Week 3 exercises, optimization

At each task, visualize the optimized fit by plotting the data and the fit.

1. Use the data below to fit the linear model equation:

$$y = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_{12} x_1 x_2$$

y	26.5	57.9	108.4	155.9	209.3	272.4	384.3
x_1	2.1	4.3	7.0	9.1	10.5	12.7	15.2
x_2	10.4	15.5	21.0	24.9	30.3	33.8	41.4

2. Consider a simple nonlinear model with two parameters, $y = \frac{1}{1+e^{-(\theta_0+\theta_1 x)}}$. Load the xy data in the file data_1.mat. Make the model linear by using a log transformation. Use the data to fit the parameters θ_0, θ_1 using the linear LSQ formula.
Note: Matlab displays a warning: "Imaginary parts of complex X and/or Y arguments ignored" when plotting the fit, just let it be.

3. Consider the nonlinear model with two parameters, $y = \frac{x}{\theta_1+\theta_2 x}$. Make the model linear and use the data below to fit the parameters θ_1, θ_2 using the linear LSQ formula.

x	1	4	7	11	14	19	21	23
y	0.13	0.24	0.27	0.29	0.30	0.31	0.31	0.31

4. Consider a simple nonlinear model with two parameters, $y = \frac{1}{\exp(\theta_0+\theta_2 x^2)}$. Make the model linear and use the data below to fit the parameters θ_1, θ_2 using the linear LSQ formula.

x	5	7	11	12	15	17	19
y	0.93	0.91	0.84	0.82	0.76	0.71	0.66