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

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

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

$\Rightarrow V_{out} \uparrow \times \sqrt{2}$

$\Rightarrow (S/N)_{out} \uparrow$ [illegible] $\times \sqrt{2}$

$\Rightarrow HD_3 \downarrow$ [illegible] $\times \frac{1}{2}$

6) $THD = HD_3 = \frac{1}{4} \frac{|\alpha_3|}{\alpha_1}$ [illegible] $\times V_{in,max}^2$

$= \frac{\text{[illegible]}\ V_{in,max}^2}{32 (V_{GS} - V_{th})^2} = 0.01$

$\therefore V_{in,max}$ [illegible] $= \sqrt{0.01 \times 32} \cdot (V_{GS} - V_{th})$

$\approx 0.57 (V_{GS} - V_{th})$

$\Rightarrow 57\%$ of $(V_{GS} - V_{th})$

↑ Compare this with single-ended case

NOTE:
Differential topology can achieve much better linearity over wide input range compared with single-ended topology.