# MATH-ICT EUROPE

Erasmus+ KA219 Project

## PROGRAMMING OF MATHEMATICAL PROBLEMS USING THE SCRATCH PROGRAM

### MODULE 2
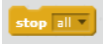
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**PROGRAMMING WITH SCRATCH**

# PROGRAMMING WITH SCRATCH

When programming with Scratch we will use two code blocks. We will use this ![when flag clicked] code block for Start from "Events" menu and this ![stop all] code block for Stop for "Control Menu"
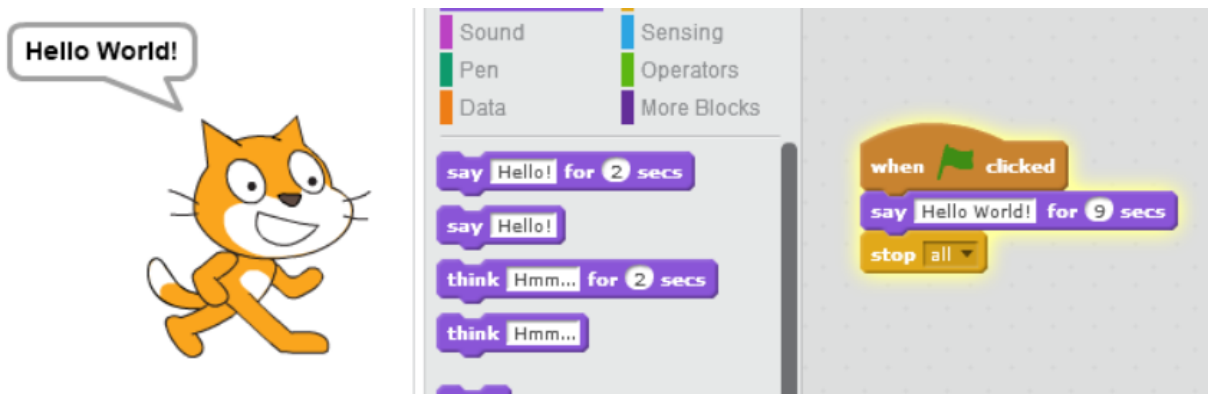
**Display on Screen**

We use two code blocks for display on screen. These codes are ![say Hello! for 2 secs] or ![say Hello!] inside of "Looks" menu. We determine the length of time that with this ![say Hello! for 2 secs] code block should stay on the screen.

In the example below, We print for 9 seconds "Hello World!".
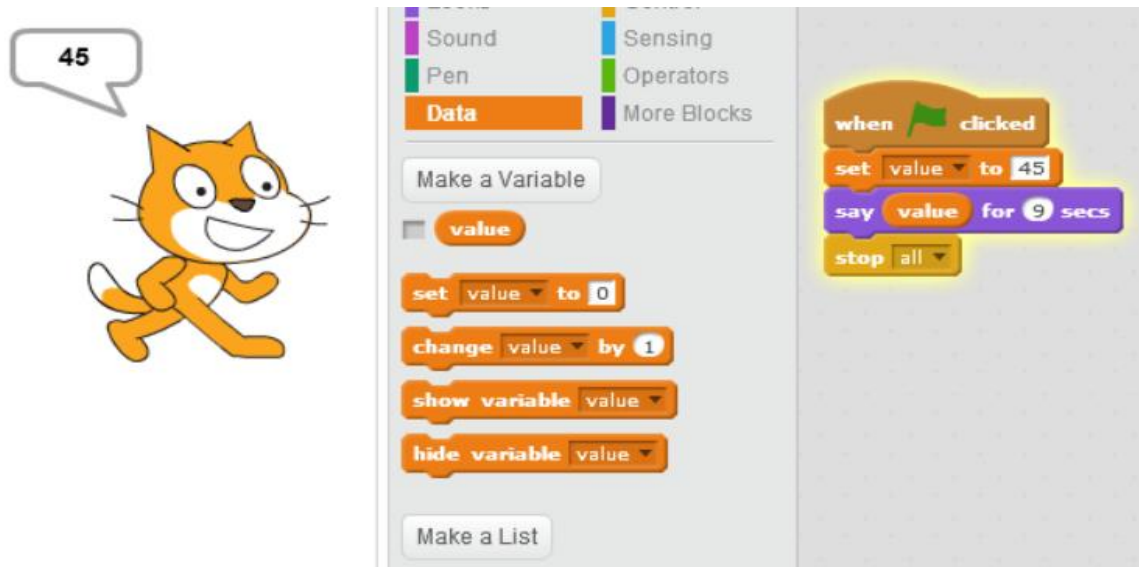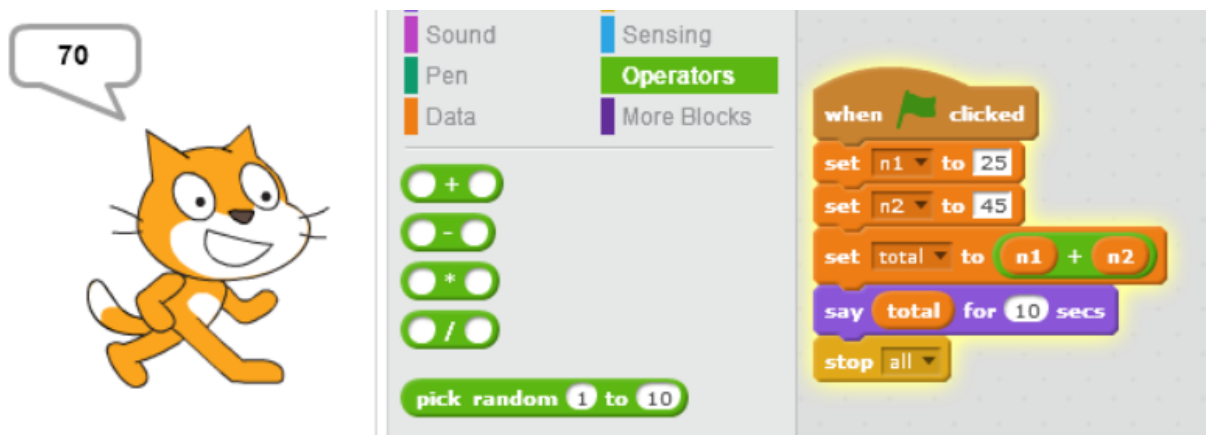


**Variables**

We will use a single variable type when programming with Scratch. Variable types like the other programming languages are not available on Scratch. To create a variable, go to the Make Variable menu from the Data menu and create a variable by specifying the name of our variable. We use this ![set value to 45] code block to assign a variable value.

Example: Make a variable named "Value". Create the program that assigns the number 45 to the variable and displays it on the screen.



Example: Create a program that gives the sum of 25 to 45 and displays the sum on the screen.



In this program, we created the sum of n1 and n2 variables using the "Operators" menu code block.

Example: Find the avarage of 98 and 27.

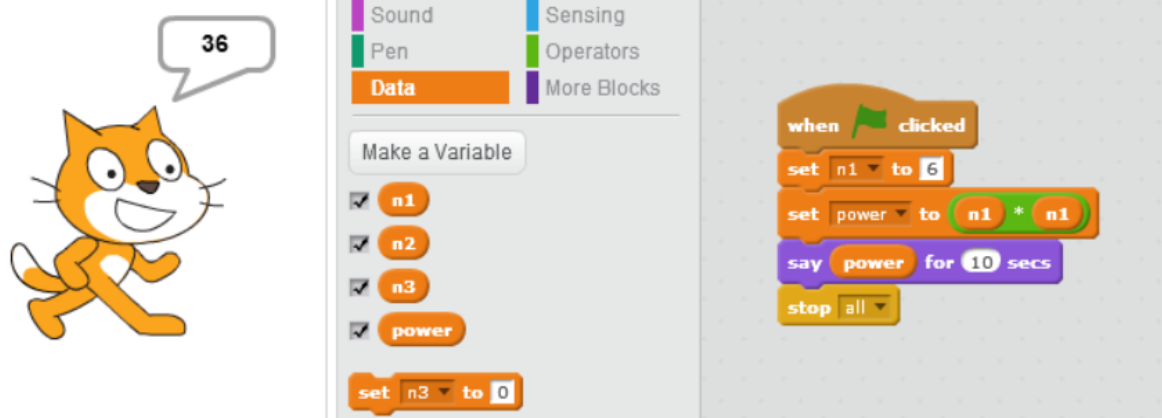Example: Find the avarege of numbers 18, 36, 45.



Example: Create a program that calculates square and cube of six.





## Value assignment to variable from output

We can use ask Enter a value : and wait and answer code blocks with variable from Sensing menu for value assignment to variable from outside. In the following example, the n1 variable is assigned a value of 45.

Example: Write a program that gives the sum of two numbers entered from the outside.



Example: Find avarege of three numbers entered from the outside.

Example: Create a program that computes the area and perimeter of the square from which the edge value are assigned from outside.



Example: Create a program that computes the perimeter and area of the rectangle from which the edge values are assigned from outside.



Example: Create a program that computes the perimeter and area of the circle from which the radius values are assigned from outside.



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Example: Create a program that computes the desired mode of an assigned value from outside.
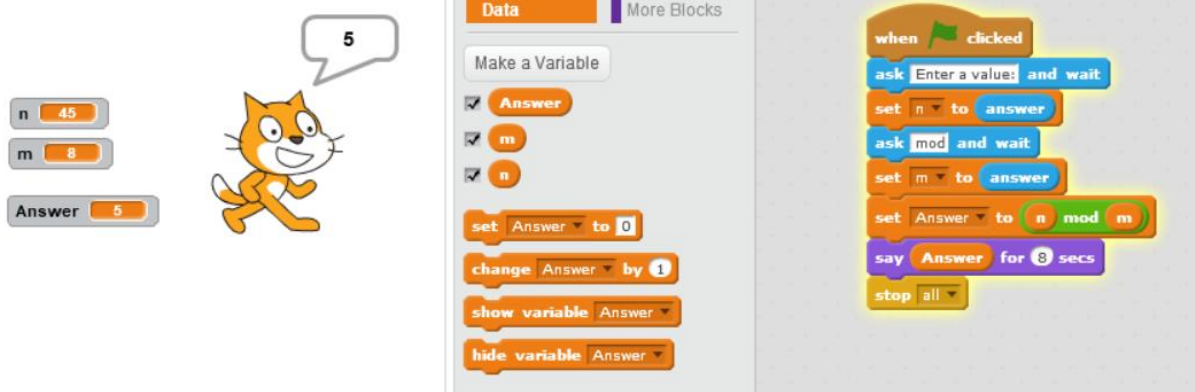


Example: The code block that finds the character length of the word



## Conditional Expressions

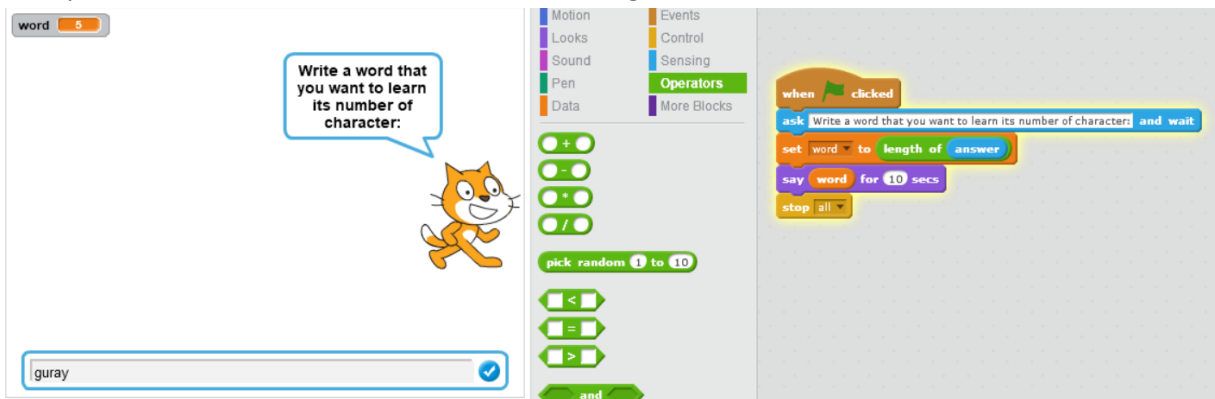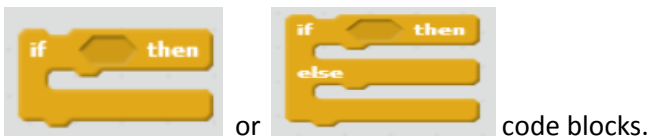You can find Conditional Expressions at Control menu. And  you can use

 or  code blocks.

Example: Create a program that displays on the screen that odd or even numbers according to the value entered from the outside.
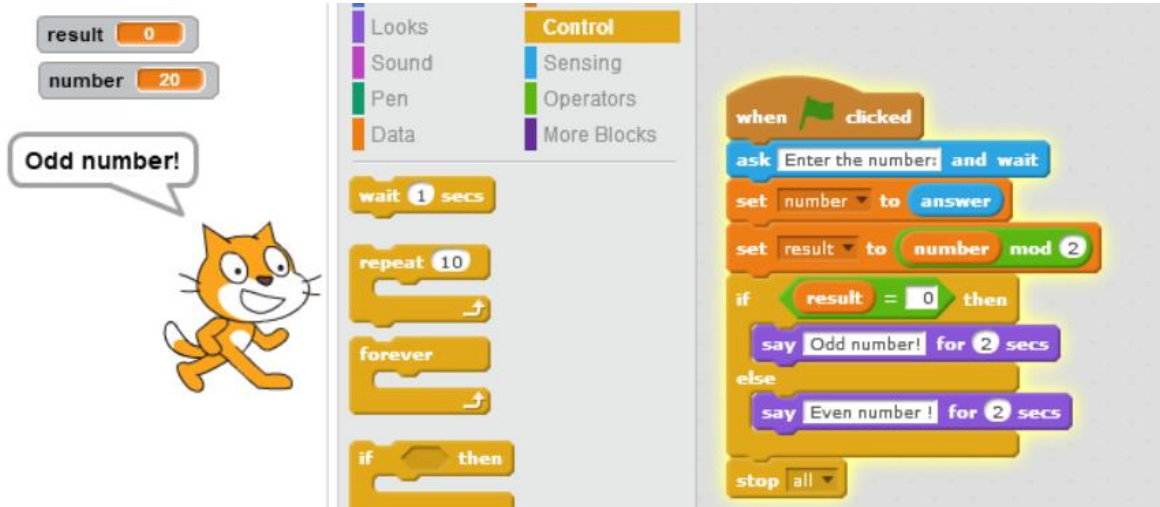


Example: Create a program that displays the physical state of the water on the screen according to the temperature value entered from the outside.
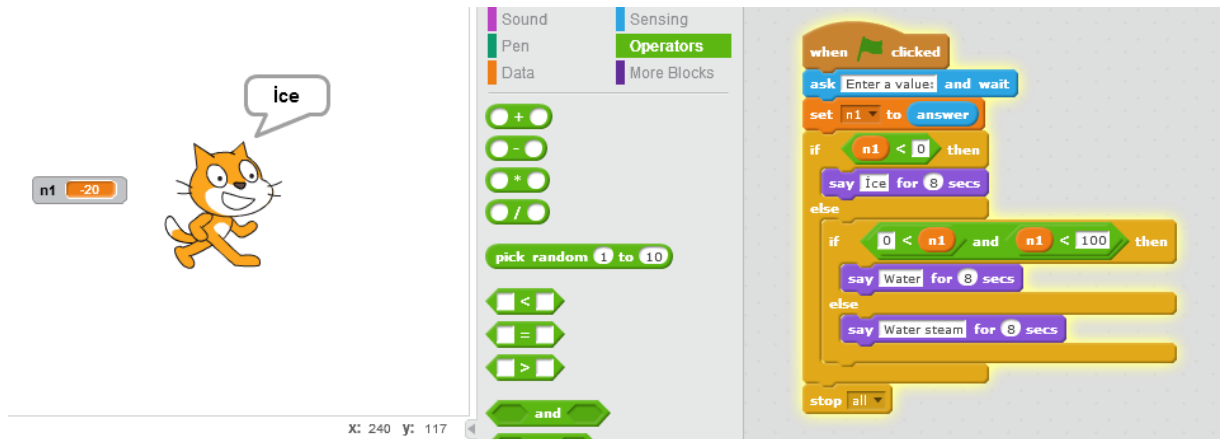


Example: Create a program that displays on the screen that it can or can not have a driving license according to the age entered from outside.

Example: Create a program that displays the two numbers entered from outside that are bigger, smaller, or equal.
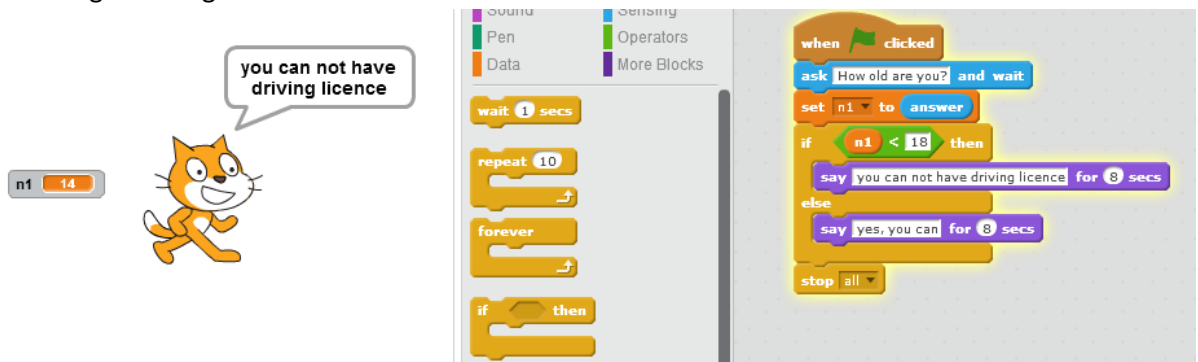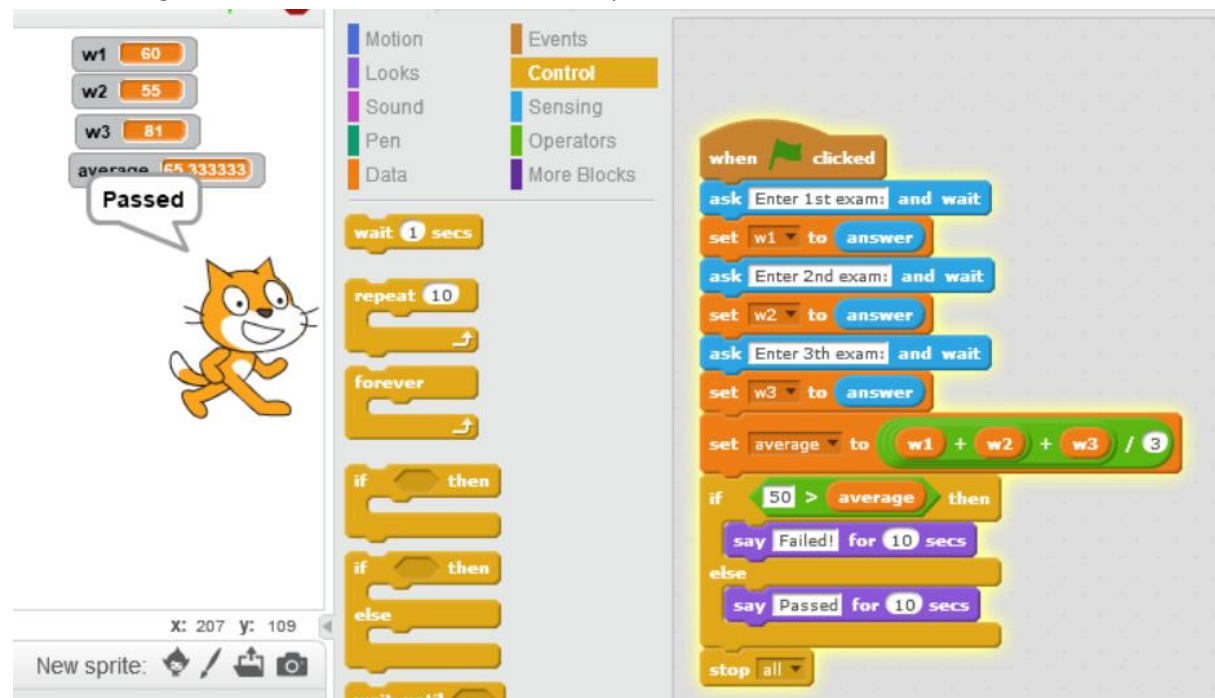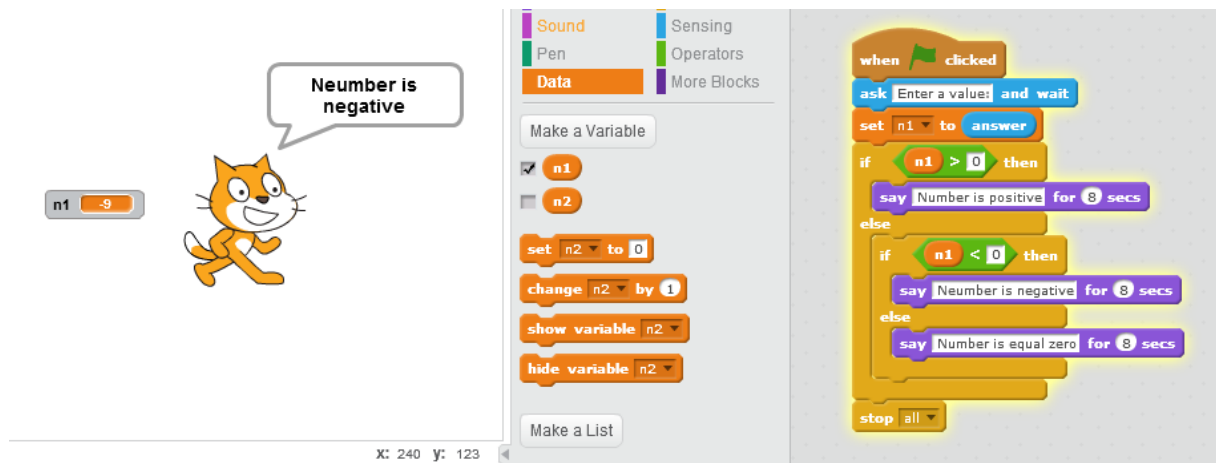


Example: Write a program that finds the average of three exams grades and displays on the screen "if the average is less than 50" "failed", if it is not "passed"

Example: Create a program that displays an assigned number from outside as positive, negative, or zero on the screen.



**Loops:**

You can use  or  code blocks on Control menu.

Example: Increase the numbers one by one starting from 1 and display on the screen up to 50.

Example: Create a program that finds the sum of numbers 1 through 10.



Example: Create a program that finds the sum of even natural numbers for a value to be entered from the outside



Example: Create a program that finds the sum of odd natural numbers for a value to be entered from the outside

Example: Create a program that finds the factorials of number's for a value to be entered from the outside
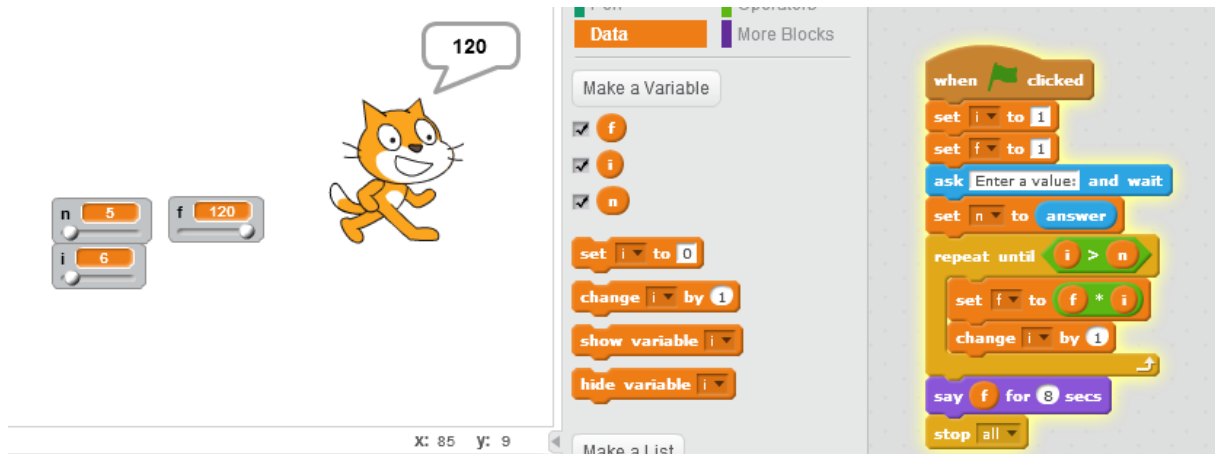


Example: Create a program that computes the average of the N piece numbers that are assigned from the outside.
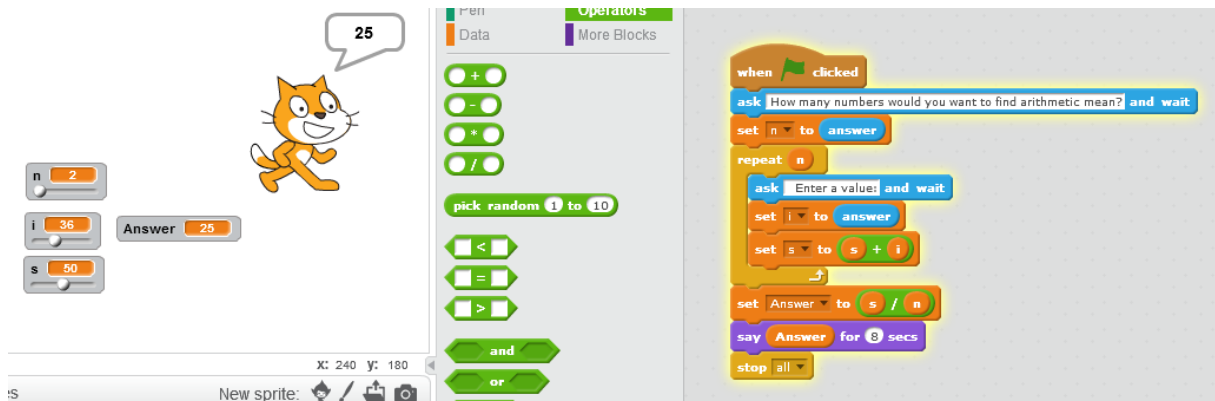


Example: Create a program that displays the numbers on the screen between two numbers that are assigned from the outside.

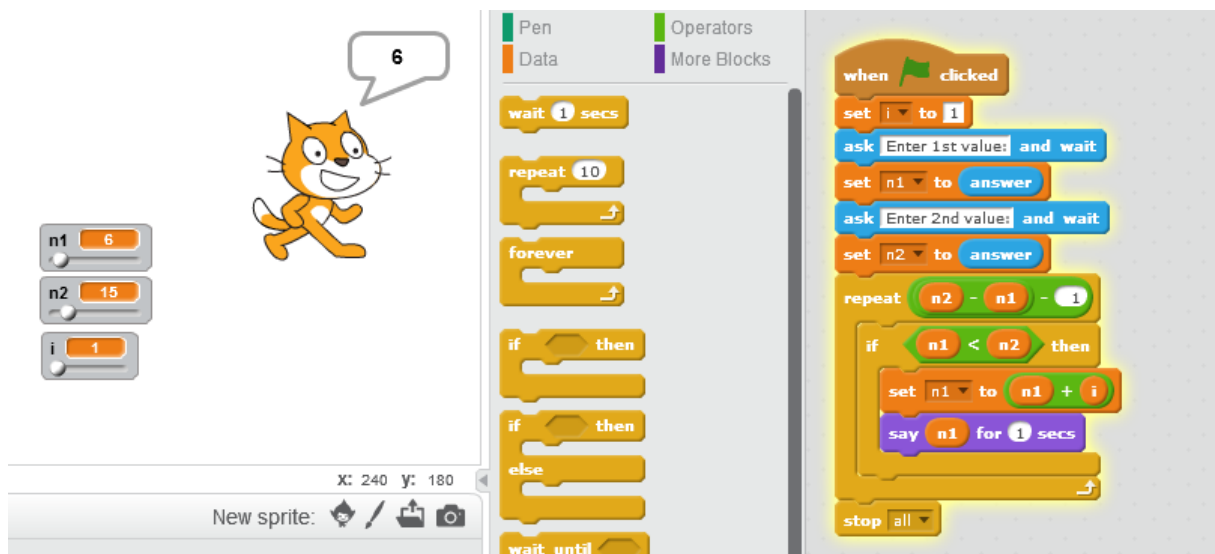Q1: We want to pour half of the water in a cylinder. How many degrees of angle should the cylinder make with the floor? You determine the radius and height of the cylinder.

$(V_s = 2\pi rh,$ r=radius, h=height $*for$ calculate the angle use the arctan function)



Q2: If you open a 1 euro account in a generous bank that given the customers 100% interest rate on January 1, how much money do you have in 31 December?

*PS1: Calculate based on compound interest.*

*PS2: Compound interest formula:* $A(1+\dfrac{r}{n})^n$    $A$: Capital, r : İnterest rate, n : Calculation period

Q3: Create the program that calculates $\pi$ according to the sum rule given below.

*PS: İf you give the maximum value of n, the result will be closer to $\pi$*

$$\pi = 4\sum_{k=0}^{n} \frac{(-1)^k}{2k+1}$$



Q4: By using Maclaurin series create a program that calculates $e^x$ the according to desired value of x.

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}$$

**First program (top):**

Looks | Control
Sound | Sensing
Pen | Operators
Data&Blocks | Robots

Make a Variable

☑ donominater
☑ j
☑ n
☑ nominater
☑ sum
☑ x

set j to 0

change j by 1

show variable j

hide variable j

Make a List

☑ e

add thing to e

e (list, length: 25):
1  2
2  .
3  7
4  1
5  8
6  2
7  8
8  1
9  8
10 2
11 8
12 4

x: -177 y: 175

New sprite:

```
when [flag] clicked
delete all of e
ask [determine value of x] and wait
set x to answer
set nominater to 1
set sum to 1
set donominater to 1
set n to 1
set j to 1
ask [How many terms do you want?] and wait
repeat until < n > answer >
    set nominater to (nominater * x)
    set donominater to (donominater * n)
    change n by 1
    set sum to (sum + (nominater / donominater))
repeat until < j > 25 >
    add (letter j of sum) to e
    change j by 1
stop all
```

Q5: Create a program that calculates the desired value according to the Maclaurin series of cosine function.

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots + \frac{x^n}{n!}$$

**Second program:**

Looks | Control
Sound | Sensing
Pen | Operators
Data&Blocks | Robots

Make a Variable

☑ donominator
☑ n
☑ nominator
☑ sign
☑ sum
☑ x

set sum to 0

change sum by 1

show variable sum

hide variable sum

Make a List

Make a Block

x: -136 y: -23

ew sprite:

```
when I start as a clone
ask [Determine the radyan value] and wait
set x to answer
set sign to 1
set nominator to 1
set donominator to 1
set sum to 1
ask [How many terms do you want?] and wait
set n to 1
repeat until < n > answer >
    if < (n mod 2) = 0 > then
        set donominator to (donominator * n)
        set sign to (-1 * sign)
        set nominator to (nominator * x)
        set sum to (sum + (sign * nominator / donominator))
    else
        set donominator to (donominator * n)
        set nominator to (nominator * x)
    change n by 1
stop all
```

Q6: Create a program that calculates the desired value according to the Maclaurin series of sine function.

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ... + \frac{x^{2n-1}}{(2n-1)!}$$