1. **A second-order recurrence**

Find a closed form for the recurrence \( x_0 = 0, \ x_1 = 1, \ x_{n+1} = x_n + 2x_{n-1} + 4^n + n, for \ n > 1. \) Use generating functions or assume a certain form (taking into account the homogeneous equation and the extra terms), and find the coefficients.

2. **Asymptotic bound**

Consider the recurrence \( T(1) = 1, \ T(n) = 2T(n/2) + \frac{1}{4} \cdot 2^{2T(n/2)} \) for \( n \geq 2. \) (To simplify reasoning, you may assume \( n \) is a power of 2). Find a tight asymptotic bound for \( T(n). \)