



Functions : Part One - Introduction



If you spend any time studying mathematics then you are bound to run into functions. They are of immense importance. Really. Hopefully you will receive some nice learning material on functions when you are studying them. This notebook is not that material.

We will not study functions in this lesson. We are going to take a look at how to study functions with LiveMath. That is, we will examine the tools LiveMath places at your ready to use in the study of functions.

Of course, it is going to be difficult to study these tools without demonstrating how to use them in the study of functions. *As you work through this material keep in mind that our goal is learning about operating LiveMath.*



Functions are basically maps from one set of things to another. A function is instructions or a recipe or rules that tell you what specific object in the second set you will receive given that you have chosen a particular object in the first set.

Sound vague? It is!

The vagueness is important because functions can be applied to almost any set of things you can think up.....but not for us.



We are going to consider only numbers and although that cuts down the possibilities quite a bit, it leaves us plenty to study...plenty.



It would get really annoying really fast to restate the instructions, recipe, or rule everytime you wanted to refer to a function. So, we give our functions names.

It is equally annoying and confusing to constantly restate what the sets are that a function is the map between. So, we present a couple of names for them and tell everyone that when these names are used they will be representing an unspecified object in the sets in question.

These names are also known as the variables used as the argument of the function and the function's output. Have you heard of domain and range?



LiveMath considers the name and argument of a function to be very special. It takes special bookkeeping steps to declare and track these.



The function's name

You must declare the name of a function in a declaration statement just as we did in the previous notebook.


Here is a declaration of the function book:

A **Function** named **book** behaves as **defined by user**.

LiveMath now knows that if "book" is ever used in this notebook that it will be referring to a function. It does not yet know any specifics about this function...just its name.

A function's argument

The argument to a function is a special variable and LiveMath also thinks of it as a very special variable. In fact LiveMath already has the variables to use for functions sitting in their own mini-palette menu.

You can find the mini-palette under the  button. Click and hold the (left) mouse button on this palette button. You will see all of the available function variables:

a	b	c	d	e	f	x
g	h	i	j	k	l	m
n	o	p	q	r	s	t
u	v	w	x	y	z	

Defining a function

We are going to give the function called book the instructions, recipe, or rule that says to take a number, square it, and add one to the result. And, we'll give book the functional variable x.

So, book will "take" the number x represents, square it, add one and return the result:

$$\text{book}(x) = x^2 + 1$$

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Keyboard Shortcut

You can choose function variables from the mini-palette or you can type **?- letter**

for the variable. Type a question mark (don't hold the key down....release it). That signals LiveMath that the next letter is a function variable letter.

And remember as you define functions that LiveMath will add in the closing parentheses). For example the definition of book above could be entered as

b o o k (? x → = x ^ + 1

The right arrow is to get your cursor out of the parentheses. If the cursor stays inside the parentheses then you may need to use the mouse to click the cursor out of the parentheses.



The function $\text{book}(x)$ is now defined and available for use in this notebook.



Evaluating a function

Once you have defined a function the next logical thing to do is evaluate the function at some number. Let's evaluate $\text{book}(x)$ at $x = 4$. The expression that represents the function $\text{book}(x)$ evaluated at $x = 4$ is

$$\text{book}(4)$$

This is what we will type into a LiveMath statement and then calculate.

$\text{book}(4)$

$\text{book}(4) = 17$ Calculate



If you take 4, square it, and add 1 you will get 17.



Substituting into a function

You may not want to evaluate. You may simply wish to substitute an expression into the function and see the resulting expression.

The expression usually used for substitution looks the same as that for evaluating a function at a number.

The expression for substituting the variable h in for x in the function book looks like $\text{book}(h)$

However you do not evaluate $\text{book}(h)$ because h is not a number. Instead you ask LiveMath to substitute the original definition of book into the expression $\text{book}(h)$. You do this by highlighting the defining equation for book and then dragging this equation onto the expression $\text{book}(h)$.

$\text{book}(h)$

$\text{book}(h) = h^2 + 1$ Substitute



Now It's Your Turn... Follow the directions below to get hands on experience.



1.

Declare a function called sherman.

Use m as its variable.

Define sherman with the formula $3x - 5$

Evaluate sherman at $m = 3$, $m = -1$, $m = 0$.



2.

Declare a function called bike.

Use x as its variable.

Define bike with the formula

$$\sqrt{\frac{3}{x}} .$$

Calculate bike(3), bike(1).