Continuous Optimization: Assignment 1

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Exercise 1

(a)

Claim: $lim_{k\to\infty} x^{(k)} = \frac{1}{30}$

Proof:

Let $\epsilon > 0$ be given. Choose $N = \max\{\frac{4}{\epsilon}, 8\}$. Assume $n > N$.

$$\begin{aligned}
\left|\frac{n^4 - 100}{5n^3 + 30k^4} - \frac{1}{30}\right| &= \left|\frac{30n^4 - 3000 - 5n^3 - 30k^4}{150n^3 + 900n^4}\right| \\
&= \left|\frac{-3000 - 5n^3}{150n^3 + 900n^4}\right| \\
&= \frac{3000 + 5n^3}{150n^3 + 900n^4} \\
&= \frac{600 + n^3}{30n^3 + 180n^4} \\
&< \frac{2n^3}{\frac{1}{2}n^4} < \frac{4}{n} < \frac{4}{N} < \frac{4}{\frac{4}{\epsilon}} < \epsilon
\end{aligned}$$