Name: _____

Date: _____

Collaborators: _____

(If applicable, collaborators submit their individually written assignments together)

Question:	1	2	3	4	5	6	Total
Points:	20	10	5	5	25	10	75
Score:							

Instructor/grader comments:

QR factorization

1. (20 points) Find the Housholder reflector P that

$$P \begin{bmatrix} -6 \\ 2 \\ 9 \end{bmatrix} = \begin{bmatrix} a \\ 0 \\ 0 \end{bmatrix}.$$

What is the value of a?

Show all your calculations in the space below.

2. (10 points) Let $A = QR$ be the factorization of a square matrix A. Show that

$$\kappa_2(A) = \kappa_2(R),$$

where $\kappa_2(V)$ is the condition number of matrix V calculated using two-norm.

Show all your calculations in the space below.

Vector and matrix norms

3. (5 points) Find l_∞ and l_1 norms of the matrix. $\alpha = \frac{1}{\sqrt{2}}$

$$\begin{bmatrix} 1 & 0 & \alpha & -1 & -\alpha & 0 & 0 & 0 & 0 \\ 0 & 0 & \alpha & 0 & \alpha & 0 & 0 & 0 & 0 \\ 0 & \alpha & -\alpha & 0 & 0 & -1 & -\alpha & 0 & 0 \\ 0 & \alpha & \alpha & 0 & 0 & 0 & -\alpha & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \alpha & 0 & \alpha \\ 0 & 0 & 0 & 0 & 0 & 0 & \alpha & 0 & \alpha \\ 0 & 0 & 0 & 0 & \alpha & \alpha & 0 & -\alpha & \alpha \\ 0 & 0 & 0 & 0 & \alpha & 0 & 0 & \alpha & -\alpha \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & \alpha & 0 \end{bmatrix}$$

4. (5 points) Find l_2 and l_∞ norms of the vector.

   $x = (\sin k, \cos k, 1)$ for arbitrary real k

Matlab

5. (25 points) Write a matlab script (call it **hw07p5.m**) that uses QR algorithm to find the least squares fit of a quadratic polynomial to a noisy data. Use the provided function `hw07p5noisydata()` to generate 100 'noisy' data points. Use matlab's `qr` function for thin QR factorization. Use matlab's backslash operator for solving the resulting system of linear equations. Include the help commands for the function `hw07p5nosydata()` in your script. choice. Place the commands `clear`, `clf` at the top of your script. Plot the graphs of nosy data (as scatter plot) and the best fit curve (as connected data points). For comparison plot the 'noiseless' function (as dashed line). Provide grid, labels, legend, title for your graph.

Gitlab

6. (10 points) Create a gitlab project called **hw07** (name it exactly as shown). Upload **all** matlab files that are required to run your code. Create README.md file - leave it empty if appropriate. Share the project with the instructor (gitlab user name `m3510_21f_in`) and the TA (gitlab user name `m3510_21f_ta`) and grant them the **Reporter** privileges.