

Robot and Maths



STEMJAM Teaching Guide

Developing make spaces to promote creativity
around STEM in schools

Acronym: STEMJAM

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www.stemjam.eu



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ROBOT AND MATHS

ABSTRACT

Using the MBOT robots assembled in the first experiment, students will explore their main programming features and abilities by playing with simple mathematical theories, which may be chosen according to the students' age. As an example in the proposed code Pythagoras' Theorem is used. Students will have to develop the codings for calculating the hypotenuse of a triangle using the mBot.

DIDACTIC OBJECTIVES

The purpose of this experiment is:

- ❖ To study maths using a robot.
- ❖ Learning about using a Led matrix.
- ❖ Learning about developing codes for formulas.
- ❖ Learning about coding some effects with the mBot.

STEM Subject: Science Technology Engineering Mathematics

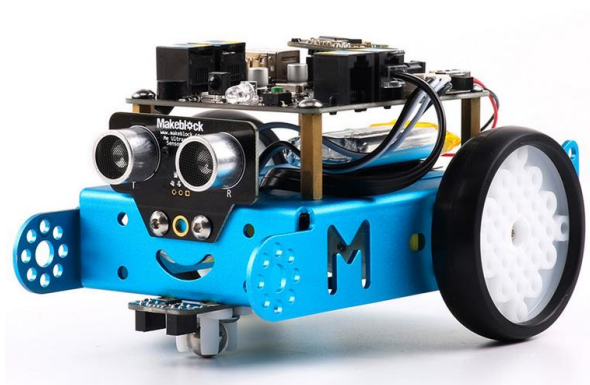
Education Level: 12-14 years 14-16 years

PROBLEM STATEMENT

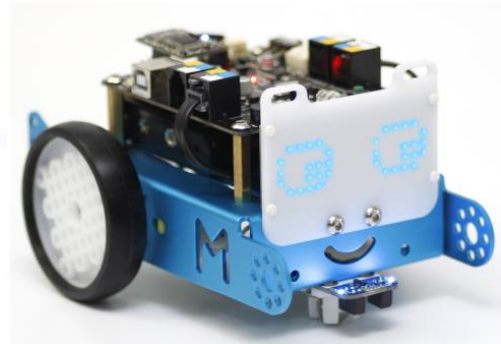
Students have to develop a code implementing Pythagoras' Theorem for calculating the hypotenuse of a triangle, given the base and the height of it.

BOM (Bill of Materials Needed)

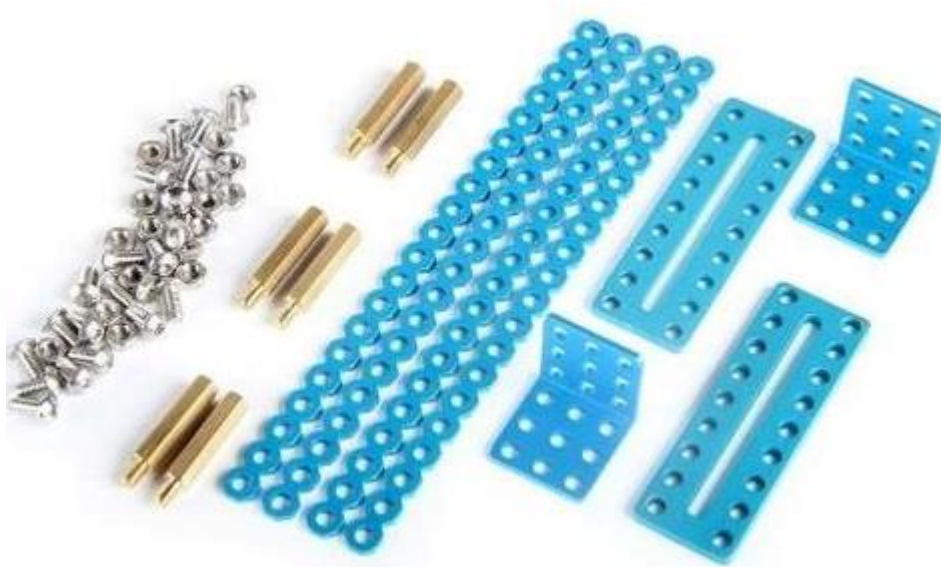
- mBot => Ref. 90054



❖ Me LED Matrix 8 × 16:



❖ Different beams and structures:



ACTIVITY DESCRIPTION

The work of the students consists first of all, in developing the flow chart needed for this activity.

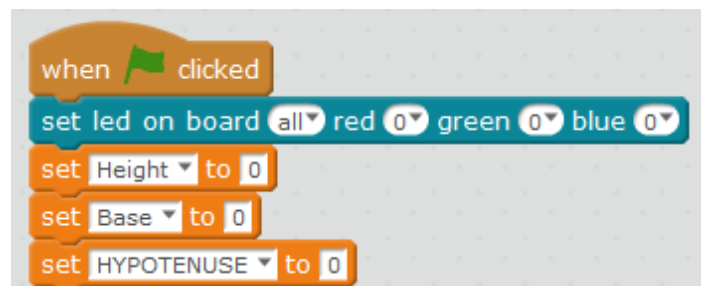
They have to realize what their unknown variable is, and then they have to create the formula for calculating it.

For this purpose, they also need to be aware of what parameters they need. So, the coding also has to ask the player about the value of these parameters.

In the meanwhile, all the information must be shown in a Led Matrix and also in the screen of the computer.

Setting the starting parameters:

We set all the variables to zero. We also switch off the Leds on board.



```
when green flag clicked
  set led on board all red 0 green 0 blue 0
  set Height to 0
  set Base to 0
  set HYPOTENUSE to 0
```

Setting the main routine:

In this part, it is shown the order of the different subroutines needed for asking the known parameters and for calculating the unknown variable, the hypotenuse.



```
when green flag clicked
  set led on board all red 0 green 0 blue 0
  set Height to 0
  set Base to 0
  set HYPOTENUSE to 0
  say Hello!!!
  START
  ask How much is the HEIGHT of your triangle? and wait
  HEIGHT
  ask How much is the BASE of your triangle? and wait
  BASE
  HYPOTENUSE
  say The HYPOTENUSE of your triangle es...
  say HYPOTENUSE
  wait 3 secs
  set led on board all red 0 green 0 blue 0
  show drawing Port3 x: 0 y: 0 draw: [ ]
```

Coding the different subroutines and its effects:

Starting subroutine: Pythagoras Theory, blue colour.

```
define START
set led on board all red 0 green 0 blue 255
set texto to 20
repeat until texto = -100
  show face Port3 x: texto y: 0 characters: PYTHAGORAS THEORY
  change texto by -1
show drawing Port3 x: 0 y: 0 draw: [triangle]
wait 3 secs
show drawing Port3 x: 0 y: 0 draw: [ ]
wait 3 secs
set led on board all red 200 green 40 blue 0
set texto to 20
repeat until texto = -240
  show face Port3 x: texto y: 0 characters: How much is the HEIGHT of your triangle?
  change texto by -1
```

Height subroutine: orange colour.

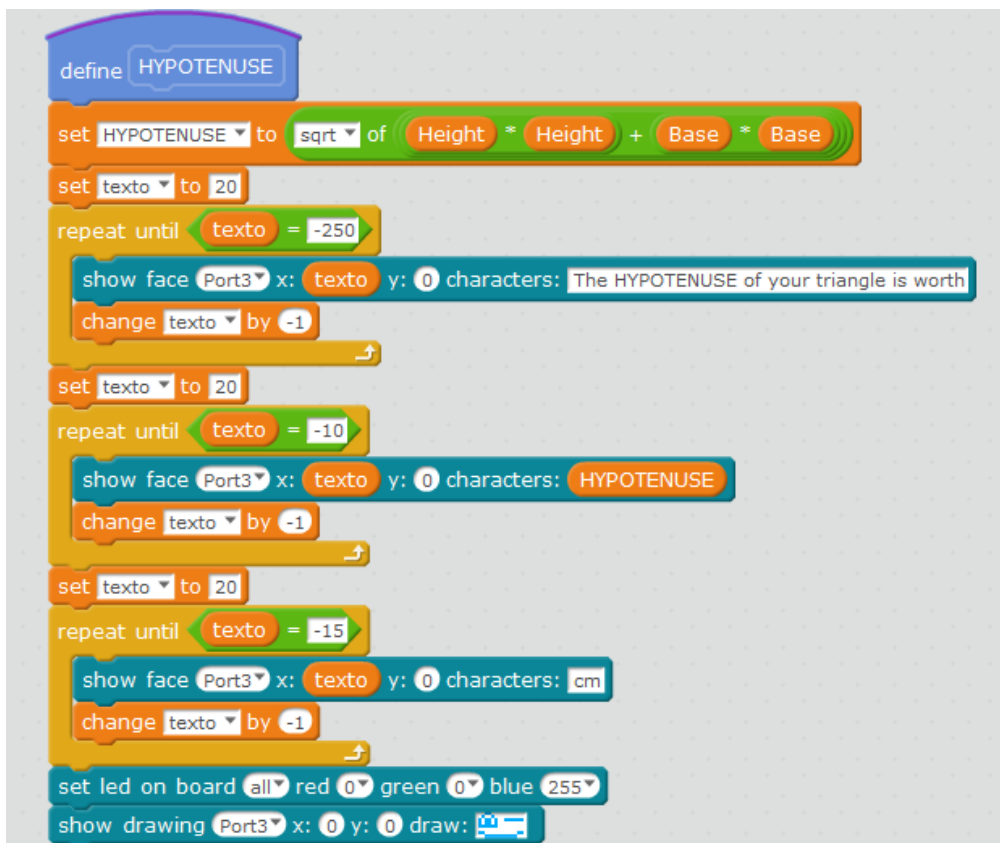
```
define HEIGHT
set Height to answer
set texto to 20
repeat until texto = -35
  show face Port3 x: texto y: 0 characters: HEIGHT =
  change texto by -1
set texto to 20
repeat until texto = -10
  show face Port3 x: texto y: 0 characters: Height
  change texto by -1
set texto to 20
repeat until texto = -15
  show face Port3 x: texto y: 0 characters: cm
  change texto by -1
set led on board all red 255 green 0 blue 150
wait 2 secs
set texto to 20
repeat until texto = -240
  show face Port3 x: texto y: 0 characters: How much is the BASE of your triangle?
  change texto by -1
```

Base subroutine: pink colour.



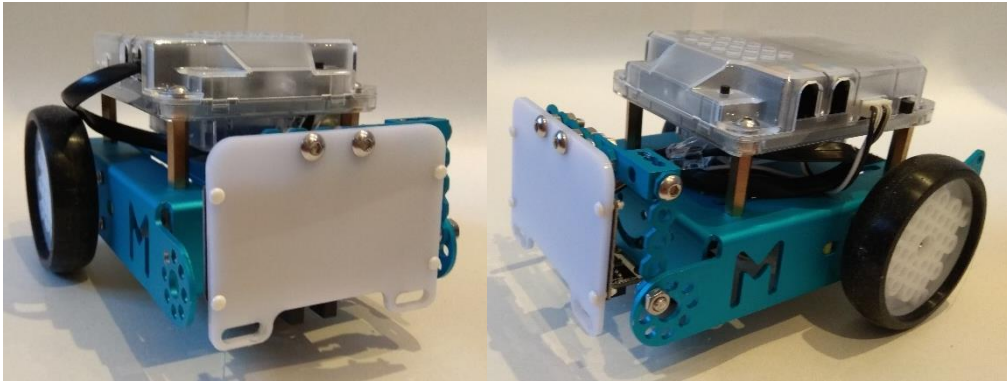
```
define BASE
  set Base to answer
  set texto to 20
  repeat until texto = -35
    show face Port3 x: texto y: 0 characters: BASE=
    change texto by -1
  set texto to 20
  repeat until texto = -10
    show face Port3 x: texto y: 0 characters: Base
    change texto by -1
  set texto to 20
  repeat until texto = -15
    show face Port3 x: texto y: 0 characters: cm
    change texto by -1
  set led on board all red 0 green 255 blue 0
  wait 2 secs
```

Hypotenuse subroutine: green colour.



```
define HYPOTENUSE
  set HYPOTENUSE to sqrt of Height * Height + Base * Base
  set texto to 20
  repeat until texto = -250
    show face Port3 x: texto y: 0 characters: The HYPOTENUSE of your triangle is worth
    change texto by -1
  set texto to 20
  repeat until texto = -10
    show face Port3 x: texto y: 0 characters: HYPOTENUSE
    change texto by -1
  set texto to 20
  repeat until texto = -15
    show face Port3 x: texto y: 0 characters: cm
    change texto by -1
  set led on board all red 0 green 0 blue 255
  show drawing Port3 x: 0 y: 0 draw: [drawing icon]
```

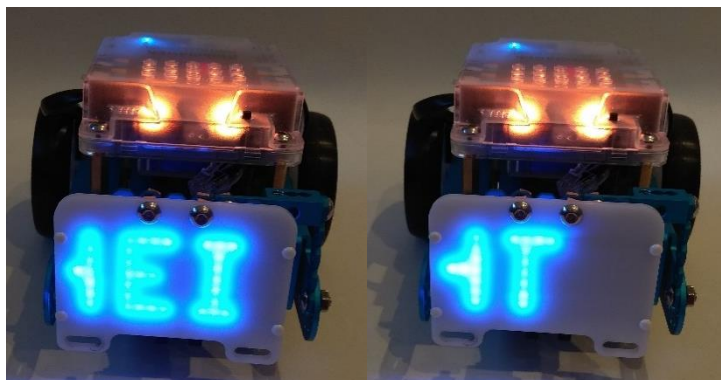

Structural composition:



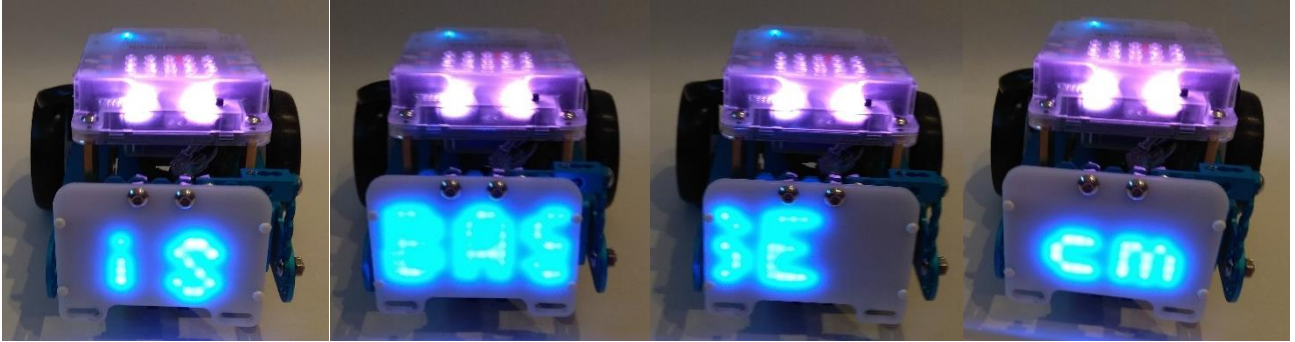
Starting subroutine: Pythagoras Theory, blue colour.



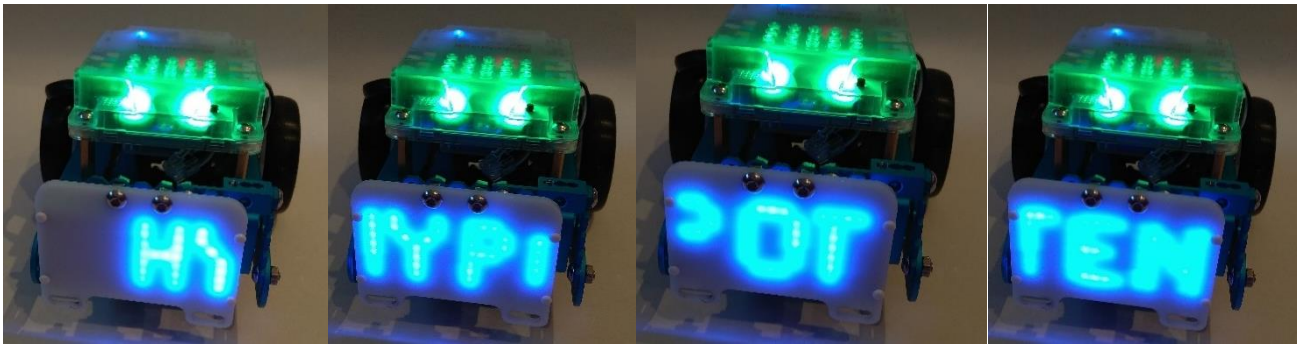
Height subroutine: orange colour.



Base subroutine: pink colour.



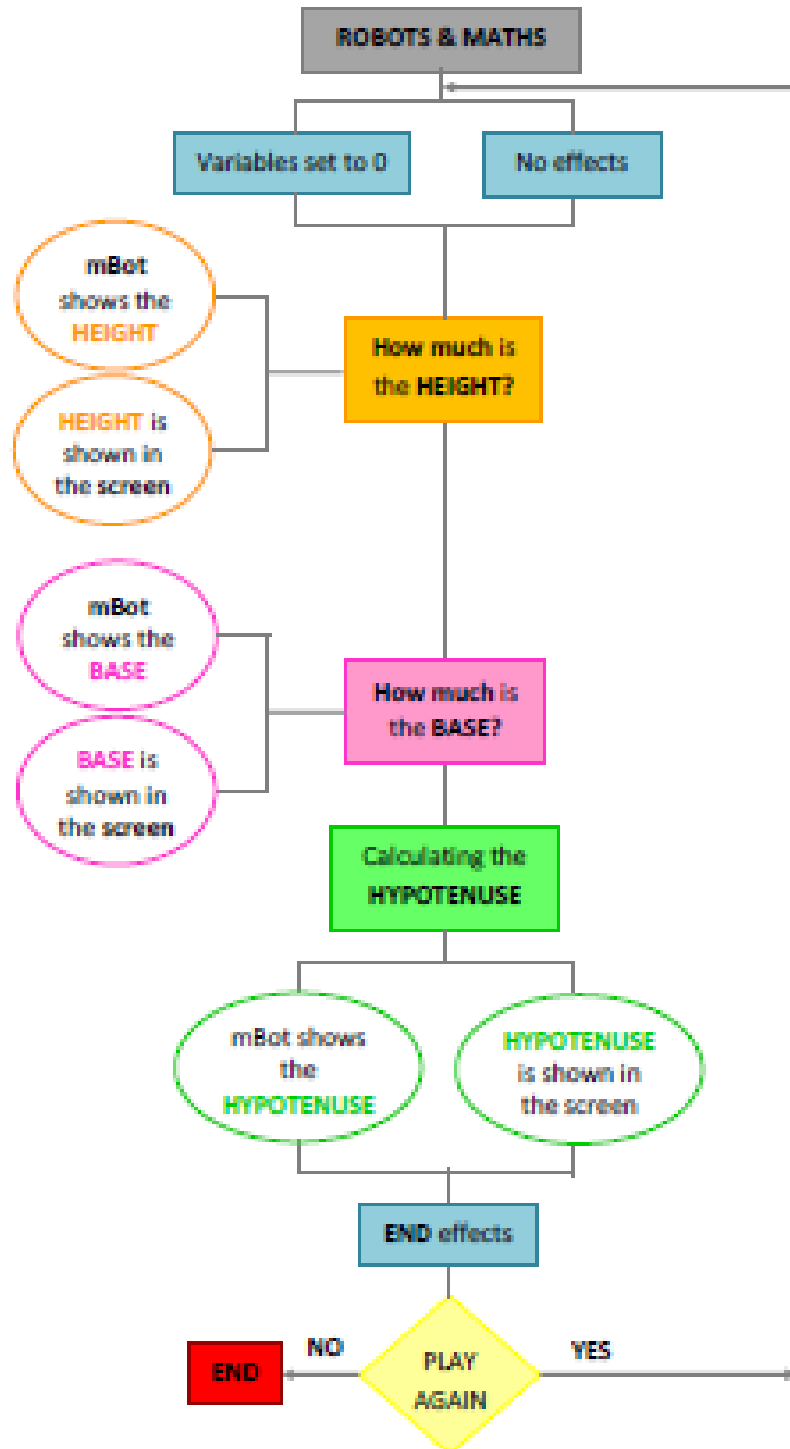
Hypotenuse subroutine: green colour.



End of the programme:



FLOW CHART



BIBLIOGRAPHY

<http://www.makeblock.com/>

SCALABILITY

The design is based on students with "zero" preconditions.

