

Examples

Matlab documentation:

- http://www.mathworks.com/help/pdf_doc/matlab/getstart.pdf
- `help`
- `help` followed by a command name
- `doc` followed by a command name (*e.g.*, `help plot`, `doc plot`)

I. Check the following operations with vectors:

```
a = [1 2 3] or a = [1, 2, 3]    %line vector
b = [4; 5; 6] or b = [4 5 6]'    %column vector
c = a * b
d = [4 5 6] or d = b'           %the transpose vector of b
e = a .* d
f = a.^2
g = a.^d
v = 1 : 6
w = 2 : 3 : 10                  %the starting point:step:the final point
y = 10 : -1 : 0
exp(a)
exp(1)                          %number e
sqrt(a)
m = max(a)
[m, k] = max(a)
h = [-2 -9 8]
k = abs(h)
mean(a)
geomean(a)
sum(a)
prod(a)
```

II. Consider the matrices $a = \begin{bmatrix} 1 & 2 & 13 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ and $b = \begin{bmatrix} 4 & 8 & 12 \\ -1 & 0 & 5 \\ 2 & 3 & 8 \end{bmatrix}$. Check

the following operations:

```
[m, n] = size(a)
t = b'    %the transpose matrix of b
c = a * b
d = a .* b
e = a.^2
size(a)
length(a)
m = mean(a)
m1 = mean(a, 2)
```

```

g = geomean(a)
s = sum(a)
s1 = sum(a, 2)
p = prod(a)
p1 = prod(a, 2)
max(a)
min(a)
diag(a)
m > 2
a > b
inv(b)
det(b)
f = abs(b)
b = [16 15 24]'
x = a\b
triu(a)
tril(a)
m = [2 3 5; 7 11 13; 17 19 23]
m(2, 1)
m(:, 1) %all rows of column 1
m(2, :) % all columns of line 2
m(2, 1 : 2) %line 2, all but last columns
m(2, 2 : end) %second row, all but first column
m(2 : 3, 2 : 3) %a submatrix
Some particular matrices: a) eye(8), eye(5, 7), zeros(5, 7), ones(7, 9)
b) M = magic(4)
sum(M), sum(M, 2), sum(diag(M)), sum(diag(fliplr(M)))

```

II. Polynomials

1. Evaluate the polynomial $p(x) = 2x^3 - 5x^2 + 8$ in $x = 2$. (Use: *polyval*).
2. Find the roots of the polynomial $p(x) = x^3 - 5x^2 - 17x + 21$. (Use: *roots*).

III. Graphs

1. Plot the function $f : [0, 1] \rightarrow \mathbb{R}$, $f(x) = e^{10x(x-1)} \sin 12\pi x$,
and the epicycloid

$$\begin{cases} x(t) = (a + b) \cos(t) - b \cos\left(\left(\frac{a}{b} + 1\right)t\right), \\ y(t) = (a + b) \sin(t) - b \sin\left(\left(\frac{a}{b} + 1\right)t\right), \end{cases} \quad t \in [0, 10\pi], \text{ for given } a, b.$$

2. Plot, on a single graph, the functions: $f_1, f_2, f_3 : [0, 2\pi] \rightarrow \mathbb{R}$, $f_1(x) = \cos x$, $f_2(x) = \sin x$, $f_3(x) = \cos 2x$.

3. For $x \in \{0, 1, \dots, 50\}$ plot the function

$$f(x) = \begin{cases} x/2 & \text{if } x = \text{even} \\ 3x + 1 & \text{if } x = \text{odd}. \end{cases}$$

4. For controlling the axes aspect we use *axis*. For illustration, check the following:

```
plot(f ft(eye(17)))
plot(f ft(eye(17))), axis equal, axis square
plot(f ft(eye(17))), axis equal, axis off
```

Remark. To establish the limits of the axes use *axis([xmin xmax ymin ymax])*. For returning to the implicit style use *axis auto*.

5. Compute

$$g = 1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \frac{1}{1 + 1}}}}.$$

6. Plot the function $g : [-2, 2] \times [-4, 4] \rightarrow \mathbb{R}$, $g(x, y) = e^{-((x-\frac{1}{2})^2 + (y-\frac{1}{2})^2)}$. (Use: *meshgrid, mesh*).