8.2: You are building a linear model $y = \beta_0 + \beta_1 x + \beta_2 x^2$ using the following data:

x	y
1	4
2	5
-1	2

Compute the total quadratic loss for your model when $\beta_0 = 1$, $\beta_1 = 0.2$, and $\beta_2 = -0.1$.

8.4: You are building a linear model $y = \beta_0 + \beta_1 x + \beta_2 x^2$ using the following data:

x	y
1	4
2	5
-1	2

Write out a system of equations in a matrix formalism using your model and the above data.

8.5 Without using the `pinv` function in Matlab, calculate the pseudoinverse of the design matrix and the least-squares estimates of the parameters β_0, β_1, and β_2.

9.2.1: In §8.3.2 we fit the model $y = \beta_0 + \beta_1 x$ to the data in the following table.

x	y
0.07	-0.05
0.16	0.40
0.48	0.66
0.68	0.65
0.83	1.12

The best parameter estimates were $y = 0.020 + 1.21x$. What is the RMSE for this model?

9.5: Linearize the model $y = \sqrt{\beta_0 + \beta_1 x}$.

Write out a system of matrix equations using your linearized model and the following data.

x	y
1	4
2	5
-1	2

10.5: Calculate the Jacobian matrix of the function

$$\mathbf{g}(\mathbf{x}) = \begin{pmatrix} \cos x_2 \\ \log x_1 \\ x_1 x_2 x_3 \end{pmatrix}$$

12.1: Start at $x = 0$, calculate two iterations of gradient descent for the function $y = (x - 3)^2 + 4$ using a step size of $\alpha = 0.1$.

13.1: A bag contains five red balls and three green balls. What are the odds that a randomly selected ball will be red?

13.4: You fit a logistic regression model that predicts the probability of Illinois' basketball team winning given the number of fouls committed by the opposing team. The best fit model is

$$P(\text{win}) = 0.3 + 0.2[\text{fouls}]$$

What is the odds ratio of the number of fouls? What is the interpretation of the odds ratio?

15.1: How far is the plane $x_1 - 2x_2 + 0.3x_3 = 5$ from the origin?

15.2: What is the intersection of the lines $2x_1 + x_2 = 4$ and $x_1 - x_2 = 3$?

15.2: What is the intersection of the planes $x_1 - x_2 + 3x_3 = 1$, $3x_1 + x_2 - 4x_3 = 2$, and $-2x_1 + 2x_2 - 6x_3 = -2$?

16.2: You want to build an SVM classifier that predicts if a cell line will respond to a drug based on the expression of three genes. Write a quadratic program based on the following four observations.

Gene 1	Gene 2	Gene 3	Response
1.6	2.4	0.1	yes
2.3	1.4	0.6	no
1.0	0.8	0.2	yes
1.9	2.1	0.4	no