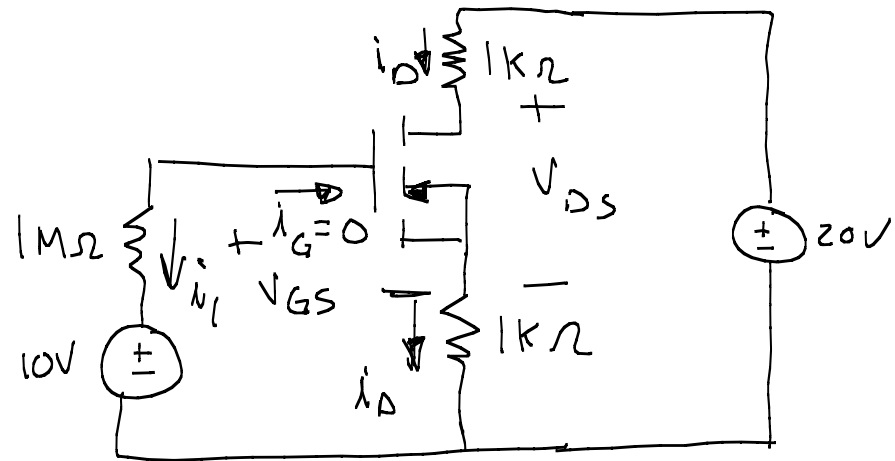


Determine
 i_D & V_{DS}



$$V_{to} = 4V, K = 1 \text{ mA/V}^2$$

KVL (Lower Left)

$$-10V + V_{GS} + i_D (1k\Omega) = 0$$

$$V_{GS} + i_D = 10$$

For Saturation Region

$$i_D = K (V_{GS} - V_{th})^2$$

$$i_D = (1 \text{ mA/V}^2) (V_{GS} - 4)^2$$

$$i_D = V_{GS}^2 - 8V_{GS} + 16$$

$$V_{GS} + (V_{GS}^2 - 8V_{GS} + 16) = 10$$

$$V_{GS}^2 - 7V_{GS} + 6 = 0$$

$$(V_{GS} - 6)(V_{GS} - 1) = 0$$

$$V_{GS} = 6 \text{ V} \quad \text{or} \quad \cancel{1 \text{ V}}$$

$$V_{GS} = 6 \text{ V}$$

$$i_D = 4 \text{ mA}$$

KVL (Right)

$$-(4\text{mA})(1\text{k}\Omega) - V_{DS} - (4\text{mA})(1\text{k}\Omega) + 20\text{V} = 0$$

$$\boxed{V_{DS} = 12\text{V}}$$

Check Saturation Region

$$V_{GS} > V_{t0}$$

$$6\text{V} > 4\text{V} \checkmark$$

$$V_{DS} > V_{GS} - V_{t0}$$

$$12\text{V} > \underbrace{6\text{V} - 4\text{V}}_{2\text{V}} \checkmark$$
$$12\text{V} > 2\text{V} \checkmark$$

Saturation
Region