matlab

Linear_Control_Systems_14031

```
clc;                              %clear command window
clear all;                        %clear workspace
close all;                        %close all figures and plots
```

Complex Numbers

we can find the magnitude and angle of a complex number, Q using abs (Q) and angle (Q)

```
Z = 3 + 4j;                 %define complex number
Z
```

```
Z = 3.0000 + 4.0000i
```

```
real(Z)                %Real part of complex number
```

```
ans = 3
```

```
imag(Z)                %imaginary part of complex number
```

```
ans = 4
```

```
angle(Z)               %Phase angle in radian
```

```
ans = 0.9273
```

```
conj(Z)                %Element-wise complex conjugate
```

```
ans = 3.0000 - 4.0000i
```

```
MagZ = abs(Z)              % Find magnitude of Z.
```

```
MagZ = 5
```

```
ThetaZ = (180/pi)*angle(Z)              % Find the angle of Z in degrees.
```

```
ThetaZ = 53.1301
```

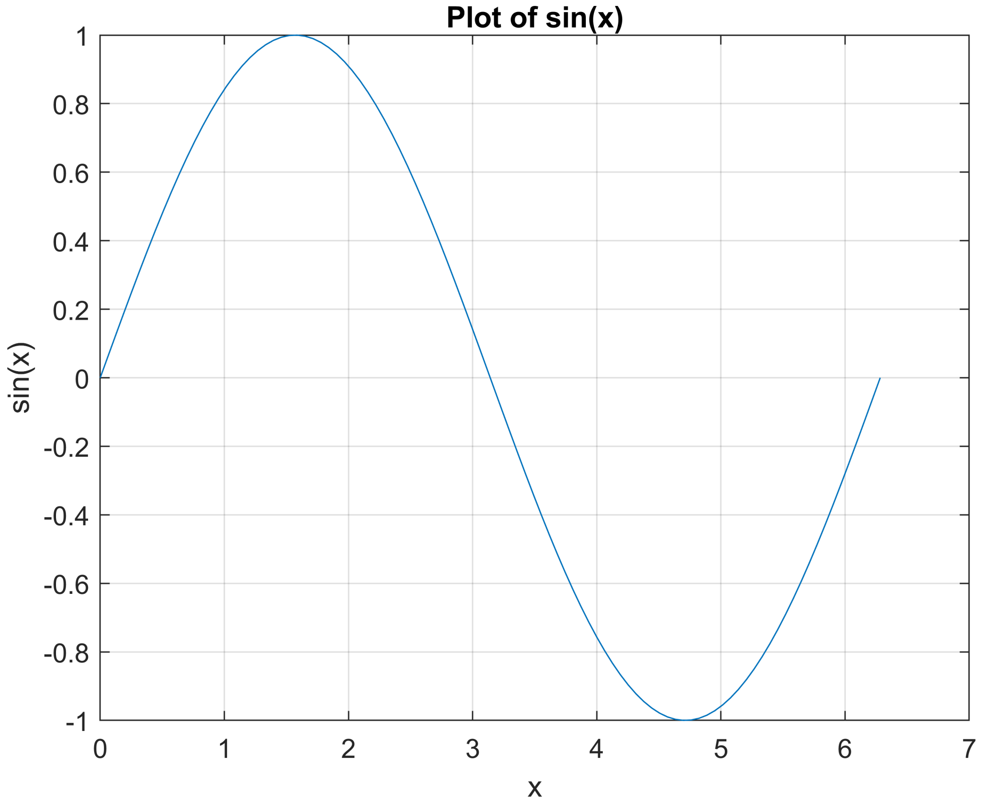
Elementary Functions

```
x = linspace(0, 2*pi, 100);
```

```
y = sin(x) % Sine of x (in radians)
```

```
y = 1×100
         0    0.0634    0.1266    0.1893    0.2511    0.3120    0.3717    0.4298 ⋯
```

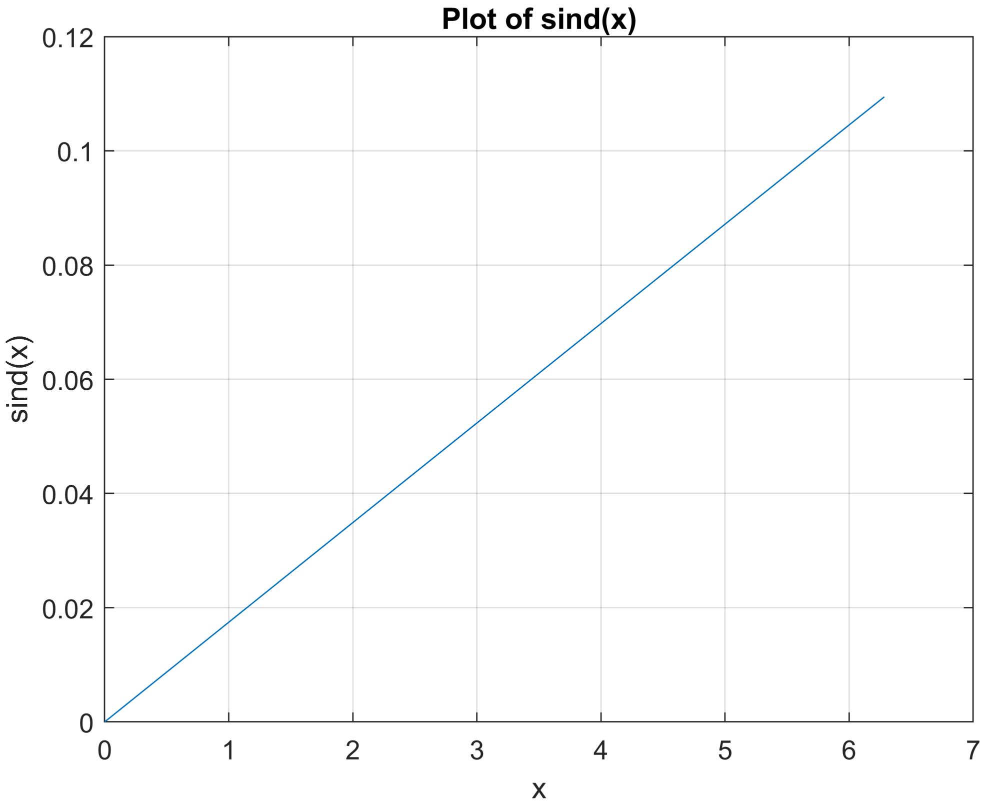
```
plot(x, y);
xlabel('x'); % Label for x-axis
ylabel('sin(x)'); % Label for y-axis
title('Plot of sin(x)'); % Title of the plot
grid on; % Turn on grid for better readability
```



```
y=sind(x)
```

```
y = 1×100
         0    0.0011    0.0022    0.0033    0.0044    0.0055    0.0066    0.0078 ⋯
```

```
plot(x, y);
xlabel('x'); % Label for x-axis
ylabel('sind(x)'); % Label for y-axis
title('Plot of sind(x)'); % Title of the plot
grid on;
```



```
sinh(x) %Analogous for the other trigonometric functions:cos, tan, csc, sec, and cot
```

```
ans = 1×100
         0    0.0635    0.1273    0.1916    0.2566    0.3227    0.3901    0.4590⋯
```

```
atan2(-2,-2)
```

```
ans = -2.3562
```

```
exp(1)
```

```
ans = 2.7183
```

logical

```
1>2
```

```
ans = logical
   0
```

```
1<2
```

```
ans = logical
   1
```

```
1==2
```

```
ans = logical
   0
```

```
1<=2
```

```
ans = logical
   1
```

```
1~=2
```

```
ans = logical
   1
```

```
s=true
```

```
s = logical
   1
```

```
g=false
```

```
g = logical
   0
```

```
s&g
```

```
ans = logical
   0
```

```
s|g
```

```
ans = logical
   1
```

```
~s
```

```
ans = logical
   0
```

```

```

Matrices and Arrays

Matrix and Vector Creation

```
A=[1 1 0 0;0 1 0 1;1 0 0 0;1 0 0 1]
```

```
A = 4×4
     1     1     0     0
     0     1     0     1
     1     0     0     0
     1     0     0     1
```

```
A(6)
```

```
ans = 1
```

```
F=A(2:4,2:4)
```

```
F = 3×3
     1     0     1
     0     0     0
     0     0     1
```

```
V = [1; 2; 3; 4]
```

```
V = 4×1
     1
     2
     3
     4
```

```
V(2)
```

```
ans = 2
```

```
length(A)
```

```
ans = 4
```

```
size(A)
```

```
ans = 1×2
     4     4
```

```
diag(A)
```

```
ans = 4×1
     1
     1
     0
     1
```

```
diag(V)
```

```
ans = 4×4
     1     0     0     0
     0     2     0     0
     0     0     3     0
     0     0     0     4
```

```
numel(A)
```

```
ans = 16
```

```
det(A)
```

```
ans = 0
```

```
rank(A)
```

```
ans = 3
```

```
trace(A)
```

```
ans = 3
```

```
zeros(3, 2)
```

```
ans = 3×2
     0     0
     0     0
     0     0
```

```
ones(3, 3)
```

```
ans = 3×3
     1     1     1
     1     1     1
     1     1     1
```

```
eye(3)
```

```
ans = 3×3
     1     0     0
     0     1     0
     0     0     1
```

Matrix Operations

```
C = A + A
```

```
C = 4×4
     2     2     0     0
     0     2     0     2
     2     0     0     0
     2     0     0     2
```

```
D = A * V
```

```
D = 4×1
     3
     6
     1
     5
```

```
AT = A'
```

```
AT = 4×4
     1     0     1     1
     1     1     0     0
     0     0     0     0
     0     1     0     1
```

```
A_inv = inv(A)          %computes the inverse of matrix
```

```
Warning: Matrix is singular to working precision.
A_inv = 4×4
   Inf   Inf   Inf   Inf
   Inf   Inf   Inf   Inf
   Inf   Inf   Inf   Inf
   Inf   Inf   Inf   Inf
```

```
d = det(A)              %Computes the determinant of matrix
```

```
d = 0
```

```
b=[2;3;4;5]
```

```
b = 4×1
     2
     3
     4
     5
```

```
x = A\b                 % Solves Ax = b for x
```

```
Warning: Matrix is singular to working precision.
x = 4×1
   NaN
   NaN
   Inf
     3
```

```
C = A .* b
```

```
C = 4×4
     2     2     0     0
     0     3     0     3
     4     0     0     0
     5     0     0     5
```

```
b=[2 3 4 5;3 4 5 6;4 5 6 7;5 6 7 8]
```

```
b = 4×4
     2     3     4     5
     3     4     5     6
     4     5     6     7
     5     6     7     8
```

```
C=A*b
```

```
C = 4×4
     5     7     9    11
     8    10    12    14
     2     3     4     5
     7     9    11    13
```

```
C = A .* b
```

```
C = 4×4
     2     3     0     0
     0     4     0     6
     4     0     0     0
     5     0     0     8
```

```
C = A ./ b
```

```
C = 4×4
    0.5000    0.3333         0         0
         0    0.2500         0    0.1667
    0.2500         0         0         0
    0.2000         0         0    0.1250
```

```
C = A.^2
```

```
C = 4×4
     1     1     0     0
     0     1     0     1
     1     0     0     0
     1     0     0     1
```

```
syms x y z
A = [x y; y z]
```

```
A =
```

$$\begin{pmatrix} x & y \\ y & z \end{pmatrix}$$

Vector Operations

```
v1 = [1 2 3];
v2 = [4 5 6];
dp = dot(v1, v2)                    %dot product
```

```
dp = 32
```

```
cp = cross(v1, v2)                  %cross product
```

```
cp = 1×3
    -3     6    -3
```

```
n = norm(v1)                    % Euclidean norm (2-norm)
```

```
n = 3.7417
```

```
n1 = norm(v1, 1)                    % 1-norm (sum of absolute values)
```

```
n1 = 6
```

```
nInf = norm(v1, Inf)                    % Infinity norm (max value)
```

```
nInf = 3
```

```

J=[7 9 5; 6 1 9; 4 3 2]
```

```
J = 3×3
     7     9     5
     6     1     9
     4     3     2
```

```
K=[1 2 3; 4 5 6; 7 8 9]
```

```
K = 3×3
     1     2     3
     4     5     6
     7     8     9
```

```
L=[9 8 7; 6 5 4; 3 2 1]
```

```
L = 3×3
     9     8     7
     6     5     4
     3     2     1
```

```
cat(3,J,K,L)
```

```
ans = 
ans(:,:,1) =

     7     9     5
     6     1     9
     4     3     2


ans(:,:,2) =

     1     2     3
     4     5     6
     7     8     9


ans(:,:,3) =

     9     8     7
     6     5     4
     3     2     1
```

```
ch=poly(cp)
```

```
ch = 1×4
     1     0   -27   -54
```

```
roots(ch)
```

```
ans = 3×1
    6.0000
   -3.0000
   -3.0000
```

loops

```
%%if
G=0;
if G>0
     f=1
elseif G==0
     f=0
else
```

```
    f=-1
end
```

```
f = 0
```

```
%%for
x1=0;
for i=1:10
    x1=x1+1/i^2;
    i=i+1;
end
x1
```

```
x1 = 1.5498
```

```
%%while
G=0;
f=10;
i=1;
while i<=f

    G=G+i;
    if i==5
        break;
    end
    i=i+1;
end
G
```

```
G = 15
```

good luck