

MATLAB Exercise 1 - Matrices & Arrays

1. The distance traveled by a ball falling in the air is given by the equation

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

Use MATLAB to calculate the position of the ball at time $t=5s$ if $x_0=10m$, $v_0=15m/s$, and

$$a = -9.81m/sec^2$$

2. Suppose that $x = 3$, $v = 4$. Use MATLAB to evaluate the following expression:

1) $\log(x^2 + v^2)$ 2) $\frac{\sqrt{x-3}}{(x-2v)^2}$ 3) $\frac{4}{3}\pi v^2$ 4) $|\sin 2x| e^v$

5) $\sqrt{x-5}$ 6) $\frac{x}{v-4}$ 7) $\frac{-x}{v-4}$ 8) `eps` 9) $\frac{x-3}{v-4}$

Help Select **Matlab Help** in the toolbar, then select **Index** and input **absolute value**, finding the function of absolute value.

Help Select **Matlab Help** in the toolbar, then select **Index** and input **exponential(指数)**, finding the exponential function.

Remark: From above example we know, the name of Matlab function is always the abbreviation of its term.

3. **4/2**

4\2

4. 1) Try to input a vector **d** = **[23, 20, 17, 14, 11, 8, 5, 2]** in different ways. Use **numel** to count the number of elements in d.

2) Please input matrix $a = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 9 & 12 \end{pmatrix}$ at least in three different methods.

- 5.

- 1) Compute the size of a.

Help Select **Matlab Help** in the toolbar, then select **Index** and input **size**, understand the different applications of this function

- 2) Show the value of `a(2,3)`? Obtain a subarray **b** which is composed by the 1st and 3rd columns of a.

- 3) Obtain a new matrix **c** by exchanging the 2nd and 3rd rows of a.

- 4) Obtain a vector **x** which is the last column of a. (**end**)

- 5) Replace the value of `a(1,1)` with 0.

- 6) Input

a (10)

a (10) = 20

a (10)

and observe what happen.

- 7) Input

```

a ( 2, : )
a ( :, 3 )
a ( :, : )
a ( :, 2 : 3 )
a ( : )
a ( 2 : 3 )

```

- 8) Add a new column to a to form a 3×5 matrix **a35**, add a new row to a as its 1st row to form a 4×4 matrix **a44**.
- 9) Input **a (20) = 100; a** and observe what happen.
- 10) Input **d = a'**; **d** and compare the value of a with d.
- 11) Input **e = a ([1 3]; :)**
- 12) *Input **help format** to study “format”

Help In command window input **help format**

Display the value of **pi** in **short** / **long** format.

Display **0.5** in **short e** / **rat** format

- 13) *In help windows search **fprintf** to study “fprintf”
Display the value of **pi** as an **integer** / **exponential format** / **at the second new line**
- 14) Input a 3×5 matrix **newmatrix**, compare the results after the following commands

```

a .* newmatrix
a * newmatirx
a .+ newmatrix
a + newmatrix
a ^ newmatrix
a .^newmatrix

```

6. Try to solve for x in the equation $Ax = B$ where $A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 3 & 2 \\ -1 & 0 & 1 \end{pmatrix}, B = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$. Compare the

command $A \setminus B$ and A/B , try to explain the result.

Help Select **Matlab Help** in the toolbar, then select **Index** and input **/ (or \)**, distinguish the difference between them (corresponding to **Exercise 3**).

7. Set **A = round (10*rand(6))**. Let us change the 6th column A so as to make the matrix singular (奇异). **B = A'**; **A (:, 6) = -sum (B (1 : 5, :))'**
 - 1) Set **x = ones (6,1)** and compute **A*x**. Explain why do we know A must be singular.
 - 2) Set **C = round (10*rand (6))**. Check whether $AC=CA$, why?

Help in command window input **help round**, understand the effect of this function.

8. Set **A = magic (8)**. Compute its sum of elements on each row, column and diagonal respectively.

Help in command window input **help magic** to understand how to construct the magic matrix

9. Examine the following statements by MATLAB, and show whether they are true.

- 1) If $A \neq 0$ and $AC = AD$, then $C = D$;
- 2) If A and B are nonsingular (可逆), then $(A + B)^{-1} = A^{-1} + B^{-1}$
- 3) For any 3×3 matrices A and B, $(A + B)^2 = A^2 + 2AB + B^2$

- 4) $A+A'$ is a symmetric matrix. (对称)
10. * Genetrite some spetial matrices
- 1) Generate a symmetric matrix (对称阵) by using function **randn** and operators $' +'$;
 - 2) Genetrate a upper matrix with positive diagonal elements by using functions **round**, **rand**, **diag**, **triu** and **abs**.
11. * Some tests
- ```
test1 = linspace (1, 11, 6)
test2 = linspace (1, 11, 5)
num_test1 = numel (test1)
[i] = find (test1 > 4)
test1 (find (test1 ==3)) = 0
test = [test1; 1:2:11]
test (:, 2) = []
Magic = magic (5)
Magic_diag = diag (Magic, 0)
Magic_diag = diag (Magic, 1)
Magic_diag = diag (Magic, -1)
help clc
clc
help clear
clear test test1
clc
```