1. Consider the following variant of a problem on the midterm exam. For
the equality constrained nonlinear optimization problem:

\[
\min_x f(x) \quad \text{s.t.} \quad c_i(x) = 0, \quad i = 1, 2, \ldots, m,
\]
suppose that \( x^* \) satisfies the KKT conditions, LICQ, and second-order
sufficient conditions. Use the implicit function theorem to show that
the quadratic penalty function

\[
P_\mu(x) := f(x) + \frac{\mu}{2} \sum_{i=1}^{m} c_i^2(x)
\]
will have a local minimizer close to \( x^* \), provided that \( \mu \) is sufficiently
large. (Hint: You need to apply the implicit function theorem to the
KKT conditions, in conjunction with the reparametrization \( \sigma := 1/\mu \)
(so that “sufficiently large \( \mu \)” corresponds to “sufficiently small positive
\( \sigma \).”)

2. Do Exercise 17.1 from the textbook.

3. Do Exercise 17.8 from the textbook.

4. Do Exercise 17.12 from the textbook.