1. What is learning? Use your own words to describe your understanding of it now that you’ve done some reading.

2. What is the difference between supervised learning and unsupervised learning? Give examples.

3. What is a loss function? Give an example.

4. Over-fitting occurs when you minimize your training error too much. What is the negative consequence of this?

5. Write out the following constrained optimization problem using the correct notation. Then solve it. A farmer wishes to build a rectangular pen for his pigs such that the area inside the pen is maximized and only 120m of fencing are used.

6. Consider the function

\[ f(x) = 3x^3 + 7x^2 - 15x - 3. \]

Find all stationary points of this function, and determine whether they are local minimizers and maximizers. Does this function have a global minimizer or global maximizer?

7. **Bonus Question** Let \( f(x_1, x_2) = 2x_1^2 + x_2^2 - 2x_1x_2 + 2x_1^2 + x_4^1. \) What is the Newton direction at the point \( x_0 = [0 1]^T? \)

8. **Bonus Question** What is semi-supervised learning?