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Y.E.

P1)

$$\frac{V_{in}}{2k\Omega} = \frac{0 - V_{out}}{12k\Omega} \rightarrow V_{out} = -6V_{in}$$

$$V_{out} = -6 \cdot (-1) = \underline{\underline{6V}}$$

P2)

$$V_{out} = -6 \cdot (-4) = 24V > V_{CC} \rightarrow \text{Saturation}$$

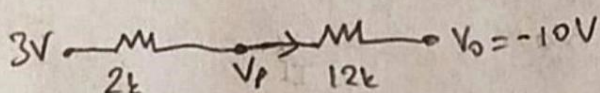
$$\underline{\underline{V_{out} = 10V}}$$

P3)

$$I_{OE} = \frac{V_{out} - V_{in}}{R_F} = \frac{10V - (-4)}{12k} = \underline{\underline{1.16 \text{ mA}}}$$

P4) $V_{out} = -6 \cdot 3V = -18V < -V_{EE} \rightarrow \text{Saturation}$

$$V_{out} = -10V$$



$$I = \frac{3 - (-10)}{14k} = 0.93 \text{ mA}$$

$$V_p = 3 - 2 \cdot 0.93 = 1.14V$$

P5) $V_p = V_N = \frac{V_{in}}{2}$

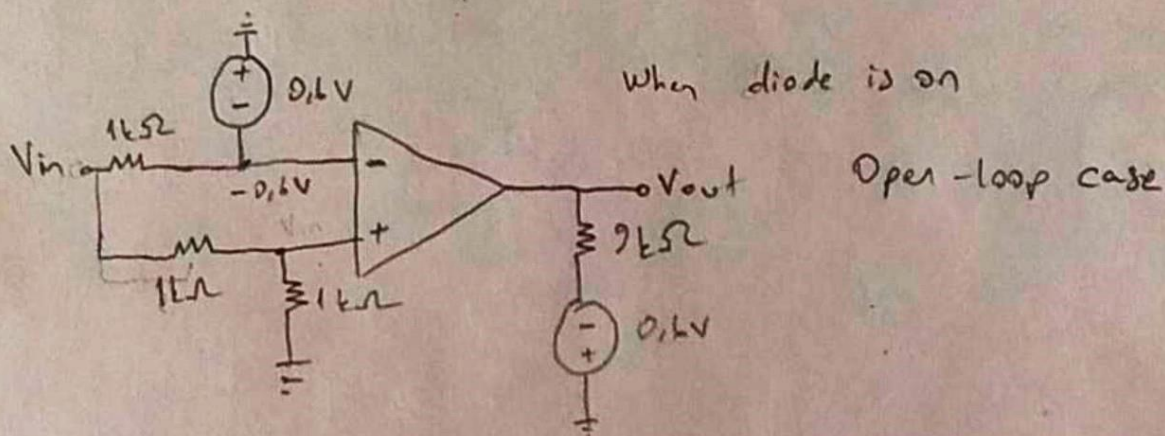
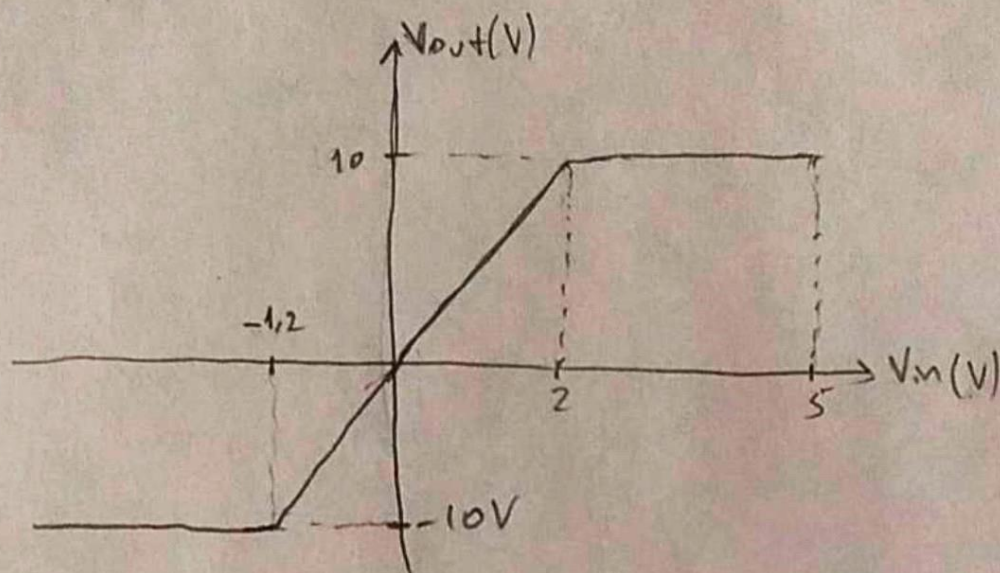
$$\frac{V_{in} - \frac{V_{in}}{2}}{1k} = \frac{V_{out} - \frac{V_{in}}{2}}{9k} \rightarrow 9 \frac{V_{in}}{2} = V_{out} - \frac{V_{in}}{2}$$

$$V_{out} = 5V_{in} \quad (\text{When diode is in cut-off})$$

If $V_p \leq -0,6V$, diode is on.



$$\frac{V_{in}}{2} \leq -0,6V \rightarrow V_{in} \leq -1,2V$$



$$V_p = \frac{V_{in}}{2} \quad V_N = -0,6V \rightarrow V_{out} = A \cdot \underbrace{\left(\frac{V_{in}}{2} + 0,6V \right)}_{\text{negative}}$$

$$V_{out} = -V_{EE}, \text{ if } V_{in} \leq -1,2V$$