Problem Set 9

Due: April 17

Reading: Chapter 13. Asymptotics

Problem 1.
Assuming the following sum equals a polynomial in \( n \), find the polynomial. Optionally, you might want to use induction to prove that the sum equals the polynomial you find, but no such proof is required for full credit.

\[
\sum_{i=1}^{n} i^3
\]

Problem 2.
Show that

\[
\ln(n^2!) = \Theta(n^2 \ln n)
\]

Hint: Stirling’s formula for \( (n^2)! \).

Problem 3.
Prove that

\[
\sum_{k=1}^{n} k^6 = \Theta(n^7).
\]

Hint: One solution uses the Integral Method, and there are other workable approaches that avoid calculus.