Pensieve header: A combinatorial riddle from Assaf: Prove $\sum_{k=0}^n \binom{2(n-k)}{n-k}\binom{2k}{k}=4^n$.

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In[•]:= AS[n_] := Sum[Binomial[2 (n - k), n - k] Binomial[2 k, k], {k, 0, n}]

In[•]:= AS /@ Range[8]

Out[•]= {4, 16, 64, 256, 1024, 4096, 16 384, 65 536}

In[•]:= DSolve[x f'[x] == 4 x f[x] + 4 x^2 f'[x] - 2 x f[x] ∧ f[0] == 1, f[x], x]

Out[•]= {{f[x] → 1/Sqrt[1 - 4 x]}}
```