Exercise 11

1.1 $$MSE(m,b) = \frac{1}{N}\sum_{i=1}^{N}(mx_i + b - y_i)^2$$

$$\frac{\partial MSE}{\partial m} = \frac{2}{N}\sum_{i=1}^{N} x_i(b + mx_i - y_i)$$

$$\frac{\partial MSE}{\partial b} = \frac{2}{N}\sum_{i=1}^{N}(b + mx_i - y_i)$$

1.2

$$\sum_{i=1}^{N} y_i - m\sum_{i=1}^{N} x_i + bN = 0$$

$$b = \frac{\sum_{i=1}^{N} y_i - m\sum_{i=1}^{N} x_i}{N}$$

Then I put this into the first equation and solve for m:

$$\sum_{i=1}^{N} x_i y_i - m\sum_{i=1}^{N} x_i^2 - \left(\frac{\sum_{i=1}^{N} y_i - m\sum_{i=1}^{N} x_i}{N}\right)\sum_{i=1}^{N} x_i = 0$$

$$\Rightarrow m = \frac{N(\Sigma x_i y_i) - (\Sigma x_i)(\Sigma y_i)}{N(\Sigma x_i^2) - (\Sigma x_i)^2}$$

$$b = \frac{(\Sigma y_i) - m(\Sigma x_i)}{N}$$

1.3