Questions about Permutations, Combinations, and Derangements

1. Evaluate $\sum_{k=0}^{n}(-1)^k C(n,k)3^{n-k}$.
2. Use the Binomial Theorem to simplify 1.01^3.
3. Prove each of the following with no more than one line
   - $\sum_{k=0}^{n}\frac{1}{k+1}2^{k+1}C(n,k)=\frac{3^{n+1}}{n+1}$.
   - $\sum_{k=0}^{n}kC(n,k)=n2^{n-1}$. You have to use here a method different than that we used in class. Remember this was solved in class but by a different method.
4. With no more than one line, evaluate $\sum_{k=1}^{n}k^2C(n,k)$.
5. You are given 33 points in the cartesian plane. No 3 of them are collinear. How many triangles can you make of these points if the vertices of each triangle have to be from the given points.
6. 23 persons are to sit around a circular table. This qroup of people includes A and B who don't like each other and don't want to sit next to each other. In how many ways can the 23 persons sit.
7. Prove that $D_n=(-1)^n+nD_{n-1}$.
8. Use the above (what you've just proved) to prove in no more than two lines that D_n is even if n is an odd positive integer and odd if n is an even positive integer.