# Classes 11. Wolfram Alpha program: Visualization and Manipulation. Programming elements.

http://reference.wolfram.com/language/ref/Manipulate.html

*Exercise* 1. Introduce in the WolframAlpha: manipulate x in x^2 + y^2 (Fig. 1):

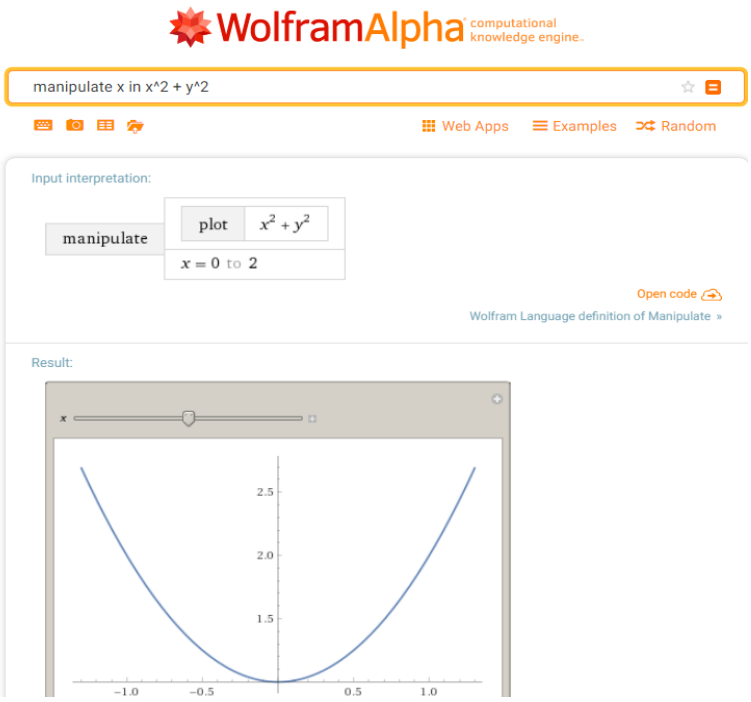



Figure 1.

Explain this example, namely:

- What does the variable x mean?

- Which range does x belong to?

- Visualization of which curve is shown in Figure 1?

*Exercise* 2. Enter in WolframAlpha: manipulate nx + y ^ 2:

- Draw a graph;

- Explain this example (what do the symbols n, x mean)?

Which interval is for x, y?

Visualization of which surface is drawn?

*Exercise* 3. Click on the area (Fig. 1) "Wolfram Language definition of Manipulate".

Consider the following examples:

1) Basic examples;

2) Applications;

3) Neat Examples.

## Programming elements

*Strings*

String is the head of a character string "*text*".

Strings can contain any sequence of ordinary or special characters.

*Mathematica* offers many functions that operate on strings. We will discuss some of them.

StringJoin[$s_1$, $s_2$,...] or StringJoin[{$s_1$, $s_2$,...}] or $s_1$<>$s_2$<>... yields a string consisting of a concatenation of the $s_i$.

StringLength["string"] gives the number of characters in a string.

StringPosition["string", "sub"] gives a list of the starting and ending character positions at which "sub" appears as a substring of "string".

StringPosition["string", patt] gives all positions at which substrings matching the general string expression patt appear in "string".

StringPosition["string", patt, n] includes only the first n occurrences of patt.

StringPosition[{$s_1$, $s_2$, …}, p] gives the list of results for each of the $s_i$.

StringTake["string", n] gives a string containing the first n characters in "string".

StringTake["string",−n] gives the last n characters in "string".

StringTake["string",{n}] gives the $n^{th}$ character in "string".

StringTake["string",{m, n}] gives characters m through n in "string".

Sort[{$s_1$, $s_2$, …}] sorts the elements $s_1$, $s_2$, …

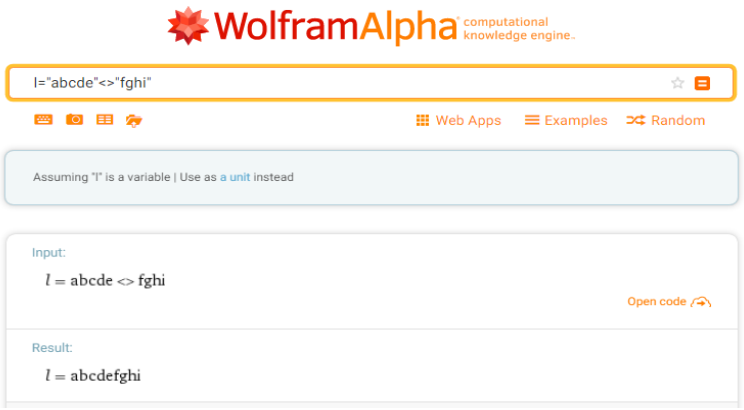
ToUpperCase[string] yields a string in which all letters have been converted to uppercase.

ToLowerCase[string] yields a string in which all letters have been converted to lowercase.

ToString[expr] gives a string corresponding to the printed form of expr in OutputForm.

ToExpression[input] gives the expression obtained by interpreting strings or boxes as Wolfram Language input.

Example.



*Exercise* 4. We have a string “abbaabbaa”.

What transformation needs to be done to get a string ”XbaXbaa”?

*Exercise* 5. Find the domain of functions:

a) $f(x) = x/(x-1)$;

b) $f(y) = tg\ y$;

c) $f(z) = (1-z)\text{^}(\frac{1}{2})$.

*Exercise* 6. Find the range of functions:

a) $f(x) = e\text{^}(-\frac{1}{4}\ x)$;

b) $f(x) = (\sin x)\text{^}2$;

c) $f(y) = y/(y^2+1)$.

*Special functions*

*Exercise* 7. Calculate the derivative of Airy's function and draw its graph. Find the value of the function at the point $x = 1$.

*Exercise* 8. Calculate the integral of the BesselJ function (*n* = 3) and draw its graph. Find the value of the BesselJ function (*n* = 3) at the point $x = 2$.