Chapter 2

Tutorial lessons 2

2.1 Mathematical functions

MATLAB offers many predefined mathematical functions for technical computing which contains a large set of mathematical functions.

Typing `help elfun` and `help specfun` calls up full lists of *elementary* and *special* functions respectively.

There is a long list of mathematical functions that are *built* into MATLAB. These functions are called *built-ins*. Many standard mathematical functions, such as $\sin(x)$, $\cos(x)$, $\tan(x)$, e^x, $ln(x)$, are evaluated by the functions `sin`, `cos`, `tan`, `exp`, and `log` respectively in MATLAB.

Table 2.1 lists some commonly used functions, where variables `x` and `y` can be numbers, vectors, or matrices.

Table 2.1: Elementary functions

`cos(x)`	Cosine	`abs(x)`	Absolute value
`sin(x)`	Sine	`sign(x)`	Signum function
`tan(x)`	Tangent	`max(x)`	Maximum value
`acos(x)`	Arc cosine	`min(x)`	Minimum value
`asin(x)`	Arc sine	`ceil(x)`	Round towards $+\infty$
`atan(x)`	Arc tangent	`floor(x)`	Round towards $-\infty$
`exp(x)`	Exponential	`round(x)`	Round to nearest integer
`sqrt(x)`	Square root	`rem(x)`	Remainder after division
`log(x)`	Natural logarithm	`angle(x)`	Phase angle
`log10(x)`	Common logarithm	`conj(x)`	Complex conjugate

In addition to the elementary functions, MATLAB includes a number of predefined

constant values. A list of the most common values is given in Table 2.2.

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Table 2.2: Predefined constant values

`pi`	The π number, $\pi = 3.14159\ldots$
`i,j`	The imaginary unit i, $\sqrt{-1}$
`Inf`	The infinity, ∞
`NaN`	Not a number

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2.1.1   Examples

We illustrate here some typical examples which related to the elementary functions previously defined.

As a first example, the value of the expression $y = e^{-a}\sin(x) + 10\sqrt{y}$, for $a = 5$, $x = 2$, and $y = 8$ is computed by

```
>> a = 5; x = 2; y = 8;
>> y = exp(-a)*sin(x)+10*sqrt(y)
y   =
    28.2904
```

The subsequent examples are

```
>> log(142)
ans   =
      4.9558

>> log10(142)
ans   =
      2.1523
```

Note the difference between the natural logarithm `log(x)` and the decimal logarithm (base 10) `log10(x)`.

To calculate $\sin(\pi/4)$ and e^{10}, we enter the following commands in MATLAB,

```
>> sin(pi/4)
ans   =
      0.7071

>> exp(10)
ans   =
      2.2026e+004
```