
Functions

Table of Contents

What is a Function?	1
Symbolic Functions	1
Plugging into Symbolic Functions	1
Solving with Symbolic Functions	2
Factoring Symbolic Functions	3
Lastly	3
Functions of Several Variables	3

What is a Function?

There are two different ways of thinking of functions in calculus and hence in Matlab. One is symbolically (as a string of symbols) and the other is as a function handle, which is a little more confusing and will be left for later. These two ways are interchangeable in some contexts and not in others.

Symbolic Functions

To define a symbolic function we proceed as follows. Note that doing this does two things. It makes x symbolic and it makes $f(x)$ symbolic.

```
syms f(x);  
f(x) = x^4+7*x^2+x+exp(2*x)
```

$$f(x) =$$
$$x + \exp(2x) + 7x^2 + x^4$$

Now we can do some basic things with this function.

Plugging into Symbolic Functions

We can substitute a constant for the symbol x :

```
f(3)
```

$$ans =$$
$$\exp(6) + 147$$

or alternately we could plug in a different symbolic variable provided it's defined as such first:

```
syms t;
```

`f(t)`

`ans =`

`t + exp(2*t) + 7*t^2 + t^4`

or even more complicated expressions:

`syms s t;`
`f(2*t+s)`

`ans =`

`s + 2*t + exp(2*s + 4*t) + 7*(s + 2*t)^2 + (s + 2*t)^4`

Solving with Symbolic Functions

The `solve` command works with symbolic functions. If we simply plug in the function then `solve` sets it equal to 0:

`syms f(x);`
`f(x) = x^2-x-6;`
`solve(f(x))`

`ans =`

`3`
`-2`

Or we can set it equal to something else using `==` and `solve`. It is important to understand that with symbolic expressions not inside single quotes that we must use `==` rather than `=`. The truth of the matter is that Matlab is slowly moving to the more standard computer science practice of doing this but they're not fully there yet.

`solve(f(x)==5)`

`ans =`

`(3*5^(1/2))/2 + 1/2`
`1/2 - (3*5^(1/2))/2`

Or

`solve(f(x)==2*x+1)`

`ans =`

$$37^{(1/2)}/2 + 3/2$$

$$3/2 - 37^{(1/2)}/2$$

Factoring Symbolic Functions

We can also factor symbolic functions, which don't need to be polynomials:

```
syms f(x);
f(x) = x^2+x*sin(x);
factor(f(x))
```

ans =

$x*(x + \sin(x))$

Lastly

Lastly, we can use `simplify`, `pretty` and `expand` as well.

Functions of Several Variables

Even though this is beyond the scope of the prerequisites of this course it's worth noting that we can also assign and work with functions of more than one variable, for example:

```
syms f(x,y);
f(x,y) = x^2+x*y;
```

and then

```
f(2,3)
```

ans =

10

Published with MATLAB® 8.0