

MATLAB assignment 2

Introduction to Linear Algebra (Week 2)

Fall, 2020

1. (2D Graphics in MATLAB)

(a) Draw graph of the polynomial

$$p(x) = x^3 - 3x$$

- i. Construct a vector \mathbf{x} which consists of equally-spaced points in $[-3, 3]$. To do this, use the MATLAB command *linspace* or the syntax $x_0 : \Delta x : x_n$.
- ii. Construct a vector \mathbf{p} whose i -th component is $p(x_i)$ where the x_i is i -th component of the vector \mathbf{x} .
[You should understand what the difference between $*$, $/$, \wedge and $.*$, $./$, $.\wedge$ is. See *MATLAB Basic (Lee, Jeon)* document in KLMS]
- iii. Make a new figure window by using the command *figure*.
- iv. Draw the graph of the given polynomial. You may use the MATLAB command *plot*.

(b) Use the MATLAB command *subplot* to produce five plots of the functions below over the specified range on the same figure.

- i. $f(x) = |x - 1|$ for $-3 \leq x \leq 3$.
- ii. $f(x) = \sqrt{|x|}$ for $-4 \leq x \leq 4$.
- iii. $f(x) = e^{-x^2}$ for $-4 \leq x \leq 4$.
- iv. $f(x) = \frac{1}{10x^2 + 1}$ for $-2 \leq x \leq 2$.
- v. $f(x) = \begin{cases} 0 & \text{if } x = 0 \\ x \log_e(x) & \text{if } x \neq 0 \end{cases}$, $g(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$ for $0 \leq x \leq e$.

Display your result images with 2×3 subplot. Here display v in 5, 6 axes simultaneously. In this problem, use the MATLAB commands *abs*, *sqrt*, *exp* and *log* for elementary functions.

(c) Find the number of intersections of the polar system

$$\begin{cases} r = 1 + \cos(k\theta) \\ r = \sin(k\theta) \end{cases}, \quad \text{where } 0 \leq \theta \leq 2\pi,$$

by drawing the polar curves in MATLAB.

- i. To draw a polar curve, you may use the MATLAB command *polarplot*.
- ii. For a polar system, use the MATLAB command *hold* to graph two polar curves on the same set of axis.
- iii. For $k = 1, 2, \dots, 6$, graph the polar curves of each polar systems. You may use *for-loop*. Then, you will have 6 graphs because you have 6 polar systems.
- iv. Display your resulting images with 2×3 subplots in the same figure window.

How many intersections do you have for each system?

2. Read the section in the '*MATLAB basic (Lee, Jeon)*' that corresponds to the this week class and practice by your self.

(The solution will be uploaded on KLMS.)

There is **nothing** to submit in this assignment.

Study and practice by yourself, and please try to make a lot of questions.