**Computational Activity 1: Linear Regression**

**Turn in these questions and your Linear Regression notebook (as a .ipynb) in Canvas!**

1. Making predictions.
   1. What parameters does the function make\_predictions take?
   2. Write the two equations being used in the function.
   3. What is the name of the second equation?
   4. How do we use this equation in linear regression?
2. Evaluating predictions.
   1. Which values of w and b do you think are best?
   2. What is the mean squared error for these values?
   3. Are there any regions where the model struggles to make good predictions?
3. Gradient descent function.
   1. Write the equations used to propose new values for w and b.
   2. In linear regression, are we guaranteed to find a global optimum using this approach?
   3. Explain all of the objects returned by this function.
      1. w
      2. b
      3. mse
      4. w\_states
      5. b\_states
4. Using gradient descent.
   1. About how many iterations does it take gradient descent to converge (Hint: Look at the graph and find where MSE stops decreasing)?
   2. Try different values of the learning rate, α. How does changing α impact convergence?
   3. Try different starting values for w and b. How does changing these values impact convergence.
   4. Choose a learning rate, starting parameters, and number of iterations you feel are appropriate. Report these values, along with the estimates of w and b.
      1. Learning rate:
      2. Starting w:
      3. Starting b:
      4. Estimated w:
      5. Estimate b:
   5. How do these values compare with those you estimated in Question 2, and how does the final MSE compare to the MSE calculated in Question 2?
5. **6990** only.
   1. Do you think that the linear model is appropriate for the variables you chose? Why or why not?
   2. Create a function to plot how w and b changed through time.