

Name: _____

Date: _____

Collaborators: _____

(Collaborators submit their individually written assignments together)

Question:	1	2	3	4	Total
Points:	30	25	25	10	90
Score:					

Instructor/grader comments:

Interpolating of functions

1. (pen and paper problem) Let \mathbf{F} be the following quasimatrix on $x \in [-1, 1]$:

$$\mathbf{F} = [1 \quad \cos(\pi x) \quad \sin(\pi x)].$$

- (a) (15 points) Find $\mathbf{F}^T x$
- (b) (15 points) Find $\mathbf{F}^T \mathbf{F}$.
2. (a) (15 points) (pen and paper problem) Find the best linear approximation (in the least squares sense) to the function $y(x) = \sin(x)$ on the interval $[-1, 1]$.
- (b) (10 points) (matlab) On the same graph plot the function and its approximation. Provide axes labels, a grid, a legend, and a title for your graph. Place the commands `clear`, `clf` at the top of your script. Place the code you wrote for this part of the homework into a matlab file **hw05p2b.m**
3. (a) (15 points) (pen and paper problem) Use the recurrence relation to find $P_2(x)$, $P_3(x)$, and $P_4(x)$, where $P_k(x)$ are Legendre polynomials.

$$P_k(x) = \frac{2k-1}{k} x P_{k-1}(x) - \frac{k-1}{k} P_{k-2}(x), \quad k = 2, 3, \dots$$

- (b) (10 points) On the same graph plot $P_k(x)$, $k = 1, 2, 3, 4$ for $-1 \leq x \leq 1$. Provide axes labels, a grid, a legend, and a title for your graph. Place the commands `clear`, `clf` at the top of your script. Place the code you wrote for this part of the homework into a matlab file **hw05p3b.m**

Gitlab

4. (10 points) Create a gitlab project called **hw05** (name it exactly as shown). Upload **all** Matlab files that are needed to run your code.

Scan your answers/solutions of Problems 1, 2(a), and 3(a), combine all scans into a single pdf file (call it **hw05.pdf**) and upload it to Gitlab. **Do not** upload other types of files (e.g. no graphics files or multiple pdf files).

Share the project with the instructor and the grader and grant them **Reporter** privileges.