

# Introduction to MATLAB

## Practice Problems

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### 1 Basics

1.1 Find 3 different ways to create the vector  $x = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ .

1.2 Let  $x = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \end{bmatrix}$  and  $y = [ 171 \quad 53 ]$ .

- (a) Find  $A = xy$ .
- (b) What are the dimensions of  $A$ ?
- (c) Does  $A$  have an inverse?
- (d) What is the size of  $A^T A$ ?
- (e) What is the size of  $AA^T$ ?
- (f) Do  $A^T A$  and  $AA^T$  have inverses?

## 2 Programming in MATLAB

- 2.1 Write a function which takes inputs  $x$ ,  $a$ ,  $b$ ,  $c$ , where  $x$  is a vector and  $a$ ,  $b$ ,  $c$  are scalars, and returns the values of

$$f(x) = ax^2 + bx + c$$

and

$$f'(x) = 2ax + b.$$

- 2.2 Write a script that calls the previous function for 3 different sets of parameters  $a$ ,  $b$ ,  $c$ , over the range  $-1 \leq x \leq 1$ .

## 3 MATLAB Functions

- 3.1 Create a 300 element column vector where the even entries are 2 and the odd entries are 1.

- 3.2 Create a  $7 \times 7$  identity matrix and then change the 4<sup>th</sup> column to

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \end{bmatrix}.$$

3.3 Let  $A = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$ .

- (a) Find  $A^{-1}$ .  
(b) Find  $A^{-1}A$  and  $AA^{-1}$ .

- 3.4 Write a function which defines the ODE

$$y'' = -y$$

- 3.5 Write a script to solve the following IVP for times  $0 \leq t \leq 2\pi$ .

$$\begin{aligned} y'' &= -y \\ y(0) &= 0 \\ y'(0) &= 1 \end{aligned}$$

## 4 Other Useful Stuff

- 4.1 Plot the results from (2.2). Be sure to include a title, axis labels, and a legend.
- 4.2 Plot the results from (3.5). Be sure to include a title, axis labels, and a legend.
- 4.3 Save all variables currently in memory.
- 4.4 Clear all variables currently in memory.
- 4.5 Load the variables from the file you just saved.