Differential Equations Intro to MATLAB Spring 2022

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2 Command Practice

2.1 Arithmetic, variables, and your workspace

Exercise 1.

```
2.^3-((3-6)./2)+7.*0.5
```

```
ans = 13
```

```
(3.^2-2*3+4)./(2+7)
```

```
ans = 0.7778
```

```
((3+4.5)./(7.^2-2*9))-((2*1.5-1)./(3-6.2))
```

```
ans = 0.8669
```

```
((sqrt(7)-sqrt(6))./4).^2
```

```
ans = 0.0024
```

Exercise 2.

```
a = 2.^3-((3-6)./2)+7.*0.5;
b = (3.^2-2*3+4)./(2+7);
c = ((3+4.5)./(7.^2-2*9))-((2*1.5-1)./(3-6.2));
d = ((sqrt(7)-sqrt(6))./4).^2;
(a+b)/c+d^2
```

```
ans = 15.8925
```

```
clear;
```

2.2 Working with arrays

Exericse 3.

```
rowVec = [1.01 17 pi 1/2];
colVec = [3/4; 15.8; 3; -5];
matrix = [1 2 3 4; 5 6 7 8; 9 10 11 12; 13 14 15 16];
```

Exericse 4.

```
matrix^2
```

```
ans = 4×4
    90   100   110   120
   202   228   254   280
   314   356   398   440
   426   484   542   600
```

```
rowVec + colVec
```

```
ans = 4×4
    1.7600   17.7500    3.8916    1.2500
   16.8100   32.8000   18.9416   16.3000
    4.0100   20.0000    6.1416    3.5000
   -3.9900   12.0000   -1.8584   -4.5000
```

```
matrix * colVec
```

```
ans = 4×1
   21.3500
   79.5500
  137.7500
  195.9500
```

```
rowVec * matrix
```

```
ans = 1×4
  120.7843  142.4359  164.0875  185.7391
```

```
rowVec * colVec
```

```
ans = 276.2823
```

```
matrix + rowVec
```

```
ans = 4×4
    2.0100   19.0000    6.1416    4.5000
    6.0100   23.0000   10.1416    8.5000
   10.0100   27.0000   14.1416   12.5000
   14.0100   31.0000   18.1416   16.5000
```

Let A and B two matricies. Then, A*B on MATLAB means matrix multiplication of A and B. Note that the number of rows in A and the numebrs of columns in B (or vice versa) have to match. A^k (where k is a scalar) means the power of the matrix A.

If you wish to calculate corresponding elements in A and B, you must use A.*B.

2.3 Functions in MATLAB

Exericse 5.

```
sin(pi)
```

```
ans = 1.2246e-16
```

```
sqrt(1-(cos(pi))^2)
```

```
ans = 0
```

```
atan(1/sqrt(3))-atan(sqrt(3)/3)
```

```
ans = 1.1102e-16
```

Exericse 6.

```
sym(sin(pi))
```

```
ans =
```

$$\frac{4967757600021511}{4056481920730334084789450257203 2}$$

```
sym(sqrt(1-(cos(pi))^2))
```

```
ans = 0
```

```
sym(atan(1/sqrt(3))-atan(sqrt(3)/3))
```

```
ans =
```

$$\frac{1}{9007199254740992}$$

Exercise 7.

```
f = @(x) x^2-log(x);
f(1)
```

```
ans = 1
```

```
f(0)
```

```
ans = Inf
```

```
f(exp(1))
```

```
ans = 6.3891
```

```
f(pi)
```

```
ans = 8.7249
```

Exercise 8.

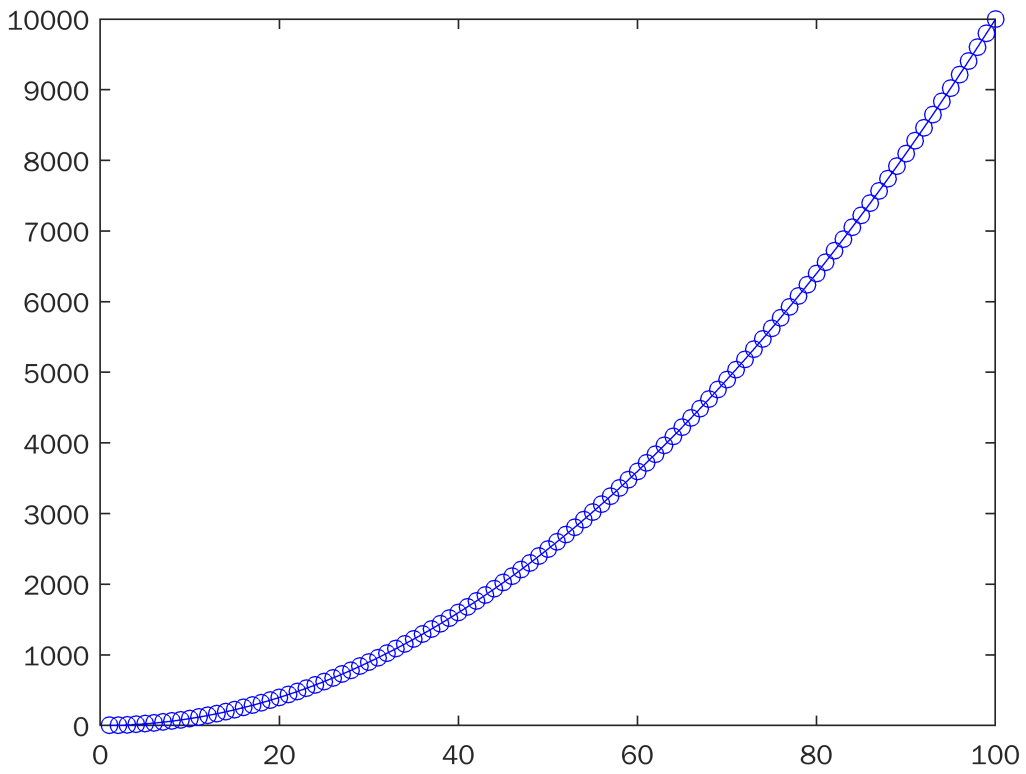
```
f = @(x) x.^2-log(x);
X = 1:100;
f(X)
```

```
ans = 1×100
10^3 ×
    0.0010    0.0033    0.0079    0.0146    0.0234    0.0342    0.0471    0.0619 ···
```

2.4 Plotting

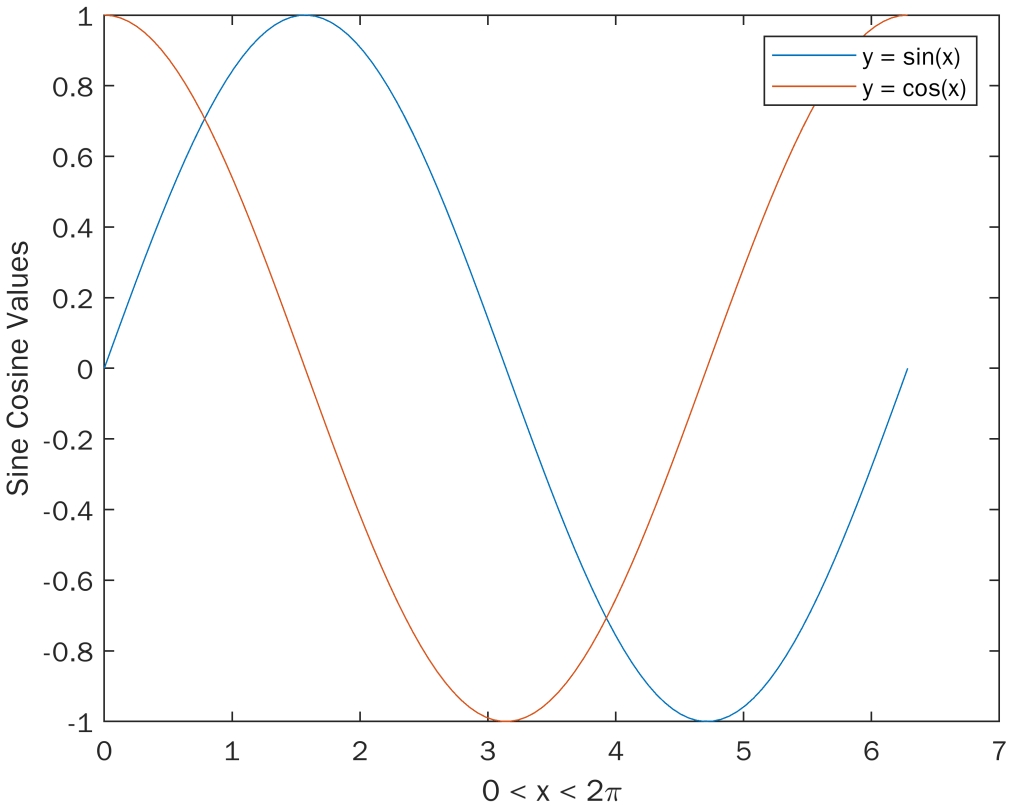
Exercise 9.

```
Xdata = 1:100;
Ydata = f(X);
plot(Xdata, Ydata,'-bo')
```



Exercise 10.

```
g = @(x) sin(x);
h = @(x) cos(x);
Xdata_2 = linspace(0, 2*pi);
plot(Xdata_2, g(Xdata_2), Xdata_2,h(Xdata_2))
legend({'y = sin(x)','y = cos(x)'})
xlabel('0 < x < 2\pi')
ylabel('Sine Cosine Values')
```


y = sin(x)
y = cos(x)
Sine Cosine Values
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
1
2
3
4
5
6
7
0 < x < 2π