VECTORLER

```
>> a = [ 7  2   5 ],    b = [ 9   0 3 ]
>>c=1:5
   c=  1  2  3  4  5

>>d=5:8
    d=  5   6   7   8

>>e=0:2:10
    0  2  4   6  8   10

>>f=0:0.1:0.6
   0   0.1   0.2    0.3   0.4  0.5   0.6

>>g=zeros(1,6)
  0   0   0   0   0   0

>>h=zeros(1,4)
      0   0   0   0

>>k=ones(1,7)
      1   1   1   1   1  1   1

>>m=ones(1,3)
      1    1    1
```

TOPLAMA ve CIKARMA

```
>>a=[ 2   8   10],   b=[  1  4  3]

>> c= a + b
       2     8     10
+      1     4      3
--------------------
       3     12    13

c=[  3    12     13]


>>d=10*a
   d=[  20   80   100]

>>e=5*b
       5    20   15

>>f=10*a + 5*b
       25    100   115

>>g= a-b
    2     4    7
```

VEKTORLERIN IC ICE KONULMASI

```
>>h = [ 1:5 ]
   1  2   3  4  5

>>k = [ 1:5     1:3 ]
   1   2  3  4   5     1   2  3

>>m = [ 0:2:10   10:3:22 ]
0  2  4   6  8    10   13   16   19    22

>> a = [ 8 10 3 ],  b= [4  7  8]
>> c= [ a  b ]
  8  10  3   4  7  8

>> d = [ a a  a ]
  8  10  3     8  10  3     8  10  3
```

Komplex vectors

```
>> a = [ 3+4*j    -6 +9j        2+5j      -7j    30]

>> w = abs(a)
          5     10.81       5.38     7    30
```

$\sqrt{3^2+4^2}$ =5, $\sqrt{6^2+9^2}$ =10.81 …

```
>> p=angle(a)
            0.92   2.15    1.19   -1.57     0

>> s=angle(a)*180/pi
       53.13     123.69     68.19     -90       0
```

$$\tan^{-1}(\frac{4}{3})=0.92^{\text{radian}} = 53.13^0$$

$$\tan^{-1}(\frac{9}{-6})=2.15^{\text{radian}} = 123.69^0$$

MATRISLER:

Asagidakileri yazin

```
>> a=[10 20 30; 40 50 60;  100 80 90];
>> b=[ 1 2 3;  4 5 6; -2 8 9];
c=[15 25 35];
```

$$a=\begin{bmatrix}10 & 20 & 30\\ 40 & 50 & 60\\ 100 & 80 & 90\end{bmatrix}, b=\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ -2 & 8 & 9\end{bmatrix},$$

$c=[15 \quad 25 \quad 35]$,

Toplama, Cikarma, Carpma, Bolme, normal islemler gibi yapilir.

```
>>qq=a+b,  ww=a-b;  ee=a*d;
```

$$qq=\begin{bmatrix}11 & 22 & 33\\ 44 & 55 & 66\\ -98 & 88 & 99\end{bmatrix},\ ww=\begin{bmatrix}9 & 18 & 27\\ 36 & 45 & 54\\ 102 & 72 & 81\end{bmatrix},\ ee=\begin{bmatrix}200\\ 440\\ 710\end{bmatrix}$$

' isareti matris transpozesi icin kullanilir.

```
>>m=[1 2 3; 4 5 6],  n=a',   d=[1  2  5]'
```

$$m=\begin{bmatrix}1&2&3\\4&5&6\end{bmatrix} \qquad n=\begin{bmatrix}1&4\\2&5\\3&6\end{bmatrix}, \qquad d=\begin{bmatrix}1\\2\\5\end{bmatrix}$$

Satir ve Sutun islemleri

Asagidaki ifadeleri yazin ve G matrisini ekranda gorun

>> G=[10 20 30 40; 210 220 230 240 ; 310 320 330 340; 410 420 430 440];

$$G=\begin{bmatrix}10&20&30&40\\210&220&230&240\\310&320&330&340\\410&420&430&440\end{bmatrix}$$

Asagidaki ifadeleri yazin ve sonuclari ekranda gorun
>>h=G(:,1), k= G(:,2), m= G(:,4), n=G(1,:), p=G(2,:),

$$h=\begin{bmatrix}10\\210\\310\\410\end{bmatrix},\ k=\begin{bmatrix}20\\220\\320\\420\end{bmatrix},\ m=\begin{bmatrix}40\\240\\340\\440\end{bmatrix},$$

$$n=\begin{bmatrix}10&20&30&40\end{bmatrix}$$

,

$$p=\begin{bmatrix}410&420&430&440\end{bmatrix}$$

Ayrica , r=G(1:2,:), t=G(:,1:2), s=G(1:2,1:2)

$$r=\begin{bmatrix}10&20&30&40\\210&220&230&240\end{bmatrix},\ t=\begin{bmatrix}10&20\\210&220\\310&320\\410&420\end{bmatrix},$$

$$s=\begin{bmatrix}10&20\\210&220\end{bmatrix},$$

>> aa=1:10

$aa=$ [1 2 3 4 5 6 7 8 9 10]

>> aa=1:7, bb=sin(aa),

bb=[0.84 0.9 0.14 -0.75 -0.95 -0.27 0.65]

her elemanin ayri ayri sinusu alinir

bb=[sin(1) sin(2) sin(3) sin(4) sin(5) sin(6) sin(7)];

Matrices can be nested into each other. Examine the following examples.

>>a=[1 2 3]; b=[10 100 200]; c=[11 22 33]; d=[a; b; c]; e=[a b c];

$$d=\begin{bmatrix}1&2&3\\10&100&200\\11&22&33\end{bmatrix},$$

$e=$ [1 2 3 10 100 200 11 22 33]

>>a=[1 2; 3 4]; b=[a [10 20]'; 7 8 9]

$$a=\begin{bmatrix}1&2\\3&4\end{bmatrix},\quad b=\begin{bmatrix}1&2&10\\3&4&20\\7&8&9\end{bmatrix}$$

MATLAB da tanimlanmis fonksiyoanlar

zeros(n,m) n x m boyutlu, tum elemanlari sifir matrix

ones(n,m) n x m boyutlu, tum elemanlari 1 matrix

eye(n) n x n boyutlu birim matris. tum elemanlari 0 sadece kosegen elemanlari 1.

size(qq) Bir matrisin boyutlarini verir. m ve n yi verir

qq' Transpose of the matrix qq

inv(qq) matris tersi (inversi)

diag(qq) diagonal of the matrix qq

sum(qq) sutunlarin toplami

det(qq) determinant of the matrix qq.

Example 1)

>>ww=ones(2,3), ff=zeros(3,4), gg=eye(3),

$$ww=\begin{bmatrix}1&1&1\\1&1&1\end{bmatrix},\quad ff=\begin{bmatrix}0&0&0&0\\0&0&0&0\\0&0&0&0\end{bmatrix},$$

$$gg=\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}$$

Example 2)

>>[wrow wcolumn]=size(ww),

wrow=2 wcolumn=3

>>[frow fcolumn]=size(ff),

frow=3 frow=4

Example 3)

>>q=[1 2; 3 4], p=[10 20; 30 40];

r=[[q zeros(2,2)] [ones(2,2) p]]

$$q=\begin{bmatrix}1&2\\3&4\end{bmatrix},\ q=\begin{bmatrix}10&20\\30&40\end{bmatrix},$$

$$r=\begin{bmatrix}1&2&0&0&1&1&10&20\\3&4&0&0&1&1&30&40\end{bmatrix}$$

Example 4)

>> e = [zeros(1,4) ones(1,3)]

0 0 0 0 1 1 1

>> e = [zeros(1,4) ones(1,3)]

0 0 0 0 1 1 1

```
>> f = [ ones(1,3)    10*ones(1,4)  ]
   1   1   1     10   10   10  10
```

```
>> g = 10*[1:3]
      10   20  30
```

```
>> h = [ ones(1,3)   10:2:20]
 1  1   1    10  12  14  16  18  29
```

```
>> k =[ 10*ones(1,3)  17   10:3:19 ]
    10  20  30    17  10   13   16  19
```


```
>> f = [ ones(1,3)    10*ones(1,4)  ]
   1   1   1     10   10   10  10
```

```
>> g = 10*[1:3]
      10   20  30
```

```
>> h = [ ones(1,3)   10:2:20]
 1  1   1    10  12  14  16  18  29
```

```
>> k =[ 10*ones(1,3)  17   10:3:19 ]
    10  20  30    17  10   13   16  19
```


Example 5)

```
>>  aa=[4 6 0  0 2   2   40    60]
 >>bb=sum(aa)
   bb=114
```

vektorun tum elemanlari toplandi.
4 + 6 + 0 + 0 + 2 + 2 + 40 +60=114

Example 6)

Most built-in functions (sin,cos,tan, exp..) also works for matrices.

```
>>a=[1 2;    3 4];

   >> b=sin(a);
```

$$b=\begin{bmatrix}\sin(1) & \sin(2)\\ \sin(3) & \sin(4)\end{bmatrix}=\begin{bmatrix}0.841 & 0.909\\ 0.141 & -0.756\end{bmatrix},$$

```
>> c=exp(a);
```

$$c=\begin{bmatrix}e^1 & e^2\\ e^3 & e^4\end{bmatrix}=\begin{bmatrix}2.718 & 7.389\\ 20.08 & 54.59\end{bmatrix}$$

MATRISLERDE SCALAR CARPMA VE BOLME

x=a.*b , a ve b vectorlerinin scalar carpimini verir.

Normal carpmada kullanilan * yerine **.*** kullanildigina dikkat ediniz.

```
>> a = [ 15  16   12   20 ],   b =[ 10   4    6   5 ],  x=a.*b
x =  [ 150  64 72  100]
15 * 10 = 150
16 * 4  = 64
12 * 6 = 72
20 * 5 =100
```

```
>> a = [15  16   12   20 ],  b =[ 10   4    6   5 ], y=a./b
```

Normal bolmede kullanilan / yerine **./** kullanildigina dikkat ediniz.

```
y = [  1.5   4  2  4 ]
15 / 10 = 1.5
16 / 4  = 4
12 / 6 =  2
20 / 5 =  4
```

```
>>q=[1 2;  3 4],    p=[10 20;  30 40];   w=p+q
```

$$p=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix},\quad q=\begin{bmatrix}10 & 20\\ 30 & 40\end{bmatrix},\quad w=\begin{bmatrix}11 & 22\\ 33 & 44\end{bmatrix}$$

```
>>q=[1 2;  3 4],  p=[10  20;  30 40];    z=q.*p,    k=p./q
```

$$z=\begin{bmatrix}10 & 20\\ 90 & 160\end{bmatrix}, k=\begin{bmatrix}10 & 10\\ 10 & 40\end{bmatrix}$$

MATRIS CARPIMLARI

$$\begin{bmatrix}b_{11} & b_{12}\\ b_{21} & b_{22}\\ b_{31} & b_{32}\end{bmatrix}$$

$$\begin{bmatrix}a_{11} & a_{12} & a_{13}\\ a_{21} & a_{22} & a_{23}\end{bmatrix}\quad\begin{bmatrix}a_{11}b_{11}+a_{12}b_{21}+a_{13}b_{31} & a_{11}b_{12}+a_{12}b_{22}+a_{13}b_{32}\\ a_{21}b_{11}+a_{22}b_{21}+a_{23}b_{31} & a_{21}b_{12}+a_{22}b_{22}+a_{23}b_{32}\end{bmatrix}$$

$$\begin{bmatrix}2 & 3 & 4\\ 5 & 6 & 7\end{bmatrix}\begin{bmatrix}10 & 20\\ 30 & 40\\ 50 & 60\end{bmatrix}=\begin{bmatrix}310 & 400\\ 580 & 760\end{bmatrix}$$

```
>>aa=[2 3 4; 5 6 7],   bb=[10 20; 30 40; 50 60], x=aa*bb
```

$$x=\begin{bmatrix}310 & 400\\ 580 & 760\end{bmatrix}$$

$$\begin{bmatrix}2 & 3 & 4\end{bmatrix}\begin{bmatrix}10\\ 20\\ 30\end{bmatrix}=200$$

>>a=[2 3 4], b=[10 20 30]', x=a*b
x=200

$$\begin{bmatrix}10\\20\\30\end{bmatrix}\begin{bmatrix}2 & 3 & 4\end{bmatrix}=\begin{bmatrix}20 & 30 & 40\\40 & 60 & 80\\60 & 90 & 120\end{bmatrix}$$

>>a=[2 3 4], b=[10 20 30]', x=b*a

$$x=\begin{bmatrix}20 & 30 & 40\\40 & 60 & 80\\60 & 90 & 120\end{bmatrix}$$

$\begin{bmatrix}2 & 3 & 4\end{bmatrix}\begin{bmatrix}10 & 20 & 30\end{bmatrix}$ = HATALI ISLEM

>>a=[2 3 4], b=[10 20 30], x=a*b
??? Error using ==> mtimes
Inner matrix dimensions must agree.

Matris boyutlari uyusmazsa carpma tanimsizdir.

DIMENSION ERROR

>> a = [2 5 4], b = [8 3 12 5]
>>x = a + b

?? Error using ==> plus
Matrix dimensions must agree.

eleman eleman yapilan islemlerde a ve b ayni boyutta olmalidir.

x = a*b, y = a.*b, z = a/b w=a./b
hepsi hatalidir.

Ornek 431 : x=0; x=1; x=8 x=5; icin $y=3x^2+5x+7$ degerini hesaplayin bir matris halinde gosterin.

```
Method  1.
    a1=0;  b1=3*a1^2 + 5*a1 +7

    a2=1;  b2=3*a2^2 + 5*a2 +7

    a3=8;  b3=3*a3^2 + 5*a3 +7

    a4=5;  b4=3*a4^2 + 5*a4 +7

tt=[a1 b1;  a2 b2;  a3 b3; a4 b4]
    tt=
     0     7
     1    15
     8   239
     5   107
---------------------------------
Method  2.
    aa=[0 1 8  5]
    aa_Length=length(aa);
 for kk=1:aa_Length,
bb(kk)= 3* aa(kk) ^2 + 5*aa(kk) +7
 end;
bb=[7    15   239   107]

tt=[aa' bb']

 tt=
     0     7
     1    15
     8   239
     5   107
----------------------
  Method  3.
    aa=[0 1 8  5]
    bb=3*aa.^2 + 5*aa +7
----------------------
  Method  4.

    aa=[0 1 8  5]
    pol_coef =[3 5 7]



  b1=polyval(pol_coef,0)

  b2=polyval(pol_coef,0)

  b3=polyval(pol_coef,0)

  b4=polyval(pol_coef,0)
bb=[ b1 b2 b3 b4]
-------------------------
   Method  5.
  aa=[0 1 8  5]
  pol_coef =[3 5 7]
  bb=polyval(pol_coef,aa)
-----------------------------
```

Problem: $y = 3x^2 + e^{0.1x} - 20\sin(x)$
Calculate y for x=0, x=0.5 , x=1, and x=2

Long method:

```
>> x=0,  y = 3*x^2 + exp(0.1*x) -20*sin(x)
        1
>> x=0.5,  y = 3*x^2 + exp(0.1*x) -20*sin(x)
       -7.78

>> x=1,  y = 3*x^2 + exp(0.1*x) -20*sin(x)
       -12.72
```

Short method

```
>> x=[0  0.5  1   2],
>> y = 3* x.^2 + exp(0.1*x) - 20*sin(x)
      1   -7.78   -12.72    -4.96
```

Notice **the dot .** in x.^2

for

```
  >> for kk=1:4,  aa(kk)=kk^3; end;

 aa=[1^3   2^3   3^3   4^3 ]

 aa=[  1   8   27   64]
------------------------
```

MATRIS KARESI VE USTEL ISLEMLER

>> a=[2 5 7 -8], b=a^2

??? Error using ==> mpower

Matrix must be square.

>> a=[2 5 7 -8], b=a**.**^2

b=[4 25 49 64]

$2^2 = 4$ $5^2 = 25$ $7^2 = 49$ $(-)8^2 = 64$

>> a=[2 5 7 -8], b=a**.**^3

b=[8 125 343 -512]

>>a=[1 2; 3 4]; d=a•^2;

$$d = \begin{bmatrix} 1^2 & 2^2 \\ 3^2 & 4^2 \end{bmatrix} = \begin{bmatrix} 1 & 4 \\ 9 & 16 \end{bmatrix},$$

>> g=a^2

$$g = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 15 & 22 \end{bmatrix}$$

a•^2 ile a^2 arasindaki farki gozelemleyin.
