MATH 152 MATLAB Computer Lab 5

Matrix Multiplication and Linear Transformations

Instructions

- Download `data5.mat` and upload to your MATLAB environment

- Save all variables to a file called `lab5.mat` and submit the file to Canvas

- Attend your scheduled lab section and visit MATLAB TA office hours for extra help

Exercise 1

The data file `data5.mat` contains matrices C and D and a vector $\boldsymbol{w}$.

(a) Compute $C^4\boldsymbol{w}$ and save the result as `Ex1Avec`.

(b) Compute $C^2 D^T \boldsymbol{w}$ and save the result as `Ex1Bvec`.

(c) Compute $DC - CD$ and save the result as `Ex1Cmat`.

Exercise 2

The data file `data5.mat` contains the matrix

$$A = \begin{bmatrix} 2 & 0 & -1 & 1 \\ 4 & 1 & 0 & 3 \\ 0 & -1 & -4 & 2 \\ -6 & 0 & 7 & -8 \end{bmatrix}$$

Construct the matrix $E = E_4 E_3 E_2 E_1$ where:

- E_1 is -2 times row 1 add to row 2

- E_2 is 3 times row 1 add to row 4

- E_3 is 1 times row 2 add to row 3

- E_4 is 2 times row 3 add to row 4

The result EA should be the row echelon form of A. Save E as `Ex2mat`.
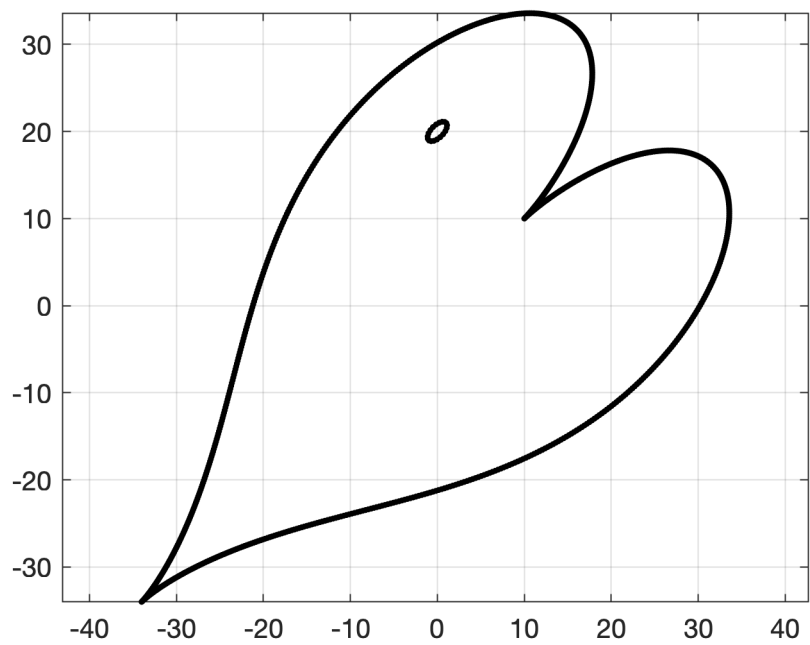
Exercise 3

The data file `data5.mat` contains a matrix called `heart` with 2 rows and 1000 columns. Each column of `heart` is a point in the xy-plane. Plot the points using the command:

```
>> plot(heart(1,:),heart(2,:),'k.'), axis equal, grid on
```
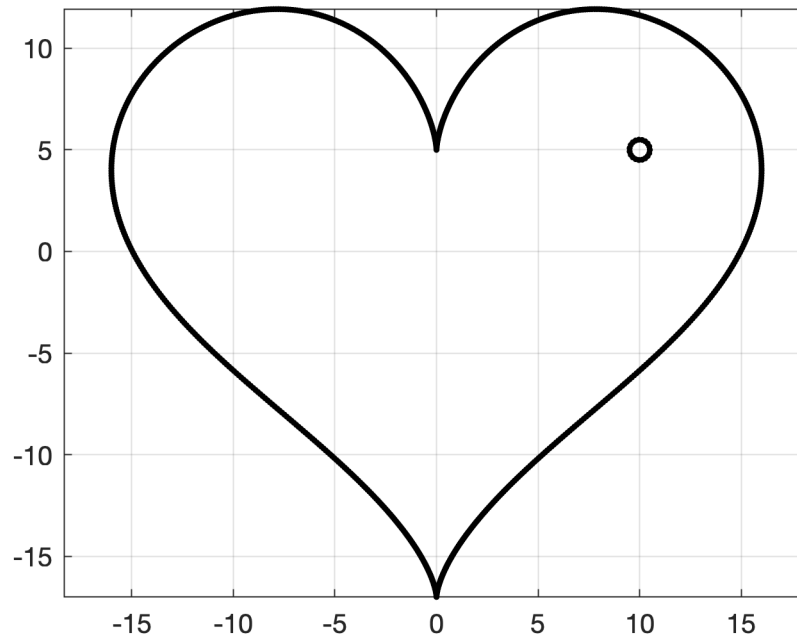

Note that the command `heart(1,:)` selects the x-values of all the points, and `heart(2,:)` selects the y-values.

(a) Find the linear transformation which reflects through the line $y = -x$ and then rotates counterclockwise by $\pi/4$. Save the result as `Ex3Amat`.

(b) Find the linear transformation which rotates counterclockwise by π, then shears in the x-direction by 2 then scales in the y-direction by 3. Save the result as `Ex3Bmat`.

(c) Find the linear transformation which corresponds to the image:

Save the result as `Ex3Cmat`.