}{R_2}}{1+\frac{R_2}{R_1}} (V_2 - V_1)$$

$$= \frac{\frac{R_2 + R_1}{R_2}}{\frac{R_1 + R_2}{R_1}} (V_2 - V_1) = \frac{R_1}{R_2} (V_2 - V_1)$$