5) $I_D \uparrow \times 2 \rightarrow g_m = \sqrt{2\mu_n C_{ox} \frac{W}{L} I_D} \uparrow \times \sqrt{2}$

$= \mu_n C_{ox} \frac{W}{L}(V_{GS}-V_{th}) \uparrow \times \sqrt{2}$

$\therefore (V_{GS}-V_{th}) \uparrow \times \sqrt{2}$

$\Rightarrow \left.\begin{matrix}(N_{out}) \uparrow \times \sqrt{2} \\ (S_{out}) \uparrow \times 2\end{matrix}\right\} (S/N)_{out} \uparrow \times \sqrt{2}$

$\Rightarrow HD_2 = \frac{1}{4(V_{GS}-V_{th})} \downarrow \times \sqrt{2}$

NOTE:
To achieve better NF and linearity at the same time, bias current needs to be increased
$\Rightarrow$ Trade-off between power and NF, linearity

6) $THD = HD_2 = \frac{V_{in,max}}{4(V_{GS}-V_{th})} = 0.01$

$\therefore V_{in,max} = 0.04(V_{GS}-V_{th})$

$\Rightarrow 4\%$ of $(V_{GS}-V_{th})$