Problem 7.1

\[
\frac{d\varepsilon}{da} = 2 \sum_{k=0}^{N-1} x_k(ax_k - y_k)
\]
which is zeroed by

\[
\hat{a} = \frac{\sum_{k=0}^{N-1} y_k x_k}{\sum_{k=0}^{N-1} x_k^2}
\]

Problem 7.2

\[
\frac{\partial \varepsilon}{\partial a^*} = x^*(ax - y)
\]
which is zeroed by

\[
\hat{a} = \frac{x^* y}{|x|^2}
\]

Problem 7.3

Plugging in the value of \( \hat{a} = \frac{\sum_{k=0}^{N-1} y_k x_k}{\sum_{k=0}^{N-1} x_k^2} \) into the definition of \( \varepsilon(P) \), we find that

\[
\varepsilon(P) = \sum_{k=0}^{N-1} y_k^2 - \left( \frac{\sum_{k=0}^{N-1} y_k x_k(P)}{\sum_{k=0}^{N-1} x_k^2(P)} \right)^2
\]