



## Module: Function Machines

### Exploration

#### “Guess my Birthday”

Make the following calculations.

- Write down the number that corresponds to your month of birth
- Multiply by 5
- Add 7
- Multiply by 4
- Add 13
- Multiply by 5
- Add the number that corresponds to your day of birth
- What is your result?

### Activities:

#### Activity 1 (Function Machines [www.explorelearning.com](http://www.explorelearning.com))

##### PART A

Choose function machine A (*additive structure*). Explore how the machine works and what happens when you insert different values.

<https://gizmos.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=1035>

(a) Fill in the following table.

Input	Output
0	
3	
5	
7	
10	
12	
15	

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(b) What is the output value when the following numbers are entered?

50 →

70 →

100→

(c) Explain the rule of the machine.

### PART B

Choose function machine D (*multiplicative structure*). Explore how the machine works and what happens when you insert different values.

(a) Fill in the following table.

Input	Output
0	
3	
5	
7	
10	
12	
15	

(b) What is the output value when the following numbers are entered?

50 →

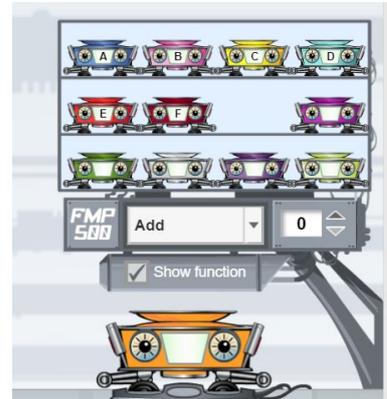
70 →

100→

(c) Explain the rule of the machine.

## Activity 2:

The following figure shows the programming section of the applet. You can drag an empty-machine and program it using the four operations.



(a) Program two function-machines that create the following tables.

Input	Output
1	7
2	14
4	28
7	49

Input	Output
6	2
7	3
8	4
10	6

(b) Program your own machine and then fill in a table of values. Show it to one of your classmates and ask him to program a function machine that gives your table.

Input	Output

**Activity 3:**

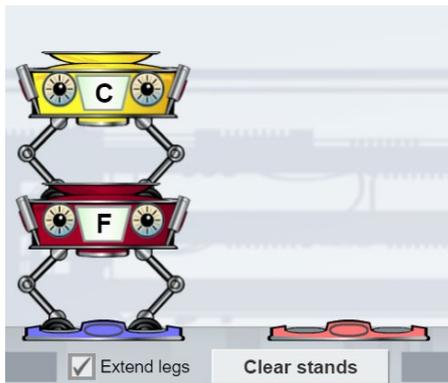
(a) You can combine functions machines. Drag machines F and C in the following way.



(b) Fill in the following table. Explain how the output value is calculated.

Input	Output 1	Output 2
1		
3		
5		
10		
12		

(c) Change the order of the machines and complete the new table.



Input	Output 1	Output 2
1		
3		
5		
10		
12		

(d) Compare the two tables. Explain how the change in the order of the machines modifies the output values of the table. Show with examples.

(e) What is the output value when the following numbers are entered in each combination?

**Combination 1**

50 →                      70 →                      100→

**Combination 2**

50 →                      70 →                      100→

(f) Find the input values that give the following output values.

**Combination 1**

\_\_\_  $\rightarrow$  8,5

\_\_\_  $\rightarrow$  13

**Combination 2**

\_\_\_  $\rightarrow$  5,5

\_\_\_  $\rightarrow$  14

## Activities for practice:

### Activity 4

Provide a combination of two function machines that give the following tables. Explain your work. Describe the rules of each combination of machines.

Input	Output
1	3
2	5
3	7
4	9

Input	Output
1	0
2	3
3	6
4	9

### Activity 5

Provide a combination of function machines (at least two) that give the following results:

“The input value is the same as the output value.”

## Extension Activities:

### Activity 6

Program a machine with a rule “add 4” and a second one with a rule “multiply by 5”.

(a) Fill in the following tables with your own input values.

Rule “add 4”

Input	Output

Rule “multiply by 5”

Input	Output

(b) Insert the value 0 and then value 1 in both machines. How does the output value change when the input value increases by 1?

(c) Insert in both machines the values 30, 31, 32 and 33 and then 50, 51, 52 and 53. How does the output value change when the input value increases by 1? Explain and compare the unit change in the two machines.

### Activity 7

*Company A rents a bicycle based on the following: €8 for each hour and additional €5 for insurance.*

(a) Create a combination of machines that gives the cost of renting a bicycle in respect of hours of renting. Explain.

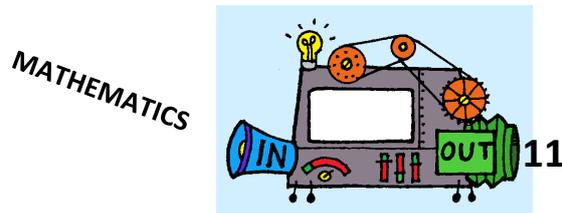
(b) Describe the graph created at the graph window.

(c) Use the graph to answer the following question: Helen does not want to spend more than 100 euro. What is the maximum number of hours that she could afford to rent a bicycle?

(d) Company B is cheaper than Company A for renting a bicycle less than 4 hours. Make a combination of machines that gives the cost of renting a bicycle for Company B. Explain your answer based on the provided graphs.

## Assessment Activities

1. In the following machine words are entered and the machine gives as an output the number of letters of the word (see example)



- (a) Find the output values for the following input:
  - a. GEOMETRY
  - b. ALGEBRA
  - c. FUNCTION
  - d. NUMBERS
- (b) Suggest possible input values for the following output values:
  - a. 8
  - b. 9
  - c. 10

2. Find below the rules of 4 Function machines.

MACHINE A: Add 5

MACHINE B: Subtract 2

MACHINE C: Multiply by 3

MACHINE D: Divide by 2

*Provide a combination of machines that could give the following tables. Explain the order.*

**TABLE 1**

<b>Input</b>	<b>Output</b>
1	4
2	5
4	7
7	10

**TABLE 2**

<b>Input</b>	<b>Output</b>
1	8
2	11
5	20
10	35

**TABLE 3**

<b>Input</b>	<b>Output</b>
1	3
3	4
7	6
15	10

**TABLE 4**

<b>Input</b>	<b>Output</b>
5	9
7	15
10	24
11	27