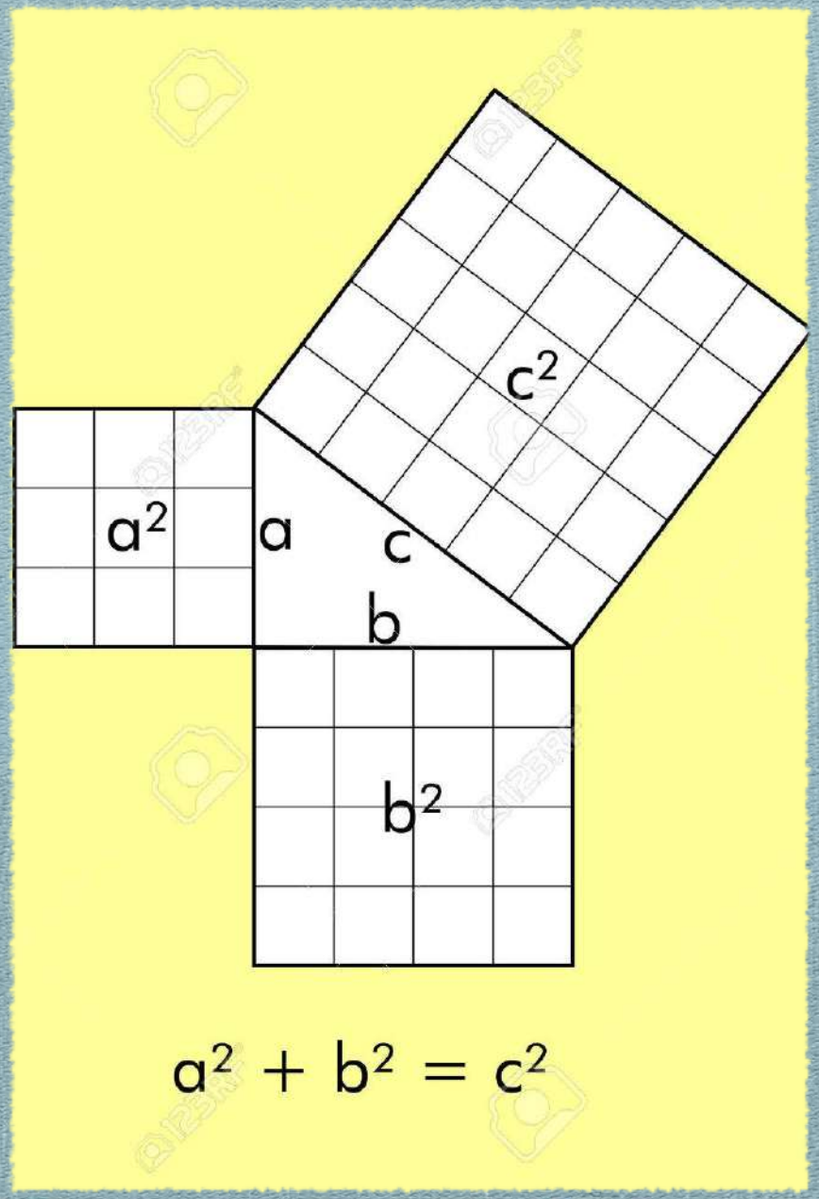
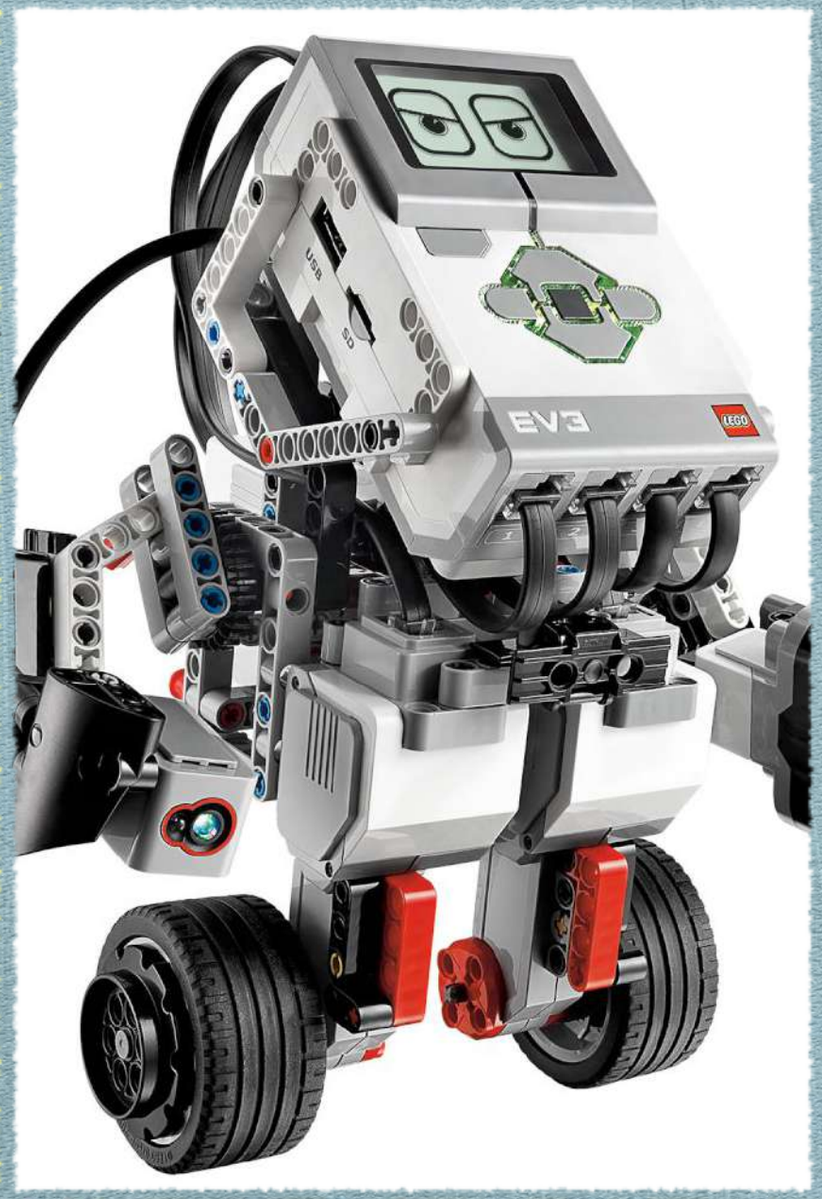




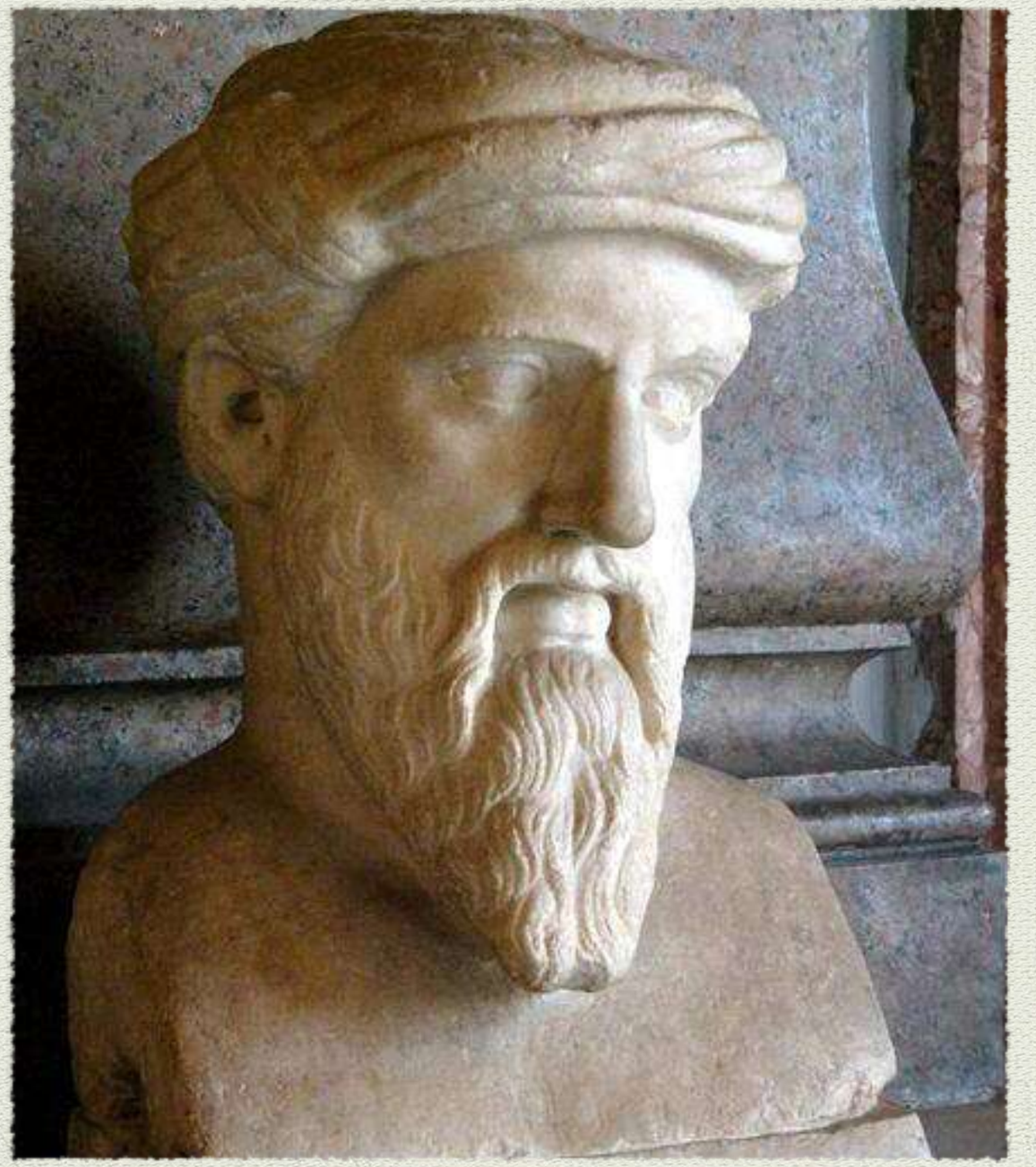
"In the traces of Pythagoras" (a programming robots approach of Pythagoras theorem)

Petros Stavropoulos CS teacher

Erasmus+

Pythagoras (1)

- Pythagoras of Samos (570-495 BC)
- Born on the island of Samos
- Son of Mnesarchus
- Greek Ionian Philosopher that influenced Plato and Aristotle
- 530 BC moved to Croton (Italy) and founded school
- Died in Metapontion (Italy)

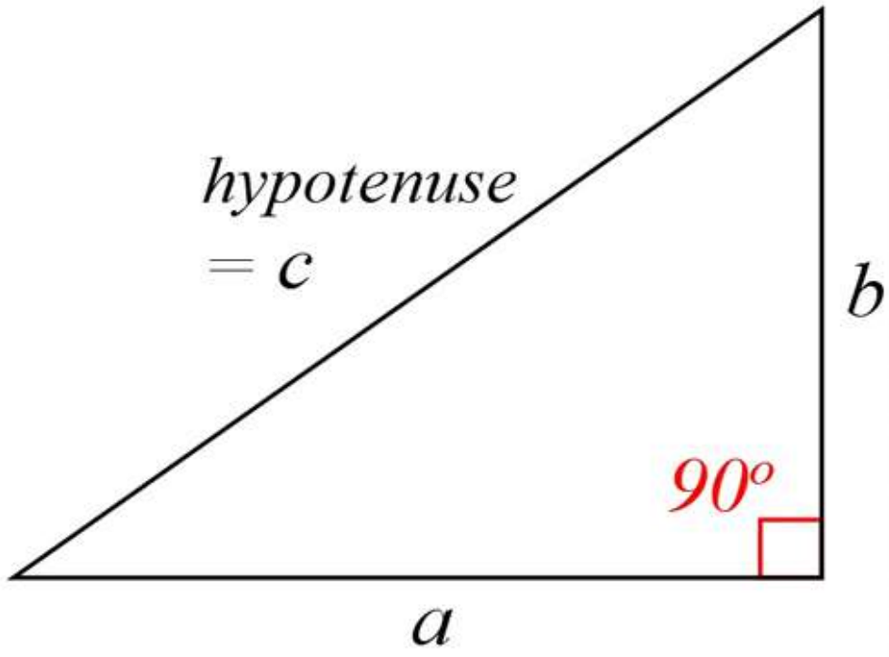


Pythagoras (2)

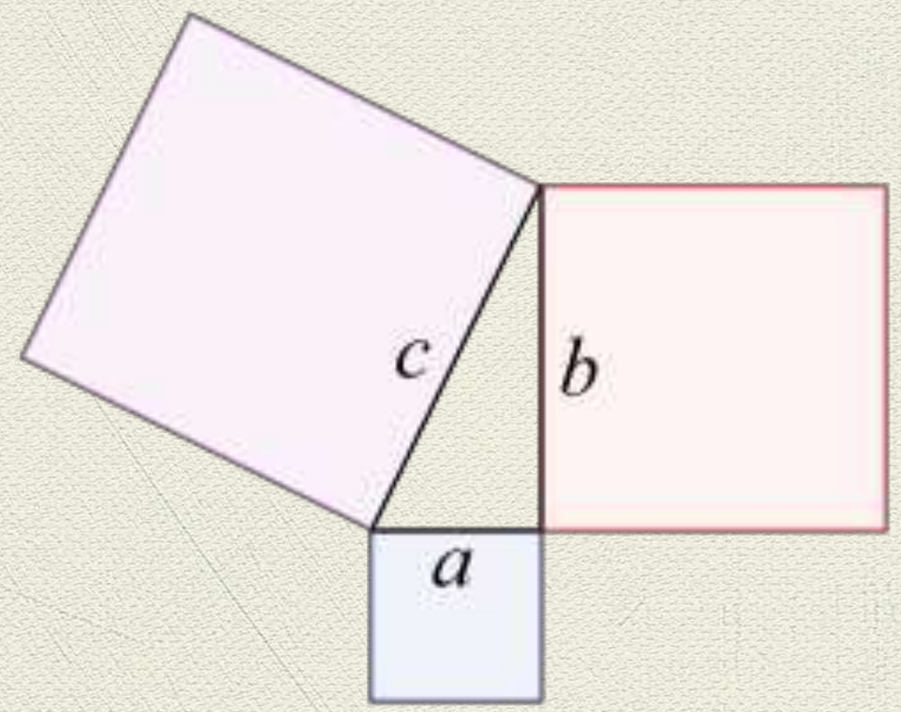
- In antiquity credited with mathematical and scientific discoveries:
  - Pythagorean theorem
  - Pythagorean tuning
  - Five regular solids
  - Theory of Proportions
  - Sphericity of Earth
  - Identified that Venus was the morning and evening star

Pythagorean Theorem

The square of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the other two sides

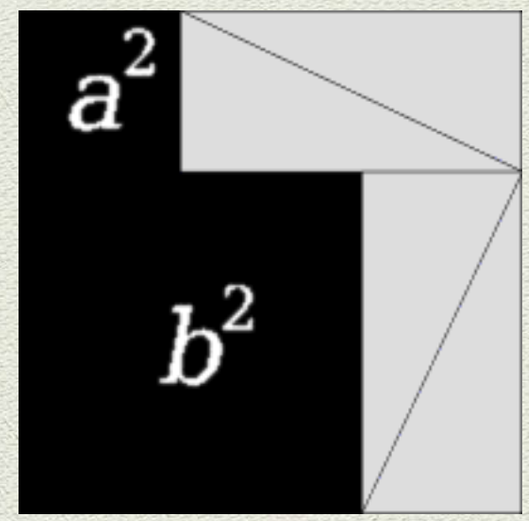


$$c^2 = a^2 + b^2$$



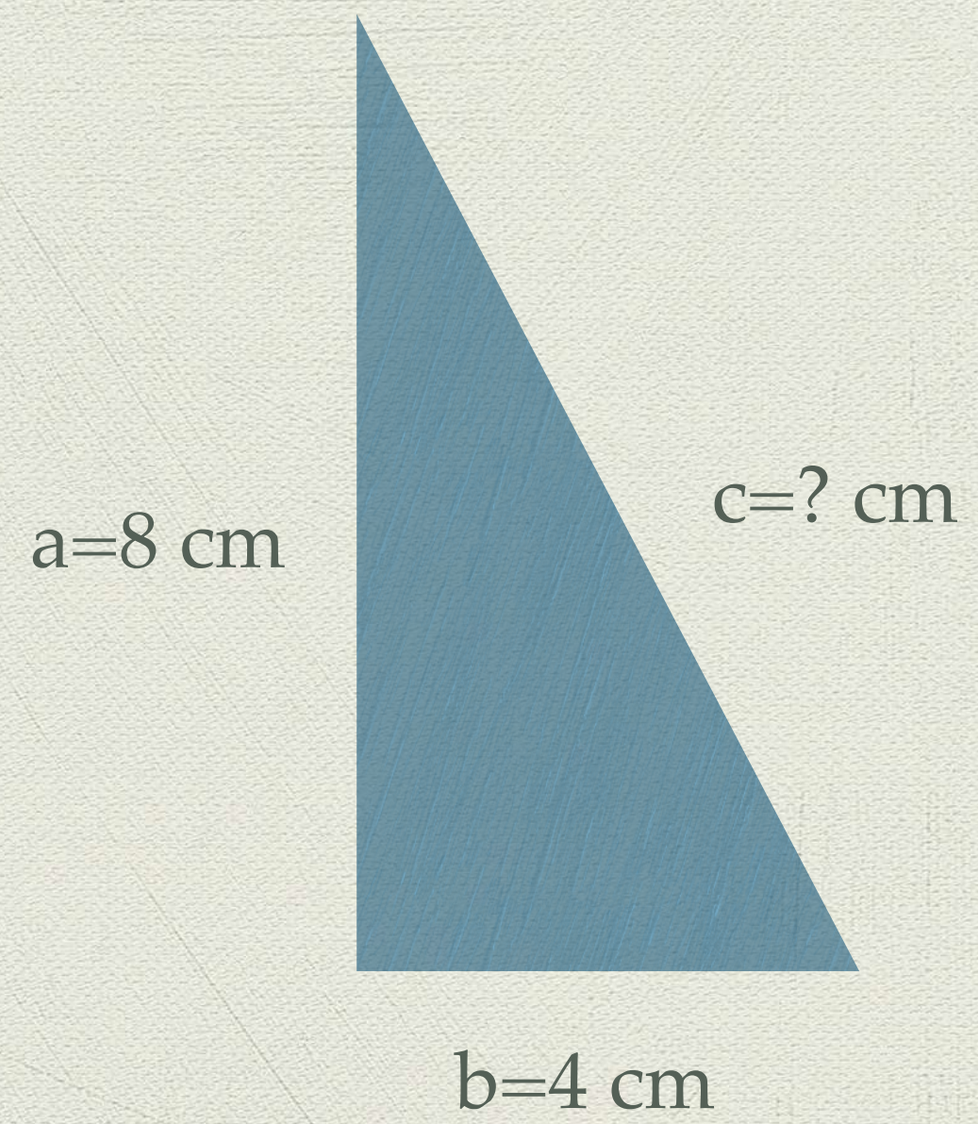
Pythagorean Theorem

- It’ s applied only in right triangles
- c represents the length of the hypotenuse and a and b represent the lengths of the two other sides
- $c = \sqrt{a^2 + b^2}.$
- $b = \sqrt{c^2 - a^2}.$
- $a = \sqrt{c^2 - b^2}$



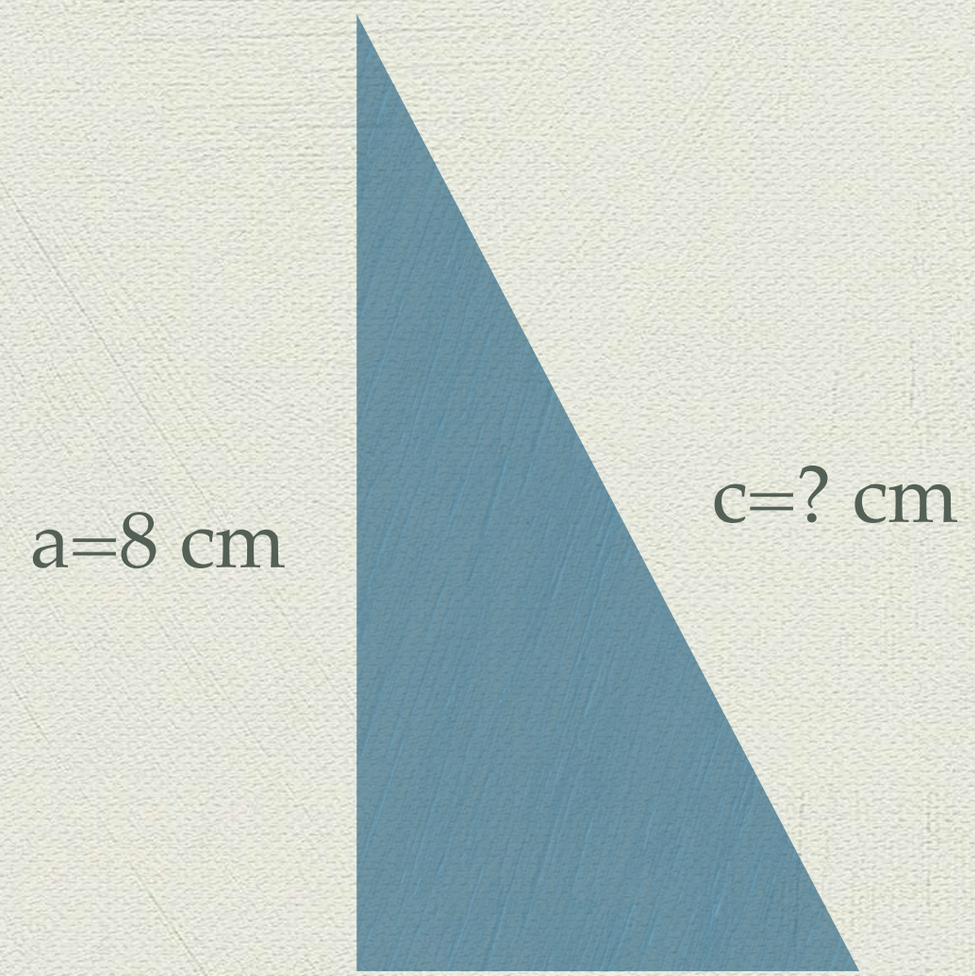
Example (1)

- At the triangle shown beside the two vertical sides are a= 8 cm and b= 4 cm
- What is the length of the hypotenuse side (c) ?



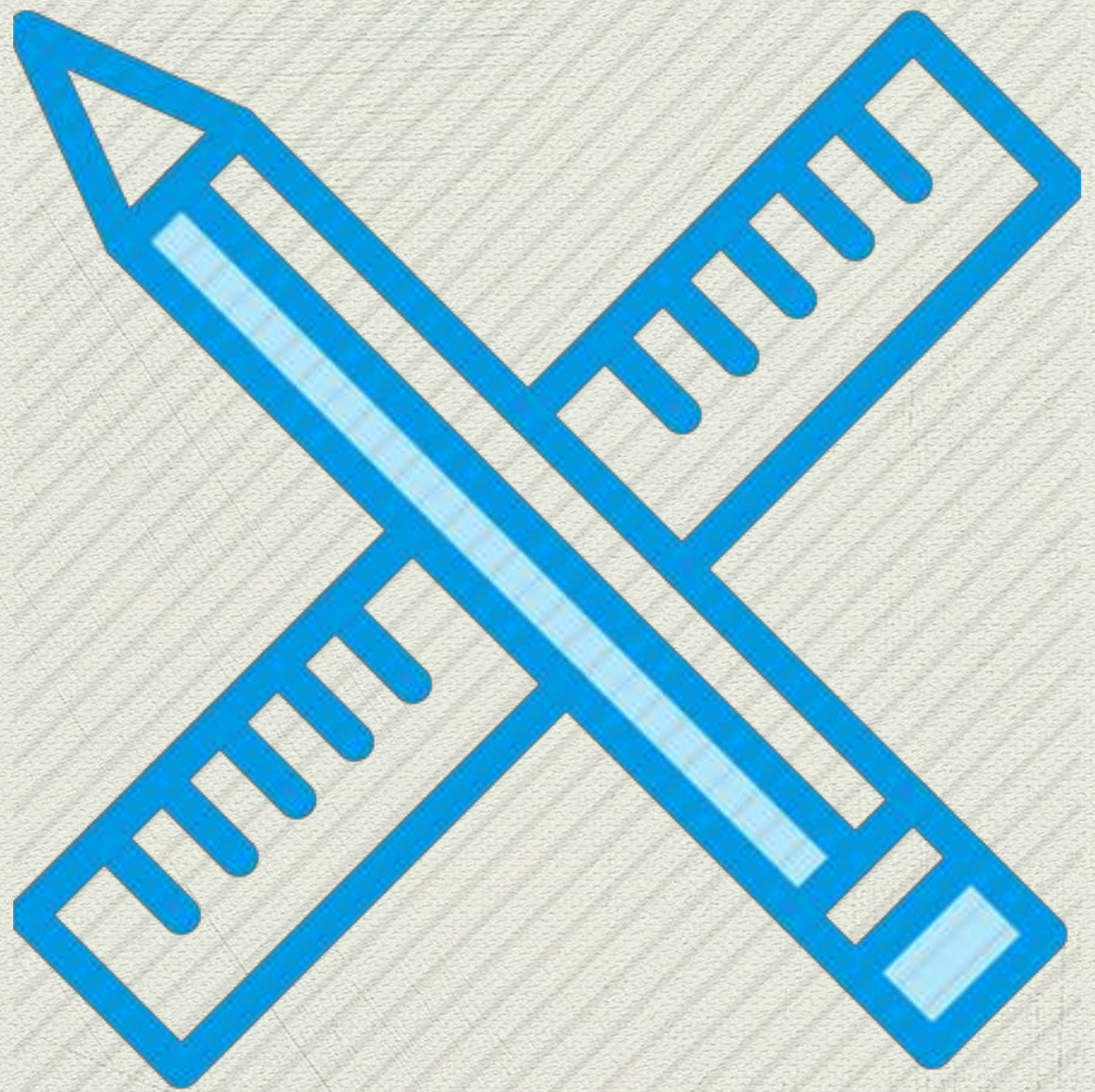
Example (2)

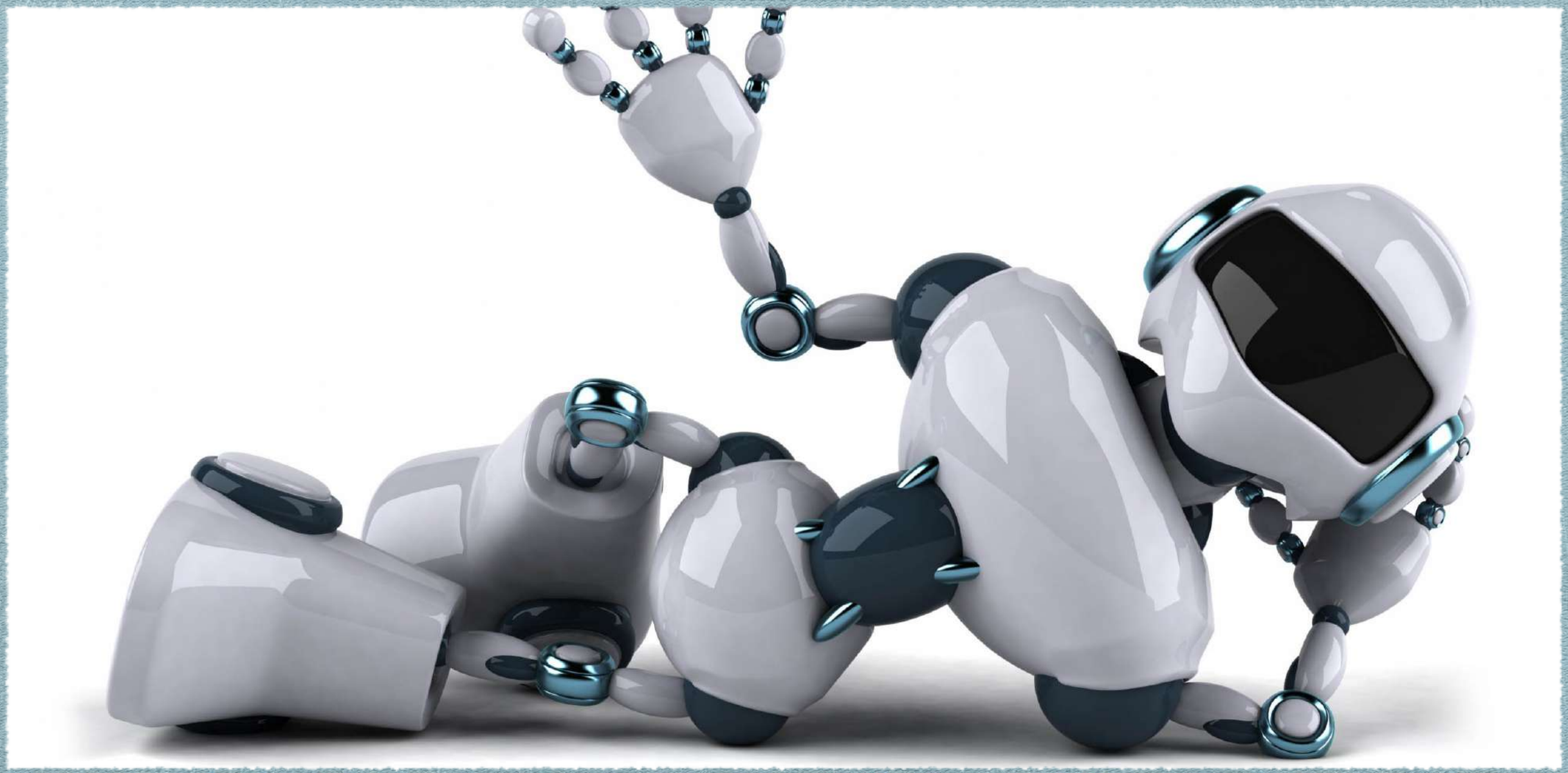
- According to the Pythagorean Theorem
- $c^2 = a^2 + b^2$
- $c^2 = 8^2 + 4^2$
- $c^2 = 64 + 16$
- $c^2 = 80$
- $c = \sqrt{80}$
- c=8.9 cm



Excercise

- At the triangle that you have on your worksheet measure with a ruler the length of the two vertical sides and calculate the length of the hypotenuse.
- You can use the calculator of your computer (in greek Αριθμομηχανή)

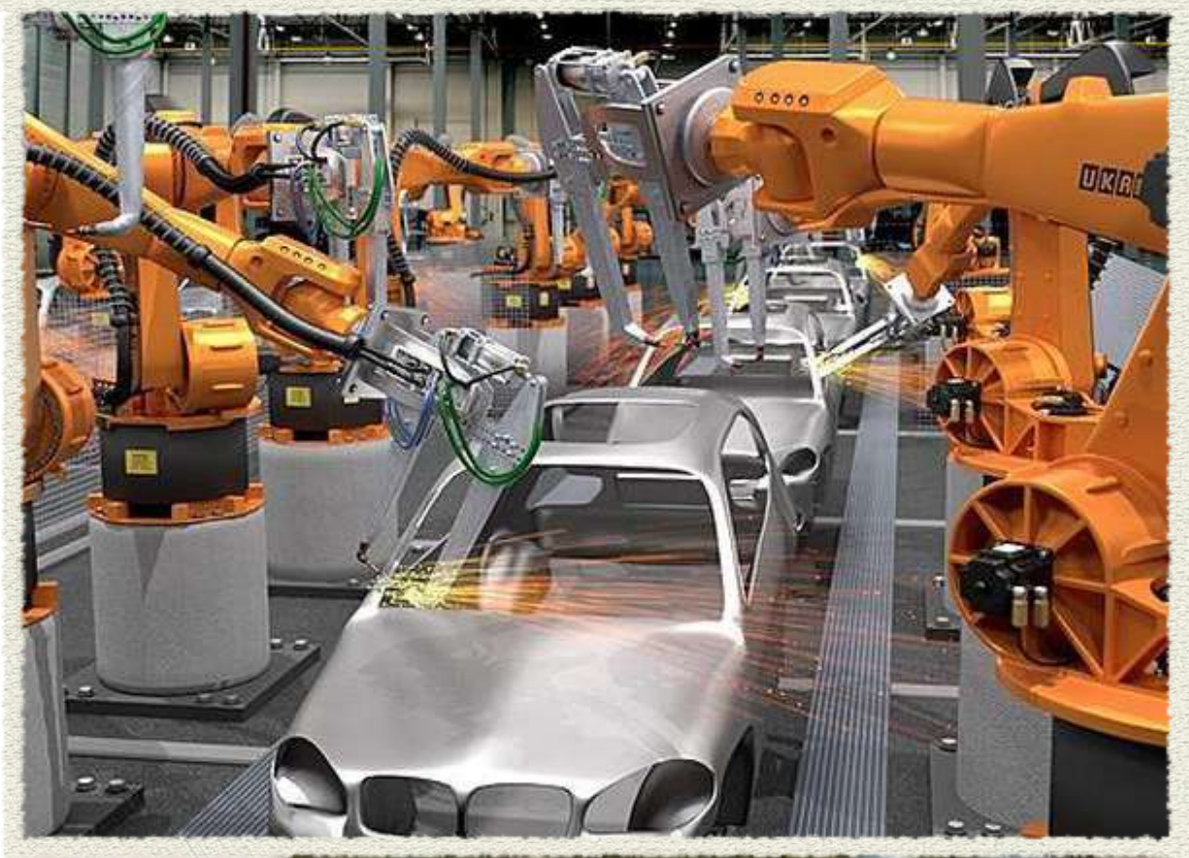




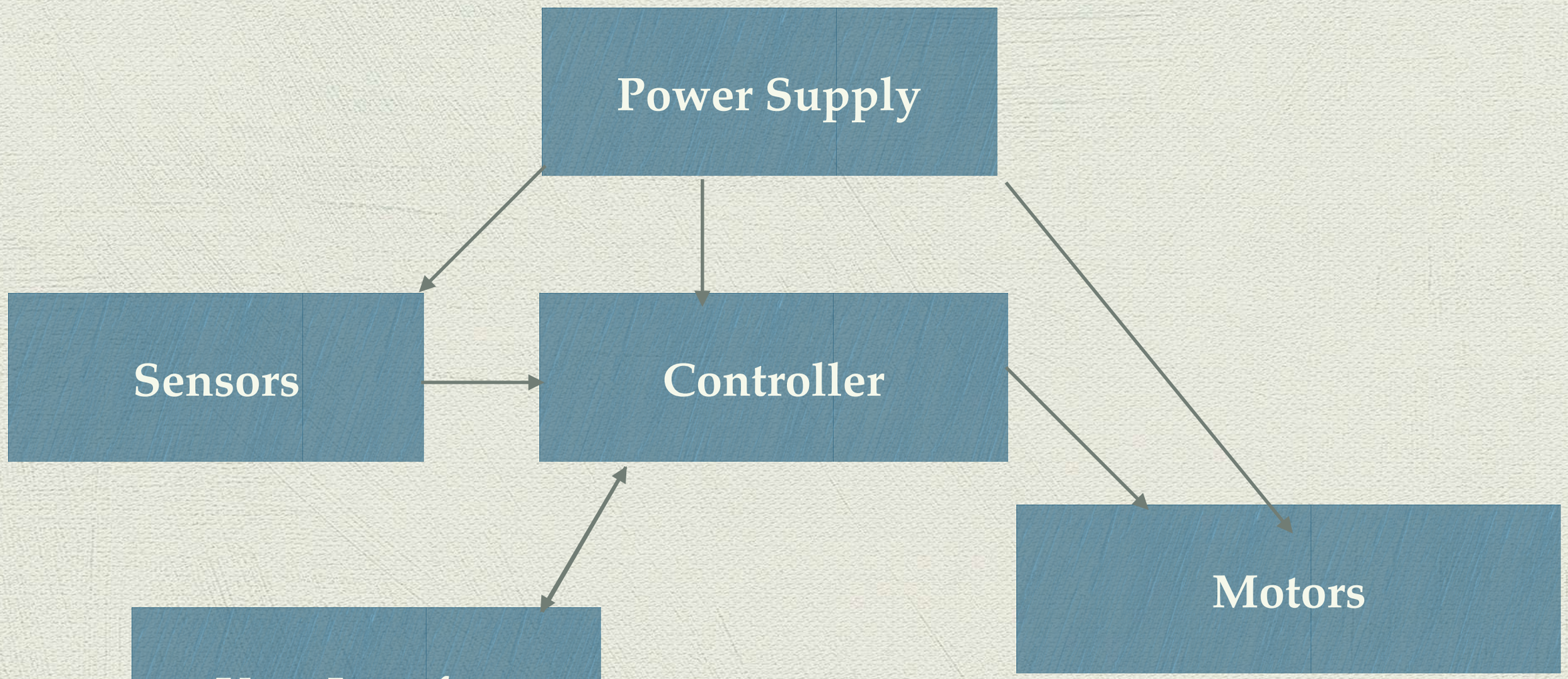
What is a robot for you?

What kind of robots do you know?

ASIMO
HONDA



The parts of a robot



Has LEGO Mindstorms EV3 all the needed parts of a robot?

The parts of a robot

- Power Supply
- Sensors
- Motors
- Controller
- User Interface

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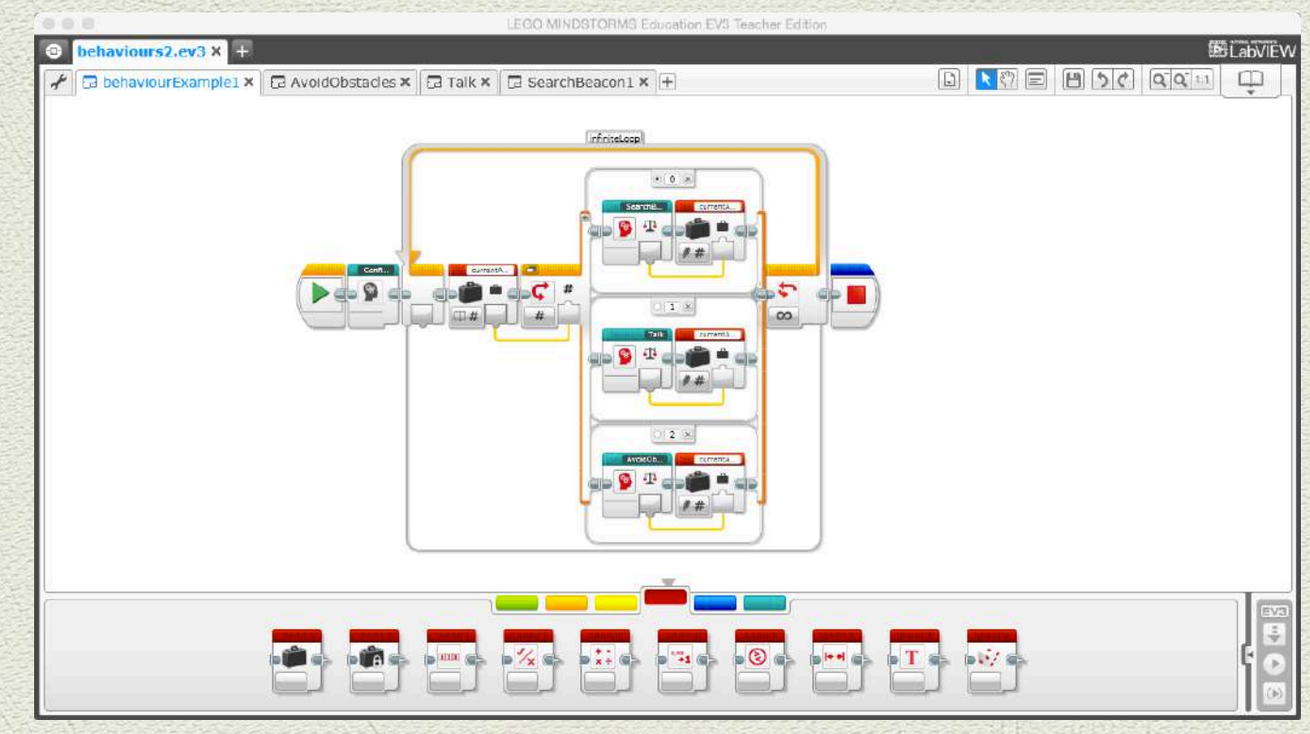


The Ev3 Programming Enviroment

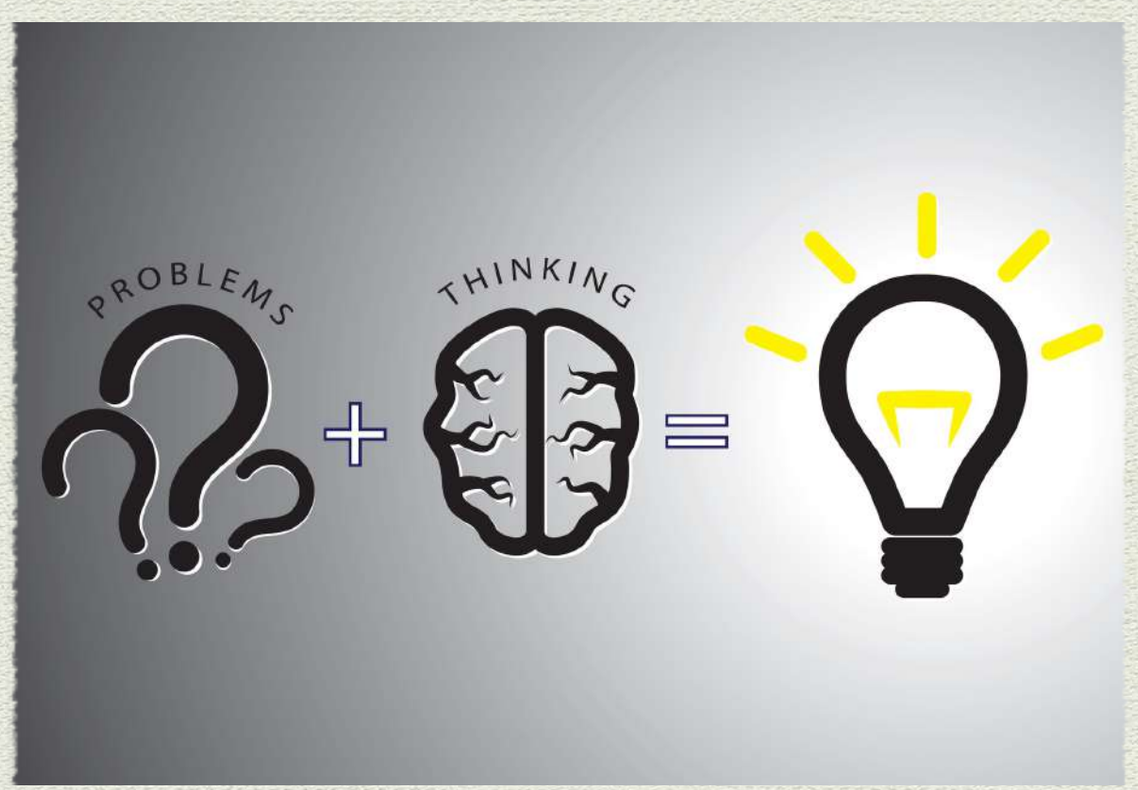
- Through the programming enviroment of LEGO Education we can handle the motors of our robot
- We can make calculations using variables
- We can get measurements from our sensors
- All the commands look like blocks

What are we aiming to do?

- We want to draw with our robot the hypotenuse of the triangles that you have on your worksheets.
- We must measure the two vertical sides (a and b) of our triangle and insert the values at the variables of the project Pythagoras.ev3 that you will find on the desktop of your computer
- After that we must put our robot at the start of the hypotenuse and let it draw it

The way that we solve the problem

- We insert the values of the a and b
- Then the robot makes the calculation $c=\sqrt{a^2+b^2}$
- The robot moves down the marker
- The robot moves for the distance c
- The robot moves up the marker



and the hypotenuse is drawn

But how does the robot know how much it must move?

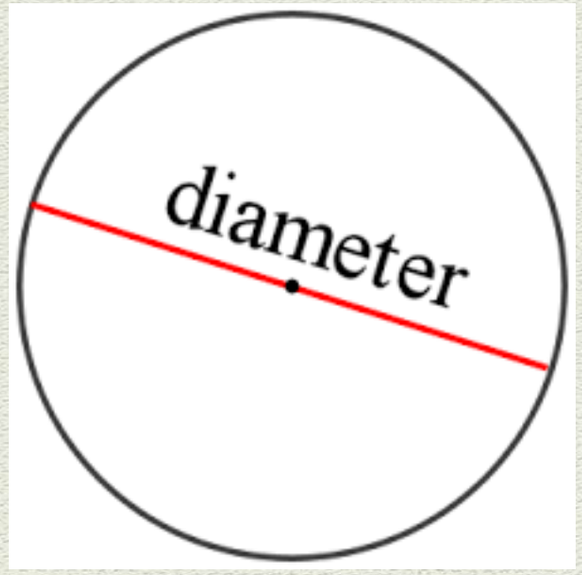
Archimedes

- Archimedes of Syracuse (287 BC -212 BC)
- Greek mathematician, physicist, engineer, inventor and astronomer
- Applying the method of exhaustion
- He calculates the mathematical constant π (pi)
- π=3.14

In what calculations must we use π?

We use π to calculate the circumference of a circle

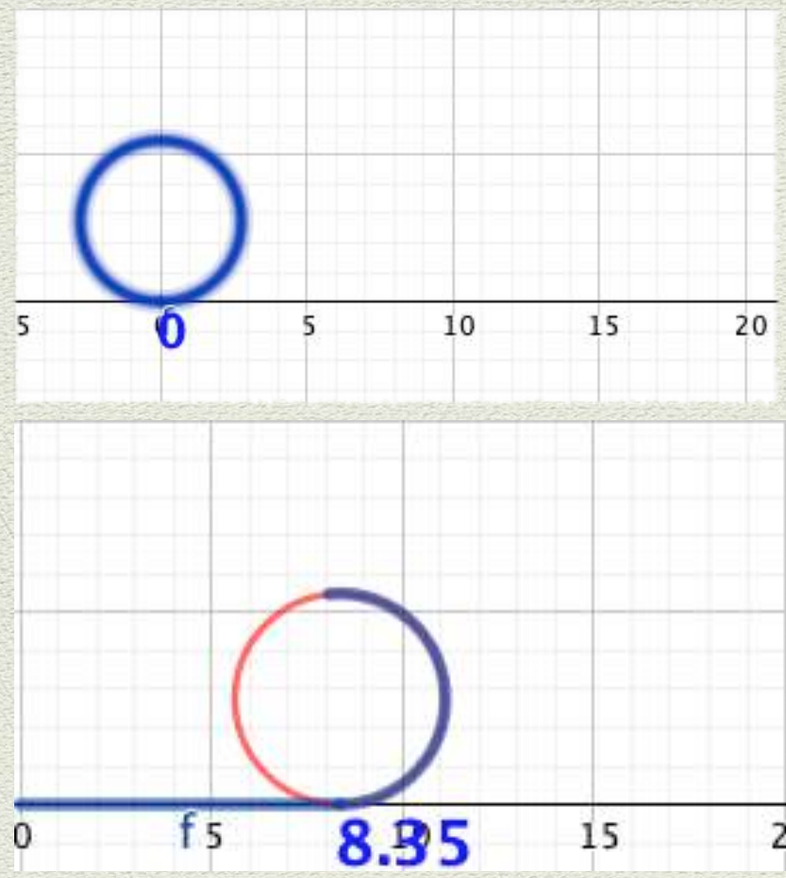
- If we know the diameter of a circle we can calculate its circumference
- The mathematical formula is $\Pi=\Delta*\pi$
- Π: circumference
- Δ: Diameter
- π: 3.14
- Diameter: The length of the straight line segment that connects two interdimensionally points of the circle and passes through its center.



Why do we mention all that?

The wheels of our robots

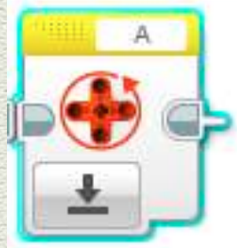
- If we know the diameter of our wheels we can find the circumference.
- We can find the distance that the wheel going trough
- We can set the distance that the robot will move



The large motor block

- We can set the rotations that our motors turn the wheels
- So we can find the distance the wheels cover.

The blocks that we will use in our practice

• Variable	
• Math operations block	
• Motor rotation Block	
• Medium Motor Block	
• Large Motor Block	

Thank you!

Let ’s do it

Have a nice time in Greece!!