



Lab Worksheet 1 (17/02/2025)

CELEN087

Instruction: Work in MATLAB Command Window for following exercises. You are suggested to complete all questions in **this worksheet** and **Homework Exercise 1** by end of this week.

1. Try the following examples. Learn by checking the outputs or using MATLAB **help** command.

- `log2(64)`
- `mod(12,5)`
- `round(2.7)`
- `power(16,-0.5)`
- `log10(0.01)`
- `floor(-4.2)`
- `round(7.2)`
- `nthroot(243,5)`
- `log(exp(2))`
- `ceil(1.3)`
- `power(2,3)`
- `cosd(60)`

2. Use appropriate functions/statements to evaluate the following expressions.

- (i) $\sin 3.14$
- (v) 10^{100}
- (ix) $|e - 2\pi|$
- (ii) $\sin 3.14159$
- (vi) 10^{-7}
- (x) $\frac{1}{e^2}$
- (iii) $\cos 60^\circ$
- (vii) $\left(\frac{1+i}{1-i}\right)^3$
- (xi) $\log_3 81$
- (iv) $5 \ln 3$
- (viii) $\log_2 32 + \log_{10} 0.0001$
- (xii) $\frac{\sqrt{5}-1}{2}$

3. Evaluate the following expression.

- (i) $y = \frac{x^3 - 5x + 2}{x^4 + 3}$, when $x = 0.35$.
- (ii) $V = \frac{4}{3}\pi r^3$, when $r = 10$.
- (iii) $c = \sqrt{a^2 + b^2}$, when $a = 2.1, b = 5.3$.

4. Use appropriate commands to create following arrays (matrices/vectors).

- (i) 5-by-2 (5 rows 2 columns) matrix, all elements are 1
 - (ii) 3-by-6 matrix, all elements are 0
 - (iii) column vector of length 10, all elements are 1
 - (iv) 4-by-4 identity matrix (all 1 in diagonal, 0 elsewhere)
 - (v) 5-by-3 random matrix, all elements are random numbers between 0 and 1
 - (vi) row vector of length 8, all elements are random integers between 1 and 100
- Hint: use **help randi** in command window and learn from it.

5. Create the following matrix in MATLAB:

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

(a) Predict the outputs of following statements, then use MATLAB to verify your answers.

(i) $B = A(1:2, :)$

(ii) $C = A(:, 2:3)$

(iii) $x = A(1, :)$

(iv) $y = A(:, 2)$

(b) Use `whos` command to check variable information, pay attention to the sizes. Then think about which of the following array products are valid? Use MATLAB to verify your answers.

(i) $x*A$

(iii) $x*C$

(v) $B*x$

(vii) $y*A$

(ii) $x*B$

(iv) $A*x$

(vi) $C*x$

(viii) $A*y$

(c) Let $D=B*C$. What is the size of matrix D ? Compute the determinant of D and its inverse matrix E by using:

`det(D)`

`E = inv(D)`

Verify the inverse matrix is correct by computing:

$D*E$

$E*D$

(d) Let $F=C*B$. What is the size of matrix F ? Compute $\det(F)$, what is the meaning of the result?

6. System of linear equations can be solved by using matrix method. For example, to find the solution of the following system

$$\begin{cases} 2x + 3y = 0 \\ x - 4y + 2z = 19 \\ 3y + 5z = 14 \end{cases}$$

we can rewrite the system into a matrix form $At = b$:

$$\begin{pmatrix} 2 & 3 & 0 \\ 1 & -4 & 2 \\ 0 & 3 & 5 \end{pmatrix} \cdot \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 0 \\ 19 \\ 14 \end{pmatrix}$$

where A is the 3-by-3 coefficient matrix, t is a **column vector** consisting of all unknown values x, y, z , and b is a **column vector** representing the right-hand side values. Then the solution to this system is given by

$$t = A^{-1}b$$

In MATLAB, we can create the matrix A and the column vector b first, then use the following statement for computing t :

`t = inv(A)*b`

Practice: Use matrix method to solve the following systems of equations.

$$(i) \begin{cases} 2x - 3y + 4z = 5 \\ 4x - 3z = 9 \\ 3y + 5z = -3 \end{cases} \quad (ii) \begin{cases} x + 3y + 5z - 8 = 0 \\ 2x - 3z + 4 = 0 \\ x - 2y - 3 = 0 \end{cases}$$