

Question Bank

Programming Application (Matlab)

Second year

Mathematics Department

Lecture

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Q1/ Show that a trigonometric identity

$$\cos^2 \frac{x}{2} = \frac{\tan x + \sin x}{2 \tan x} \text{ by calculating each side of the equation, substitution } x = \frac{\pi}{5}$$

Q2/ The following problems can be solved by writing commands in the Command Window.

$$\frac{(5.9^2 - 2.4^2)}{3} + \left(\frac{\log_{10} 12890}{e^{0.3}} \right)^2$$

Q3/ The following problems can be solved by writing commands in the Command Window.

Define the variables a , b , c , and d as:

$$a = 12, \quad b = 5.6, \quad c = \frac{3a}{b^2}, \quad \text{and} \quad d = \frac{(a-b)^c}{c}, \text{ then evaluate:}$$

$$\frac{a}{b} + \frac{d-c}{d+c} + (d-b)^2$$

Q4/ The following problems can be solved by writing commands in the Command Window.

Define the variables a , b , c , and d as:

$$a = 12, \quad b = 5.6, \quad c = \frac{3a}{b^2}, \quad \text{and} \quad d = \frac{(a-b)^c}{c}, \text{ then evaluate:}$$

$$e^{\left(\frac{d-c}{a-2b}\right)} + \ln\left(\left|c - d + \frac{b}{a}\right|\right)$$

Q5/ The following problems can be solved by writing commands in the Command Window.

Define the variable t as $t = 3.2$, then evaluate:

$$14e^{-0.1t} \sin(2\pi t)$$

Q6/ define a vector with 10 elements, then eliminate the 6th elements from the vector. Do not type the vector elements explicitly.

Q7/ Create a row vector in which the first element is 1 and the last element is 43, with an increment of 6 between the elements.

Q8/ Create a row vector with 11 equally spaced elements in which the first element is 96 and the last element is 2.

Q9/ Create a column vector in which the first element is 26, the elements decrease with increments of (-3.6) , and the last element is -10 .

Q10/ Create a column vector with 9 equally spaced elements in which the first element is -34 and the last element is -7 .

Q11/ Create two row vectors: $a = 2 : 3 : 17$ and $b = 3 : 4 : 15$. Then, by only using the name of the vectors (a and b), create a row vector c that is made from the elements of b followed by the elements of a .

Q12/ Create two column vectors: $a = [2 : 3 : 17]'$ and $b = [3 : 4 : 15]'$, Then, by only using the name of the vectors (a and b), create a column vector c that is

made from the elements of a followed by the elements of b .

Q13/ Use matrix operations to solve the following system of linear equations:

$$4x - 2y + 6z = 8$$

$$2x + 8y + 2z = 4$$

$$6x + 10y + 3z = 0$$

Q14/ Define the vector $v = [8\ 6\ 4\ 2]$. Then use the vector in a mathematical expression to create the following vectors:

(a) $a = [1\ 1\ 1\ 1]$

(b) $d = [3\ 1\ -1\ -3]$

$$A = \begin{bmatrix} 2 & 4 & 6 \\ -3 & 6.4 & 9 \\ 4 & 8 & 12 \end{bmatrix}$$

Q15/ find the result of the following in command windows:

- 1- Summation of second row of matrix A. then changes it to binary string.
- 2- Round $A(2,2)$ to nearest integer .

3- Change matrix A to the matrix $B = \begin{bmatrix} 2 & 1 & 0 \\ -3 & 0 & 1 \\ 4 & 8 & 12 \end{bmatrix}$ by using matrix =

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. Do not type the matrix elements explicitly.

- 4- Diagonal of matrix A and determined of matrix A.
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Q16/ find the result of the following in command windows:

- 1- Minimum value of matrix A.
 - 2- Create a matrix B1 which is an up down of matrix A then find lower triangular of B1.
 - 3- Take double rotation of matrix A and named it by aHb, then sort the row of matrix aHb in descending way.
 - 4- Show in command windows a non-zero elements of 2×2 ones matrix and named it by ABC, then find binary string of summation of ABC , Do not type the vector elements explicitly.
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$$A = \begin{bmatrix} 2.2 & 4.2 & 6.2 \\ -3.3 & -6.6 & -9.9 \\ 4.4 & 8.8 & 13.2 \end{bmatrix}$$

Q17/ find the result of the following in command windows:

1. Create matrix A by using colon operation.
 2. Summation of second column of A. then changes it to binary string.
 3. Round matrix A towards zero.
 4. Change matrix A to the matrix $B = \begin{bmatrix} 4.4 & 1 & 0 \\ -6.6 & 0 & 1 \\ 8.8 & 8.8 & 13.2 \end{bmatrix}$ by using matrix $= \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. Do not type the matrix elements explicitly.
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$$A = \begin{bmatrix} 2.2 & 4.2 & 6.2 \\ -3.3 & -6.6 & -9.9 \\ 4.4 & 8.8 & 13.2 \end{bmatrix}$$

Q18/A- find the result of the following in command windows:

- 1- Sort the column of matrix A in ascending way, then take a one rotation of it.

2- Minimum value of matrix A, then find binary string of summation of second column of A.

B- If a vector $v = [1.2 \ 2.4 \ 3.6]$, then create the following matrix in command windows.

$$AA = \begin{pmatrix} 0 & 1.2 & 0 & 0 \\ 1.2 & 0 & 2.4 & 0 \\ 0 & 2.4 & 0 & 3.6 \\ 0 & 0 & 3.6 & 0 \end{pmatrix}$$

then find lower triangular matrix of AA, do not type the matrix elements explicitly.

Q19/ Fibonacci numbers are the numbers in a sequence in which the first two elements are 0 and 1, and the value of each subsequent element is the sum of the previous two elements: 0, 1, 1, 2, 3, 5, 8, and 13, write a MATLAB program in a script file that determines and displays the first 20 Fibonacci numbers.

Q20/ Write a MATLAB program to calculate Fibonacci numbers X_n , $n=1,2,3,5,8,13 \dots,1000$

Q21/ Write a MATLAB program TO REARRANGE A LIST OF RANDOM NUMBERS X_n INTO ASCENDING ORDER

Q23/ Write a MATLAB program to get mean of the degrees of student (use struct) (Math = 80 , Science =67, Arabic= 65 , Studies= 88 , English = 56.

Q24/ Write a MATLAB program to transfer inches to centimeters (1 inch= 2.54 centimeters)

Q25/ Use for loop to get the factorials of n positive integers 1,2,...,1000

Q26/ Write a MATLAB program to get the volume and the area of a sphere or radius r

Q27/ Write a MATLAB program to enter N random values between 0 and 100 and get

their mean \bar{x} and the standard deviation sd

$$\bar{\mu} = \frac{\sum_{i=0}^N X_i}{N}, \quad sd = \frac{\sum_{i=0}^{N-1} (X_i - \mu)^2}{N - 1}$$

14 : Write a MATLAB program to enter the elements of the two matrix A and B

and their sum and difference where

$$A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 3 \\ 7 & 4 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & 1 & 3 \\ -1 & 0 & -2 \\ 0 & 4 & 1 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 3 \\ 7 & 4 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 3 & 1 & 3 \\ -1 & 0 & -2 \\ 0 & 4 & 1 \end{bmatrix}$$

17: Write a MATLAB program to calculate the sum of the series

$$1 - \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{999}$$

18: Write a program to convert English units to metric (e.g., miles to kilometers, gallons to liters, etc.). Include a specification and a code design.

19: Write a program to perform date arithmetic, such as how many days there are between 6/1/90 and 8/3/92. Include a specification and a code design.

20: A serial transmission line can transmit 960 characters a second. Write a program that will calculate how long it will take to send a file, given the file's size. Try it on a 400MB (419,430,400 byte) file.

Use appropriate units. (A 400MB file takes days.)

21: Write a program to tell whether a number is prime.

22: Write a program that takes a series of numbers and counts the number of positive and negative values.

23: Write a MATLAB program to solve the second degree equation $aX^2 + bX + c = 0$ for any real a, b and c

24: Write a Matlab program to get the sum of a square of odd numbers between 22 and 389

25: Write a MATLAB program to enter names and degrees of student and give the grades according to the degree

26: Write a MATLAB program to calculate the area of a triangle with sides a, b and c .

Activate Windows

28. Write a MATLAB program to check whether the sequence of the numbers in a given array is a "Arithmetic" or "Geometric" sequence. Return -1 if the sequenc is not "Arithmetic" or "Geometric". Go to the editor

From Wikipedia

In mathematics, an arithmetic progression (AP) or arithmetic sequence is a sequence of numbers such that the difference between the consecutive terms is constant. Difference here means the second minus the first. For instance, the sequence 5, 7, 9, 11, 13, 15, . . . is an arithmetic progression with common difference of 2.

29: Write a MATLAB program using two `for` loops to produce the following pattern of asterisks

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*
**
***
****
*****
*****
*****
*****
*****
```

1. Write a MATLAB program to get the volume and the area of a cylinder of radius r and height h

2. Write a MATLAB program to get the sum of the series

$$SUM = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots + \frac{1}{99} - \frac{1}{100}$$

3. Write a MATLAB program to get the sum of the series

$$SUM = 1 - \frac{1}{2!} + \frac{1}{3!} - \frac{1}{4!} + \dots + \frac{1}{99!} - \frac{1}{1000!}$$

4. Write a MATLAB program to get the sum of the series

$$SUM = 1 - 3^3 + 5^3 - 7^3 + \dots + (-1)^n (2n+1), n = 333$$

5. Write a MATLAB program to solve the second degree equation

$$A X^2 + B X + C = 0, \text{ where the inputs are the coefficients } A, B \text{ and } C$$

6. Write a MATLAB program to inter N random values between 0 and 100 and get