# Homework # 8

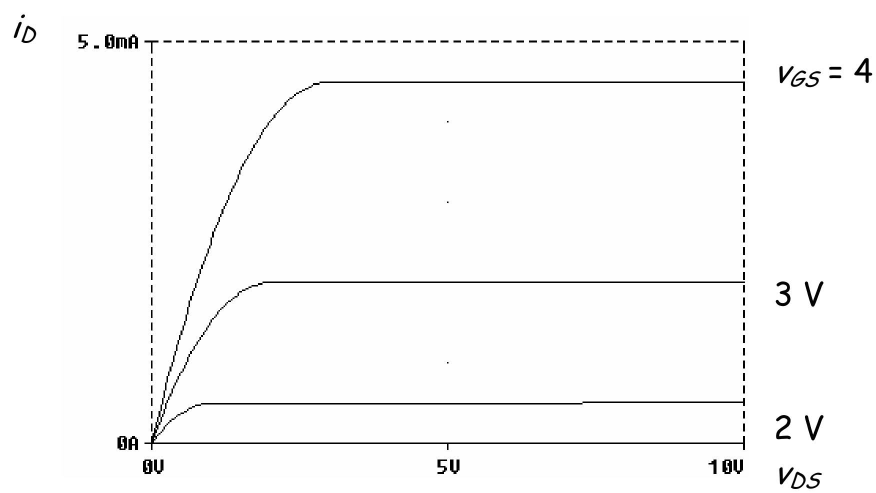
**P12.3*** $K = \frac{1}{2} KP(W / L) = 0.25\,\text{mA/V}^2$

(a) Saturation because we have $v_{GS} \geq V_{to}$ and $v_{DS} \geq v_{GS} - V_{to}$.
$i_D = K(v_{GS} - V_{to})^2 = 2.25$ mA

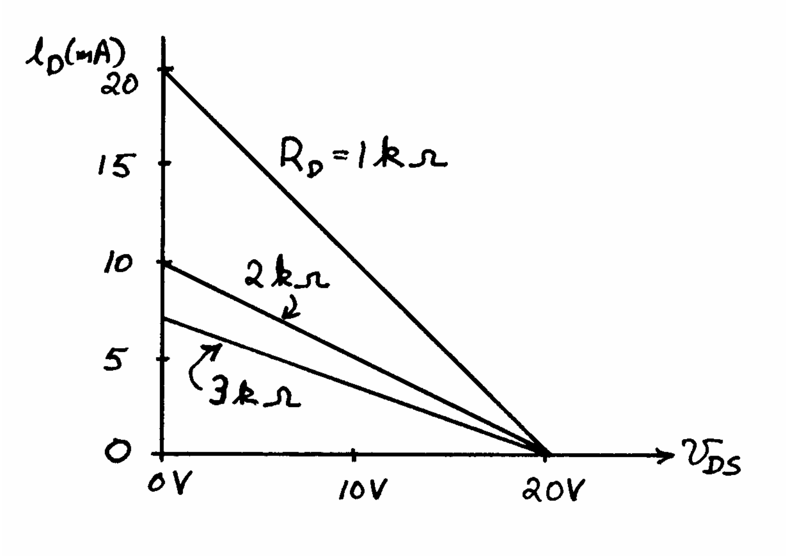
(b) Triode because we have $v_{DS} < v_{GS} - V_{to}$ and $v_{GS} \geq V_{to}$.
$i_D = K[2(v_{GS} - V_{to})v_{DS} - v_{DS}^2] = 2$ mA

(c) Cutoff because we have $v_{GS} \leq V_{to}$. $i_D = 0$.

**P12.5***




**P12.13*** The load-line equation is $V_{DD} = R_D i_D + v_{DS}$, and the plots are:



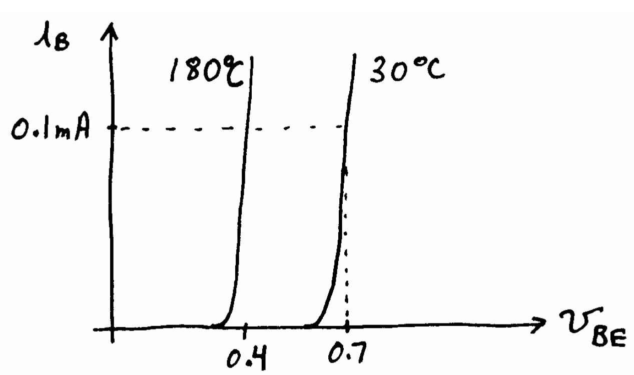

Notice that the load line rotates around the point ($V_{DD}$, 0) as the resistance changes.

**P13.6***

$$i_E = i_C + i_B$$
$$= 9 + 0.3 = 9.3\text{ mA}$$
$$\alpha = \frac{i_C}{i_E} = \frac{9}{9.3} = 0.9677$$
$$\beta = \frac{i_C}{i_B} = \frac{9}{0.3} = 30$$

**P13.15*** At $180^\circ C$ and $i_B = 0.1\text{ mA}$, the base-to-emitter voltage is approximately:

$$v_{BE} = 0.7 - 0.002(180 - 30) = 0.4\text{ V}$$



**P13.18*** Following the approach of Example 13.2, we construct the load lines shown. We estimate that $V_{CE\max} = 18.4\text{ V}, V_{CEQ} = 15.6\text{ V}$, and $V_{CE\min} = 12\text{ V}$. Thus, the voltage gain magnitude is $|A_v| = (18.4 - 12)/0.4 = 16$