1. Consider the sequence $2, 9, 16, 23, \ldots 7n + 2$.

   (a) How many terms are there in the sequence?

   (b) What is the second-to-last term?

   (c) Find the sum of all the terms in the sequence.

2. Consider the linked system $A_{n+1} = 5A_n + B_n$, $B_{n+1} = 3A_n + 3B_n$, $A_0 = 1$, $B_0 = 3$. Find the quadratic characteristic equation you would need in order to solve this system. Then **STOP**.

3. Use polynomial fitting to find the nth term of the sequence $(a_n)_{n\geq 1}$:

$$5, 10, 17, 26, 37, \ldots$$

4. You are given that the solution to the recurrence $g_{n+2} = 7g_{n+1} - 10g_n$, $g_0 = 0$, $g_1 = 1$, is of the form $c_1 \cdot 5^n + c_2 \cdot 2^n$. Find c_1 and c_2.

5. Choose one of the following induction problems to solve.

   (a) Show that $\displaystyle\sum_{k=0}^{n} 3^k = \frac{1}{2}\left(3^{n+1} - 1\right)$ for all $n \in \mathbb{N}$.

   (b) Suppose the sequence L_n is given by the recurrence $L_{n+2} = L_{n+1} + L_n$, $L_1 = 1$, $L_2 = 3$. These are called *Lucas numbers.* Show that for all $n \geq 1$,

$$\sum_{k=1}^{n} L_k^2 = L_n L_{n+1} - 2.$$

6. Determine if each statement is true or false.

   (a) TRUE FALSE $\log_2 n + n^2$ is $\Theta(n^2)$.

   (b) TRUE FALSE $\log_2 n + n^2$ is $O(n^2)$.

   (c) TRUE FALSE A $\Theta(2^n)$ algorithm is $O(n^3)$.

   (d) TRUE FALSE An $O(\sqrt{n})$ algorithm is $\Theta(n)$.

   (e) TRUE FALSE A $\Theta(3n)$ algorithm is $O(n)$.

   (f) TRUE FALSE A $\Theta(2^n)$ algorithm is $O(3^n)$.

7. Compute $\displaystyle\sum_{n=1}^{\infty} \frac{2^{3n}}{9^n}$.

Extra Credit: Using mathematical induction, prove that $P_n(x) = (x+1)^n - x^n$ is the solution to the system

$$P_{n+1}(x) = (x+1)P_n(x) + x^n, \quad P_0(x) = 0.$$