Exercise 1. Consider the differential equation

\[(x - 1) y'''(x) + (-x + 3) y'(x) - y(x) = 0.\] (E)

1. Let \(y(x) = \sum_{n=-N}^{\infty} y_n (x - 1)^n\) be a solution of (E) and set \(y_n = 0\) for \(n < -N\).
   Show that the sequence \((y_n)_{n \in \mathbb{Z}}\) satisfies
   \[
   \forall n \in \mathbb{Z}, \quad (n + 1) (n + 2) u_{n+1} = (n + 1) u_n.
   \]

2. Find all rational solutions of (E).
   (Hint: significant shortcuts are possible w.r.t. the full algorithm!)

Exercise 2. Give an algorithm to convert an \(n\)-bit number from base 2 to base 10 in \(O(M(n) \log n)\) bit operations.