

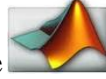
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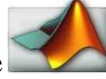
Department of Mathematics

National Workshop on Analytical and Numerical solutions of

Non-linear Differential Equations

Matlab Worksheet -1



- Double click the icon in the desktop with the picture . Matlab will start and a command window will be opened.

- Type the following lines in the command window one at a time and observe the output.

Operations on real numbers

- (i) 3256767+9992
- (ii) x=3;y=2;z=x+y
- (iii) z1=x*y
- (iv) z2=x/y
- (v) z3=x^2+y^2
- (vi) z4=log(2)
- (vii) z5=log10(2)
- (viii) t1=exp(x+z1)
- (ix) clc
- (x) x
- (xi) clear
- (xii) x
- (xiii) t2=sin(pi/2)
- (xiv) t3=tan(pi/4)
- (xv) t4=asin(1)
- (xvi) t5= tan(pi)^2
- (xvii) t8=cosh(5)
- (xviii) y1=sqrt(9)
- (xix) y2=8^(1/3)
- (xx) x=pi, y=sqrt(2)
- (xxi) format long
- (xxii) x,y
- (xxiii) format short
- (xxiv) x,y

log(a) = ln of *a* (to the base *e*, by default)
logb(a) = log of *a* to the base *b*

clc = clears the command window, but memory is not cleared
clear=clears the memory, but not the command window
(after clc if you type x, you will get its value which was assigned before, but after clear if you call x, output will be undefined variable)

sin(x), where x should be in terms of radians(**not degrees**)
asin(x) gives $\sin^{-1}x$ in **radians** only
tan(pi)^2 = $\tan^2\pi$
cosh(x)=hyperbolic function
sqrt(x)= \sqrt{x} , **m^(1/n)**= n^{th} root of m

format long command is used to get arithmetic values with 15 decimal places and **format short** for 4 decimal places. Default is 4 decimals.

Operations on complex numbers

- (i) sqrt(-1)
- (ii) a=2+3i;b=4+5i;
- (iii) c1=a+b
- (iv) c2=b-a
- (v) c3=a*b
- (vi) c4=a/b
- (vii) real(a)
- (viii) imag(a)
- (ix) conj(b)
- (x) abs(b)

Exercise:

1. Assigning $u=1.5$, $v=9$, evaluate the following expressions in Matlab

(a) $\frac{2v^{-2}}{(u+v)^2}$ (b) $\frac{\sec(uv)}{\ln(u^2v)}$ (c) $\sqrt{u^2 + \left(\frac{1}{v}\right)}$ (d) $\sqrt[3]{6v} e^{-u}$ (e) $7\sqrt{u^6 + v^9} \tan^{-1}(v^3)$

(f) $\sinh^2 u - \cosh^2 u$

2. Assigning $z=1+5i$, $w=9+6i$, evaluate the following expressions in Matlab

(a) $\left| \frac{2z}{z+w} \right|$ (b) conjugate of $9(z-6w)$

3. Find the area of a rectangle with length 55cm and breadth 125cm.

4. Obtain the area of a circle with radius five, up to 15 decimal places.

5. Find the area of the ellipse $(x-1)^2 + 9(y-5)^2 = 9$ in the first quadrant.

➤ Type the following lines in the command window one at a time and observe the output.

Creation of vectors and vector operations

- (i) $x=[1\ 2\ 3\ 4\ 5\ 6\ 7]$ ← row and column vectors
- (ii) $y=[1;2;3;4;5]$
- (iii) $x1=\text{ones}(1,10)$ ← row and column vectors with ones and zeros
- (iv) $y1=\text{zeros}(5,1)$
- (v) $\text{length}(x), \text{length}(y)$
- (vi) $z=y'$ ← Transpose of the row and column vectors
- (vii) $z=\text{transpose}(y)$
- (viii) $x=[2\ 4\ 1\ 6\ 8\ 3]$
- (ix) $\text{sort}(x, 'ascend'), \text{sort}(x, 'descend')$
- (x) $\text{sum}(x)$
- (xi) $\text{max}(x), \text{min}(x)$
- (xii) $p=[30\ 20\ 50]; q=[-20\ 40\ 70];$
- (xiii) $p+q$
- (xiv) $p-q$
- (xv) $\text{exp}(p), \text{log}(p), \text{sqrt}(p), \text{sin}(p), \text{etc}$ ← component wise evaluation
- (xvi) $p*q'$
- (xvii) $2*q$
- (xviii) $p.*q$ ← component wise multiplication of p and q
- (xix) $\text{dot}(p,q)$ ← dot product and cross product of vectors
- (xx) $\text{cross}(p,q)$

Creation of matrices and matrix operations

- (i) $A=[1\ 2\ 3;4\ 5\ 6;7\ 8\ 9]$
- (ii) $B=[20,12,13,43;54\ 4\ 62\ 23]$
- (iii) $C=B', C=\text{transpose}(B)$
- (iv) $\text{size}(A), \text{size}(B), \text{size}(B')$
- (v) $A+B, A-B$
- (vi) $2*A$
- (vii) $A=[1\ 2\ 3;2\ 4\ 5], B=[2\ 4;4\ 6;4\ 5], C=A*B, E=B*A$
- (viii) $D=\text{det}(E)$
- (ix) $I=\text{inv}(E)$
- (x) $D=\text{diag}(E)$
- (xi) $\text{ones}(3), \text{zeros}(2,4)$
- (xii) $\text{eye}(4), \text{eye}(5,8)$

(xiii)	$E, u=E(2,:)$	← displays the specific rows and columns
(xiv)	$E, v=E(:,3)$	
(xv)	$E, a=E(2,3), b=E(1,2)$	← locating an element in the matrix
(xvi)	$E, p=[9\ 8\ 7], F=[E;p]$	← appends E with a new row vector p
(xvii)	$F, q=[1\ 2\ 3\ 4], G=[F\ q']$	← appends F with a new column vector q

Exercise:

6. Evaluate the following for $\bar{x} = (-9\ 8\ 7)$, $\bar{y} = (1, 2, -3)$, $\bar{z} = (11, 0, 2)$ using Matlab
 - (a) $\bar{x} \cdot \bar{y}$ (b) $\bar{x} \times \bar{y} \cdot \bar{z}$ (c) $\bar{x} \cdot \bar{y} \times \bar{z}$ (d) $(\bar{x} \times \bar{y}) \times (\bar{z} \times \bar{x})$ (e) $(2\bar{x} \times 5\bar{y}) + 9\bar{z}$
7. The marks of all students in a class for a mathematics exam is given below :
 21, 99, 45, 97, 15, 89, 100, 78, 68, 37, 44, 56, 77, 88, 99, 22, 19, 3, 50, 44, 78, 98, 86, 65, 91, 51
 Answer the questions after entering these marks as a vector in matlab command window.
 - (a) How many students are there in the class?
 - (b) What is the class average in mathematics?
 - (c) What is the maximum mark? minimum mark?
 - (d) Write all the marks in (i) ascending order and (ii) descending order.
8. If $P = \begin{bmatrix} 99 & 12 & 3 \\ 4 & 43 & 6 \\ 77 & 65 & 49 \end{bmatrix}$, $Q = \begin{bmatrix} 91 & 22 & 35 \\ 14 & 42 & 16 \\ 72 & 43 & 51 \end{bmatrix}$ and $R = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 9 & 8 \end{bmatrix}$
 - (i) Find (a) $3P+Q-PQ$ (b) QR^T (c) $RQ-R$ (d) P^2Q (e) $(P+Q)^2$ (f) $|P|$ (g) P^{-1}
 - (ii) Find the vector consisting of diagonal elements of $P+Q$.
 - (iii) Find the trace of (i) $P+Q$ and (ii) PQ .
 - (iv) Create an identity matrix of order 15.
 - (v) Obtain the third row of $P+Q$ and call it as vector u.
 - (vi) Obtain a 4×3 matrix by appending P with u.
 - (vii) Obtain the second column of $P+Q$
9. If $A = \begin{bmatrix} 9 & 1 & 3 \\ 4 & 4 & 6 \\ 0 & 5 & 4 \end{bmatrix}$, $B = [24\ 56\ 78]^T$ in the system of equations $AX=B$, find
 - (i) the augmented matrix AB, (ii) $X=A^{-1}B$
10. If $P = \begin{bmatrix} 10 & 3 & 13 \\ 44 & 21 & 62 \\ 7 & 35 & 49 \end{bmatrix}$, $Q = \begin{bmatrix} 931 & 232 & 345 \\ 154 & 462 & 186 \\ 722 & 463 & 501 \end{bmatrix}$, verify (i) $(PQ)^T = Q^T P^T$ (ii) $PI=IP=P$.