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4) $\sum_{k=1}^{n}(2k-1)^2$

$\Delta F_k=(2k-1)^2$; $F_k=Bk+Ck^2+Dk^3$

$\Delta(Bk+Ck^2+Dk^3)=B+C+D+k(2C+3D)+3Dk^2$

$B+C+D+2Ck+3Dk+3Dk^2=4k^2-4k+1$

$$\begin{cases} 3D=4 \\ 2C+3D=-4 \\ B+C+D=1 \end{cases} \Rightarrow \begin{cases} D=\frac{4}{3} \\ C=-4 \\ B=3\frac{2}{3} \end{cases} \Rightarrow F_k=\frac{11}{3}k-4k^2+\frac{4}{3}k^3$$

$\sum_{k=1}^{n}(2k-1)^2=\left(\frac{11}{3}(n+1)-4(n+1)^2+\frac{4}{3}(n+1)^3\right)-\left(\frac{11}{3}-4+\frac{4}{3}\right)=\frac{11}{3}n+\frac{11}{3}-4n^2-8n-4+\frac{4}{3}n^3+4n^2+$

$+4n+\frac{4}{3}-1=\frac{4}{3}n^3-\frac{1}{3}n=\frac{4n^3-n}{3}=\frac{n(4n^2-1)}{3}$

Ответ: $\frac{n(4n^2-1)}{3}$