**Digital Signal Processing - Assignment 6**

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# Exercise 1

## 1.1

This is the Method of Least Squares, which can be solved as follows. First, find the partial derivatives by $a$ and $b$, and set them to 0:

$$\frac{\partial \epsilon}{\partial a} = \sum_{i=1}^{N} 2x_i(ax_i + b - y_i) = 0$$

$$\frac{\partial \epsilon}{\partial b} = \sum_{i=1}^{N} 2(ax_i + b - y_i) = 0$$

Next, rewrite them as a series of linear equations:

$$\left[\sum_{i=1}^{N} x_i^2\right] a + \left[\sum_{i=1}^{N} x_i\right] b = \sum_{i=1}^{N} x_i y_i$$

$$\left[\sum_{i=1}^{N} x_i\right] a + \left[\sum_{i=1}^{N} 1\right] b = \sum_{i=1}^{N} y_i$$

Then solve the equation for $a$ and $b$ (the matrix is invertible as long as all of the $x_i$ are not equal):

$$\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} \sum_{i=1}^{N} x_i^2 & \sum_{i=1}^{N} x_i \\ \sum_{i=1}^{N} x_i & \sum_{i=1}^{N} 1 \end{pmatrix}^{-1} \begin{pmatrix} \sum_{i=1}^{N} x_i y_i \\ \sum_{i=1}^{N} y_i \end{pmatrix}$$

### 1.2

TODO

## Exercise 2

TODO