





## Steps to Success

| Lockdown  |                         |
|---|-------------------------|
| Date  |                         |
| Subject/s   | <b>Maths</b>            |
| Learning Objective<br> | To find a two-step rule |

|   |   | SA<br> | TA<br> |
|---|---|---|---|
| Success Criteria<br> | I know to complete the functions in the correct order |   |   |
|   | I can write the functions as algebraic expressions    |   |   |
|   | I know letters can be used to represent numbers       |   |   |
| Support   | Independent      Adult Support (    )      Group Work |   |   |

### Pre-task

Complete the table for the given function machine.



|        |   |   |   |   |   |
|--------|---|---|---|---|---|
| Input  | 1 | 2 | 3 | 4 | 5 |
| Output |   |   |   |   |   |

- What patterns do you notice in the outputs?
- What is the input if 20 comes out? How did you work it out?
- What is the algebraic function for this function?

Each of these function machines has two steps. Give the missing inputs and outputs for each machine.



1) **Input**                      **Function**    **Function**                      **Output**

|                |  |     |
|----------------|--|-----|
| 12             |  | c)  |
| 2000           |  | d)  |
| 7.2            |  | e)  |
| a)             |  | 7   |
| b)             |  | 199 |
| $2\frac{1}{4}$ |  | f)  |

2) **Input**                      **Function**    **Function**                      **Output**

|                |  |     |
|----------------|--|-----|
| 12             |  | c)  |
| 2000           |  | d)  |
| 7.2            |  | e)  |
| a)             |  | 7   |
| b)             |  | 199 |
| $2\frac{1}{4}$ |  | f)  |

1) Give the missing function and missing inputs for this two-step function machine.



|              |                 |                 |               |
|--------------|-----------------|-----------------|---------------|
| <b>Input</b> | <b>Function</b> | <b>Function</b> | <b>Output</b> |
| 12           |                 |                 | 11            |
| 20           |                 |                 | 13            |
| a)           |                 |                 | 14            |
| b)           |                 |                 | 88            |
| c)           |                 |                 | 9.2           |
| d)           |                 |                 | 17.75         |

2) a) Give an input number, two functions and an output that follow the rules set by the function machine.

|                            |                 |                 |               |
|----------------------------|-----------------|-----------------|---------------|
| <b>Input</b>               | <b>Function</b> | <b>Function</b> | <b>Output</b> |
| Any whole number up to 200 |                 |                 | 4             |
|                            |                 |                 | 16            |
|                            |                 |                 | 24            |

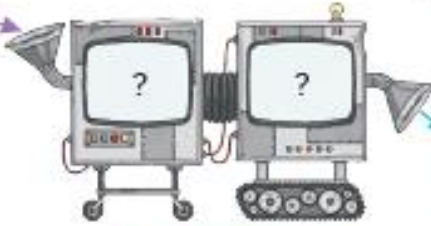
For example:  $56 \div 2 - 24 = 4$

b) Now use the function machine to make two output numbers of your choice that are  $>100$ . Make each number in four different ways. Are there any numbers that can't be made?

1) Is each child's statement about the missing functions correct? Prove it!



21



12

Subtraction followed by multiplication could be the functions that are missing.

Thomas

The missing functions could be a multiplication function followed by an addition function.

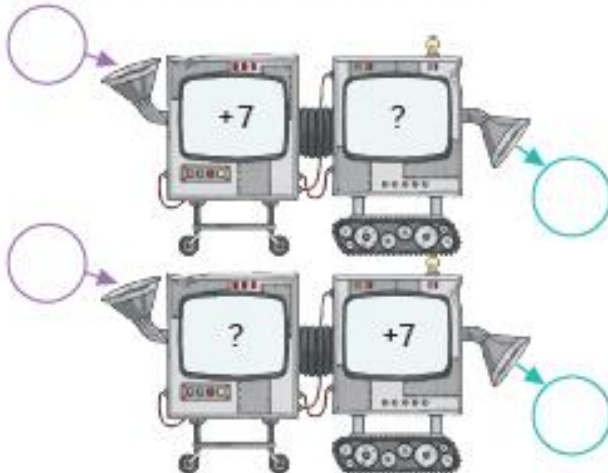
Ola

The missing functions could be addition followed by division.

Layla



2) Look at these two-step function machines.



Do you agree or disagree with each child's statement? Explain why.

If I add the function  $-6$  into both function machines then both machines will give the same answer.

Ruby



Leo

If I add the function  $\times 4$  as the missing function in both machines, they will both give the same answer.

- 1) a) 4  
 b) 68  
 c) 31  
 d) 5995  
 e) 16.6  
 f)  $1\frac{3}{4}$

- 2) a) 16  
 b) 56  
 c) 7  
 d) 20  
 e) 35  
 f) 2.2



- 1) Ola could be correct.  $21 \times 0 = 0$  and  $0 + 12 = 12$   
 Layla could be correct.  $21 + 3 = 24$  and  $24 \div 2 = 12$   
 Thomas could be correct.  $21 - 15 = 6$  and  $6 \times 2 = 12$

2) Leo: This is incorrect, as each machine will give a different answer if we do what Leo suggests. Adding 7 to a number, then multiplying by 4, will give a different answer to multiplying a number by 4, then adding 7 to it.

Ruby: This is correct, as the pair of function machines will now have the function of  $+1$ .



1) Function  $\div 4$

- a) 24  
 b) 320  
 c) 4.8  
 d) 39

2) a) Answers may vary. Example answers shown for each number given.

$$20 \div 2 - 6 = 4$$

$$44 \div 2 - 6 = 16$$

$$60 \div 2 - 6 = 24$$

$$32 \div 2 - 12 = 4$$

$$88 \div 4 - 6 = 16$$

$$72 \div 2 - 12 = 24$$

$$44 \div 2 - 18 = 4$$

$$132 \div 6 - 6 = 16$$

$$84 \div 2 - 18 = 24$$

$$40 \div 4 - 6 = 4$$

$$176 \div 8 - 6 = 16$$

$$96 \div 2 - 24 = 24$$

b) Odd numbers cannot be made due to the 'divide by 2' rule given by the function machine. If we input an odd number, we will make a decimal number, which cannot be classed as either odd or even.



## Problem Solving and Reasoning

Use it!



Explain it!



David has a two function machines.



He says,



The function machines will give the same answer.

Is David correct?  
Is there an input that will give the same output for both machines?

Use it!



Explain it!



Lola has the following function machine.



Explain how this can be written as a single function machine.

Use it!



1) Is each child's statement about the missing functions correct? Prove it!



Subtraction followed by multiplication could be the functions that are missing.

Thomas

The missing functions could be a multiplication function followed by an addition function.

Ola

The missing functions could be addition followed by division.

Layla



## Answers

No they do not give the same answer. Children can just put any number in to show this.

Write is as  $-6$

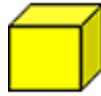
*Ola could be correct.  $21 \times 0 = 0$  and  $0 + 12 = 12$*

*Layla could be correct.  $21 + 3 = 24$  and  $24 \div 2 = 12$*

*Thomas could be correct.  $21 - 15 = 6$  and  $6 \times 2 = 12$*

## Further Challenge

One block is needed to make an up-and-down staircase, with one step up and one step down.



4 blocks make an up-and-down staircase with 2 steps up and 2 steps down.



How many blocks would be needed to build an up-and-down staircase with 5 steps up and 5 steps down?

Explain how you would work out the number of blocks needed to build a staircase with any number of steps.