5.2 Logarithmic and power functions

This group includes the functions used to raise to a power or evaluating natural and base−ten logarithms.

Square root: to find the square root of positive numbers the function (sqrt) is used:

```
y = sqrt( 4 )        y = sqrt( [ 4 , 9 , 16 ] )        y = sqrt( [ 9 , 4 , 100 ; 81 , 49 , 36 ] )
y = 2                y =  2   3   4                    y =  3    2    10
                                                            9    7    6
```

General root: to evaluate the nth root of a number the function (nthroot) is used:

```
y = nthroot( 8 , 3 )   y = nthroot( [ 8 , 27 , 64 ] , 3 )   y = nthroot( [ 243 , 125 ] , [ 5 , 3 ] )
y = 2                  y =    2      3      4                y =    3      5
```

Exponential: it is the number that is the exponent to (e = 2.7183). It is obtained by the function (exp):

$y = e^{2}$ ⟶ y = exp(2) ⟶ y = 7.3891

Natural logarithm: which is the logarithm to the base (e) and is evaluated by the function (log):

y = ln(2) ⟶ y = log(2) ⟶ y = 0.6931

Base−10 logarithm: which is the logarithm to the base (10) and is evaluated by the function (log10):

$y = \log_{10}(100)$ ⟶ y = log10(100) ⟶ y = 2

Note: to find (y) that is the logarithm of the number (x) to any base (z) the following formula can be used: y = ln(x) / ln (z)

e.g.: $y = \log_3(4)$ ⟶ y = log(4) / log(3) ⟶ y = 1.2619

Ex. 5.2 Write Matlab code to evaluate the following function for 5 values of x equally spaced between 4.5 and 8.5:

$$y = \frac{(ln(x) + 2)^{1.5}}{\sqrt{log_{10}(x) + 4}} + log_2(x^{2.5} + 1)$$

```
4.5000    8.4988
5.5000    9.4439
6.5000   10.2371
7.5000   10.9201
8.5000   11.5196
```

Sol.

```
clear , clc
x = linspace( 4.5 , 8.5 , 5 ) ;
A = ( log(x) + 2 ) . ^ 1.5 ; B = sqrt( log10( x ) + 4) ;
C = log( x^2.5 + 1 ) . / log( 2 ) ; y = A . / B + C ; disp( [ x ; y ] ' )
```

5.3 Trigonometric functions

Matlab contains large collection of trigonometric and inverse trigonometric. Matlab names of these functions are the same as their mathematical counterparts. The argument of the trigonometric functions and the output of the inverse functions are in radians. The letter (d) is suffixed when their arguments are intended in degrees. Inverse functions are achieved by prefixing the names with letter (a).

I) Trigonometric functions:

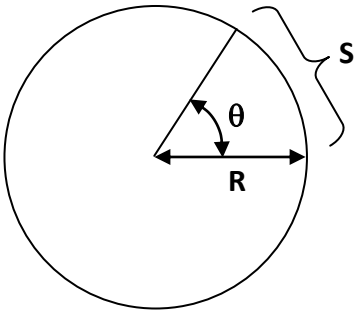
Math. name	Matlab name (x in radians)	Matlab name (x in degrees)	Example
sine	y = sin(x)	y = sind(x)	y = sind(30) , y = 0.5
cosine	y = cos(x)	y = cosd(x)	y = cos(60 * pi / 180) , y = 0.5
tangent	y = tan(x)	y = tand(x)	y = tand(45) , y = 1
secant	y = sec(x)	y = secd(x)	
cosecant	y = csc(x)	y = cscd(x)	
cotangent	y = cot(x)	y = cotd(x)	

II) Inverse trigonometric functions:

Math. name	Matlab name (y in radians)	Matlab name (y in degrees)	Example
Inverse sine	y = asin(x)	y = asind(x)	y = asind(0.5) , y = 30
Inverse cosine	y = acos(x)	y = acosd(x)	y = acosd(0.5) , y = 60
Inverse tangent	y = atan(x)	y = atand(x)	y = atan(1) , y = 0.7854
Inverse secant	y = asec(x)	y = asecd(x)	
Inverse cosecant	y = acsc(x)	y = acscd(x)	
Inverse cotangent	y = acot(x)	y = acotd(x)	

when θ = 1 rad, S = R

θ = 57.29^o



Ex. 5.3 Write Matlab program to print a table of three columns where the first column is the angles from pi/10 to 2pi at a step of pi/6 and the second and third columns are given by the following functions:

$$y = \big(sin(x) + cos(x)\big)^2 \qquad z = ln\big(x^2 + sec(x)\big)$$

Sol.

```
clear,clc
x=pi/10:pi/6:2*pi;
y=(sin(x)+cos(x)).^2;
z=log(x.^2+sec(x));
R=[x;y;z]';
disp(R)
```

Run

0.3142	1.5878	0.1399
0.8378	1.9945	0.7868
1.3614	1.4067	1.8966
1.8850	0.4122	-1.1489
2.4086	0.0055	1.4941
2.9322	0.5933	2.0249
3.4558	1.5878	2.3879
3.9794	1.9945	2.6631
4.5029	1.4067	2.7387
5.0265	0.4122	3.3500
5.5501	0.0055	3.4704
6.0737	0.5933	3.6353