Part I. Recursion

1. First-order and second-order linear recursions
   6.11, 6.31 (a)/(b)/(c)/(d), 6.32 (a)/(b)/(c)/(d)

2. Proof
   6.34

Part II. Growth of functions

1. Show that \((x^3 + 2x)/(2x + 1)\) is \(O(x^2)\).

2. Let \(k\) be a positive integer, show that \(1^k + 2^k + \cdots + n^k\) is \(O(n^{k+1})\)

3. Determine whether each of these functions is \(O(x^2)\): (Note: to establish the big-\(O\) relationship, find constants \(C\) and \(k\) such that \(|f(x)| \leq C|g(x)|\) when \(x > k\). otherwise, justify why not)
   (a) \(f(x) = x^2 + 1000\)
   (b) \(f(x) = x^4/2\)
   (c) \(f(x) = x \log x\)
   (d) \(f(x) = 2^x\)

4. Find the least integer \(n\) such that \(f(x)\) is \(O(x^n)\) for each of these functions:
   (a) \(f(x) = 2x^2 + x^3 \log x\)
   (b) \(f(x) = 3x^5 + (\log x)^4\)
   (c) \(f(x) = (x^4 + x^2 + 1)/(x^4 + 1)\)
   (d) \(f(x) = (x^3 + 5 \log x)/(x^4 + 1)\)

5. Give as good a big-\(O\) estimate as possible for each of these functions
   (a) \((n^2 + 8)(n + 1)\)
   (b) \((n \log n + n^2)(n^3 + 2)\)
   (c) \((n! + 2^n)(n^3 + \log(n^2 + 1))\)

6. Show that
   (a) \(f(x) = 2x^2 + x - 7\) is \(\Theta(x^2)\)
   (b) \(f(x) = \log(x^2 + 1)\) is \(\Theta(\log x)\)