الجامعة المستنصرية

كلية الهندسة

قسم هندسة الموارد المائية

Lecture 5: Some Useful Built-In Functions

المحاضرة الخامسة: بعض الدوال المدمجة المفيدة

المنهاج الدراسي لمادة البرمجه والتطبيقات (ماتلاب)

الكورس الدراسي الاول / المرحلة الثانية

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Built-in Functions in MATLAB

As we mentioned before, MATLAB provides many functions as well as the ability to define your own functions. Fortunately, the names of the functions are very similar to those commonly used in mathematics. The following some of these functions which can be used to do many mathematical operations:

a- Exponential Functions

These types of functions are used widely in MATLAB to determine the values of variables with a specific form. The following table demonstrates these functions with their information.

Math Form	Description	Syntax in MATLAB
$\sqrt{x}$	**Square root**	**sqrt(x)**
Y^x	**Power to**	**Y^(x)**
e^x	**Exponential**	**exp(x)**
ln(x)	**Natural logarithm (base e)**	**log(x)**
log(x)	**Logarithm base 2**	**log2(x)**
$\log_{10}(x)$	**Logarithm base 10**	**log10(x)**

Example: Write a code script to solve the following equations:

$$y = \left(\frac{\sqrt{x^2 - 12e^{2x}}}{\ln(x^3) + 4x^2}\right) - 9\log(x) \qquad \text{where x =7}$$

$$z = \left(\frac{3x^2}{13+4x^2}\right) + 3(\ln(x) - \log(x)) \quad \text{where x =2.5}$$

```
>> %% This code is used to solve equations.

>> x1=7;x2=2.5;

>> % Equation (1)

>> y=((sqrt(x1^2)-12*exp(2*x1))/(log(x1^3)+4*x1^2))-9*log10(x1);

>> z=((3*x2^2)/(13+4*x2^2))+3*(log(x2)-log10(x2));

   y =  -7.1507e+04

   z =    2.0485
```

b- Trigonometric Functions

Also, library of functions in MATLAB contains function that can use to find the values of trigonometric functions as follows:

Math Form	Description	Syntax in MATLAB
sin(x)	**Sine function**	**sin((x)**
cos(x)	**Cosine function**	**cos(x)**
tan(x)	**Tangent function**	**tan(x)**
sec(x)	**Secant function**	**sec(x)**
$\sin^{-1}$(x)	**Sine inverse function**	**asin(x)**
Cos^{-1}(x)	**Cosine inverse function**	**acos(x)**
$\tan^{-1}$(x)	**Tangent inverse function**	**atan(x)**

In which, variable x in above trigonometric functions is always in radians. In some cases, the variable defines in degrees, so it is quite easy to convert from radians to degrees or from degrees to radians as follows:

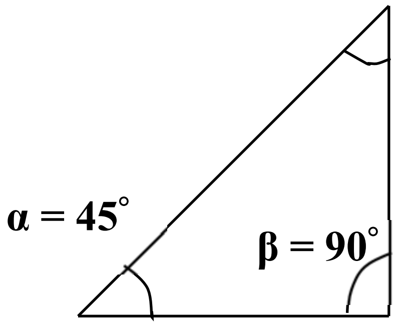
$$\boldsymbol{2\pi\ radians = 360\ degrees}$$

This lead to:

$$\boldsymbol{x\ (degrees) = x(radians) * (\frac{180}{\pi})}$$

$$\boldsymbol{x\ (radians) = x(degrees) * (\frac{\pi}{180})}$$

Example: Write a code script to compute the trigonometric functions (sine, cosine, tangent, and secant) of the angles shown in the triangle shape.



```
>> %% This code is used to find trigonometric functions of a triangle.
>> Th1=45;     % alpha angle in degrees
>> Th2=90;      % beta angle in degrees
>> Alph=Th1*(pi/180);
>> Beta=Th2*(pi/180);
>> %% Angle alpha
>> SinF=sin(Alph); CosF=cos(Alph); TanF=tan(Alph); SecF=sec(Alph);
>> SinB=sin(Beta); CosB=cos(Beta); TanB=tan(Beta); SecB=sec(Beta);
```

The results are:

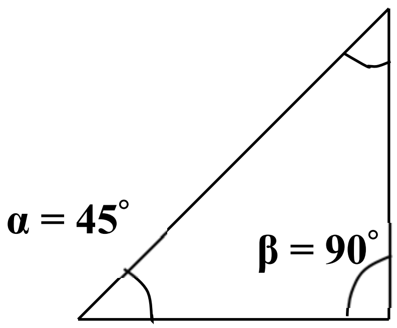
Angle	Sin(x)	Cos(x)	Tan(x)	Sec(x)
α = 45°	0.7071067	0.7071067	1	1.4142135
β = 90°	1	0	0	1.63312e+16

c- Other Functions

There are more functions in MATLAB library can be used in some mathematical operations such as:

Math Form	Description	Syntax in MATLAB
sinh(x)	**Hyperbolic sine function**	**sinh((x)**
cosh(x)	**Hyperbolic cosine function**	**cosh(x)**
tanh(x)	**Hyperbolic tangent function**	**tanh(x)**
round	**Round numbers**	**round(x)**
floor	**Round towards negative infinity**	**floor(x)**
ceil	**Round towards positive infinity**	**ceil(x)**
fix	**Round towards zero**	**fix(x)**
factorial	**Factorial x or x!**	**factorial(x)**

Example: Write a code script to compute the hyperbolic trigonometric functions (sine, cosine, and tangent) of the angles shown in the triangle shape.



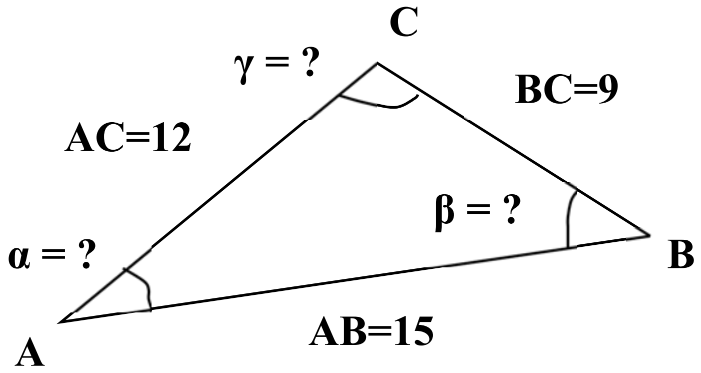
```
>> %% This code is used to calculate hyperbolic trigonometric functions of a
   %% triangle.
>> Th1=45;     % alpha angle in degrees
>> Th2=90;      % beta angle in degrees
>> Alph=Th1*(pi/180);
>> Beta=Th2*(pi/180);
>> %% Angle alpha
>> SinhF=sinh(Alph); CoshF=cosh(Alph);
>> TanhF=tanh(Alph);
>> SinhB=sinh(Beta); CoshB=cosh(Beta);
>> TanhB=tanh(Beta);
```

The results are:

Angle	**Sinh(x)**	**Cosh(x)**	**Tanh(x)**
α = 45°	**0.86867096**	**1.32460908**	**0.65579420**
β = 90°	**2.30129890**	**2.50917847**	**0.91715233**

Helpful Example:

Write a script code to find the angles (in degrees) of the triangle shown below, then determine the trigonometric functions (sine, cosine, and tangent) and their inverse values, use the following functions (round and fix) to round all resulted values.



```
>>%% Writing code to do the requested operations of the example
>> %% Entering the known values
>> L1= 15;     % AB line length
>> L2= 9;      % BC line length
>> L3= 12;       % AC line length
>> %% Calculating the angles
>> AlphR=atan(9/12);   % in radians
>> BetR=atan(12/9);   % in radians
>> Alph= AlphR*(180/pi);      % in degrees
>> Beta= BetR*(180/pi);      % in degrees
>> Gama= 180-Alph-Beta;      % in degrees
>> %% Determination of trigonometric functions
>> SinF=sin(Alph); CosF=cos(Alph); TanF=tan(Alph);
>> SinB=sin(Beta); CosB=cos(Beta); TanB=tan(Beta);
>> SinG=sin(Gama); CosG=cos(Gama); TanG=tan(Gama);
>> %% Determination of the inverses of trigonometric functions
>> SinFv=asin(Alph); CosFv=acos(Alph); TanFv=atan(Alph);
>> SinBv=asin(Beta); CosBv=acos(Beta); TanBv=atan(Beta);
>> SinGv=asin(Gama); CosGv=acos(Gama); TanGv=atan(Gama);
>> %% Rounding the resulted values
>>RSF=round(SinF);FSF=fix(SinF);
>>RSFv=round(SinFv);FSFv=fix(SinFv);
>>RCF=round(CosF);FCF=fix(CosF);
>>RCFv=round(CosFv);FCFv=fix(CosFv);
>>RTF=round(TanF);FTF=fix(TanF);
>>RTFv=round(TanFv);FTFv=fix(TanFv);
>>RSB=round(SinB);FSB=fix(SinB);
>>RSBv=round(SinBv);FSBv=fix(SinBv);
>>RCB=round(CosB);FCB=fix(CosB);
>>RCBv=round(CosBv);FCBv=fix(CosBv);
>>RTB=round(TanB);FTB=fix(TanB);
>>RTBv=round(TanBv);FTBv=fix(TanBv);
>>RSG=round(SinG);FSF=fix(SinG);
>>RSGv=round(SinGv);FSFv=fix(SinGv);
>>RCG=round(CosG);FCF=fix(CosG);
>>RCGv=round(CosGv);FCFv=fix(CosGv);
>>RTG=round(TanG);FTF=fix(TanG);
>>RTGv=round(TanGv);FTFv=fix(TanGv);
```