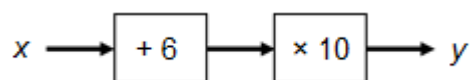# GCSE (9–1)
MATHEMATICS

OCR
Oxford Cambridge and RSA

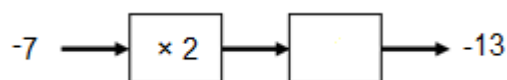# Foundation Check In - 6.05 Language of functions

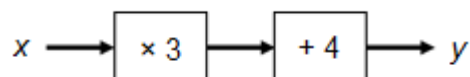1. Use the function machine to find the value of *y* when *x* = 2.5.

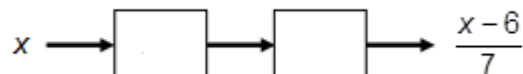$$x \longrightarrow \boxed{+6} \longrightarrow \boxed{\times 10} \longrightarrow y$$

2. Complete the empty box in the function machine below.

$$-7 \longrightarrow \boxed{\times 2} \longrightarrow \boxed{} \longrightarrow -13$$

3. Find a formula for *y* in terms of *x* for this function machine.

$$x \longrightarrow \boxed{\times 3} \longrightarrow \boxed{+4} \longrightarrow y$$

4. Complete the empty boxes in the function machine below.

$$x \longrightarrow \boxed{} \longrightarrow \boxed{} \longrightarrow \frac{x-6}{7}$$
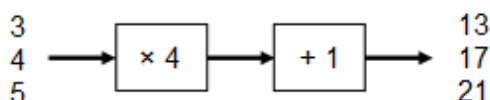
5. *Plumbright* charge their customers for plumbing work in the following way.
   - £20 callout fee: everyone pays this once, no matter how long the job takes.
   - £30 for every hour worked.

   Complete the empty boxes below to give a function for the cost (£*c*) in terms of the time it takes to complete the job (*t* hours).

$$t \longrightarrow \boxed{} \longrightarrow \boxed{} \longrightarrow c$$

6. Zia inputs some numbers to this function machine and notices that she always gets an output that is an odd number.

$$\begin{matrix}3\\4\\5\end{matrix} \longrightarrow \boxed{\times 4} \longrightarrow \boxed{+1} \longrightarrow \begin{matrix}13\\17\\21\end{matrix}$$

   Zia claims this function machine will always output an odd number. Zia is wrong. Explain why. [1.02a initial]
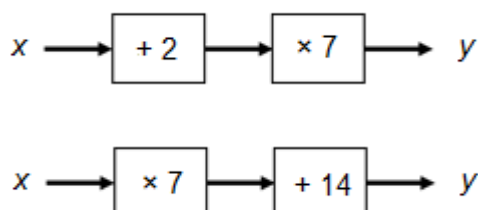
7. Gemma has a burst pipe and needs to call out a plumber. She considers *Plumbright* from question 5 but also asks another plumbing company, *Dripdrip*, for details of how much they charge.

   Dripdrip have a higher callout fee of £40, but then charge a lower hourly rate of £20 for every hour worked. Gemma wants to pay as little as possible.

   By considering the length of job for which the two companies would charge the same price, explain which company Gemma should choose.

8. These two function machines will give the same output for a particular input.

   $$x \longrightarrow \boxed{+\,2} \longrightarrow \boxed{\times\,7} \longrightarrow y$$

   $$x \longrightarrow \boxed{\times\,7} \longrightarrow \boxed{+\,14} \longrightarrow y$$

   For each function machine, find a formula for *y* in terms of *x*. Show that these two formulas are equivalent.

9. Benji asks his teacher how old he is. His teacher replies "if you add 3 to my age, divide that value by 2 and then subtract 5, you get 16". How old is Benji's teacher?

10. The graph on the right shows five pairs of numbers (*x*, *y*).

   Complete the boxes below to give a function machine that could have been used to generate the five pairs of numbers.

   $$x \longrightarrow \boxed{} \longrightarrow \boxed{} \longrightarrow y$$
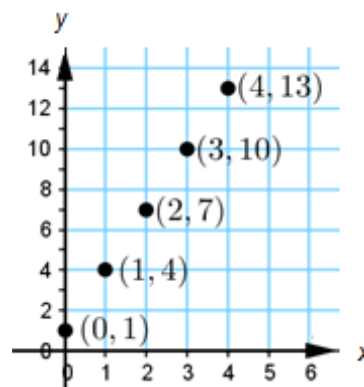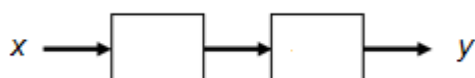
Extension

Complete the empty boxes in the function machine below.

$$x \longrightarrow \boxed{} \longrightarrow \boxed{} \longrightarrow \boxed{} \longrightarrow \boxed{} \longrightarrow \frac{2x+9}{3} - 5$$
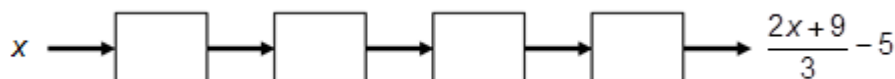
Check that your function machine gives an output of 2 when you input 6.

Use your function machine to work out the input values which give an output of
(a) 6,
(b) -2.

Only some inputs give outputs that are integers. What is special about these input values?

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Answers
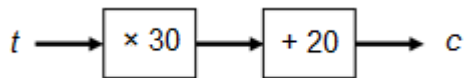
1. 85

2. + 1

3. $y = 3x + 4$

4.

$$x \longrightarrow \boxed{-6} \longrightarrow \boxed{\div 7} \longrightarrow \frac{x-6}{7}$$

5.

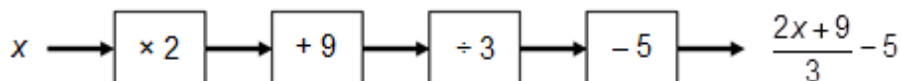$$t \longrightarrow \boxed{\times 30} \longrightarrow \boxed{+ 20} \longrightarrow c$$

6. This function machine will always give an odd number for an integer input (or an input that ends in .5). One counterexample is sufficient to show Zia is wrong. If she inputs, for example 0.25, she gets an output of 2, which is even. Also, if she inputs, for example 1.1, she gets 5.1 which is neither even nor odd.

7. At two hours, the companies both charge £80. If the job will take up to two hours, Gemma should use *Plumbright*; if the job will take over two hours, Gemma should use *Dripdrip*.

8. The first function machine represents $y = 7(x + 2)$. The second function machine represents $y = 7x + 14$. Expanding the brackets of the first formula gives the same formula as the one for the second function machine.

9. 36 years old

10.

$$x \longrightarrow \boxed{\times 3} \longrightarrow \boxed{+ 1} \longrightarrow y$$

Extension

$$x \longrightarrow \boxed{\times 2} \longrightarrow \boxed{+ 9} \longrightarrow \boxed{\div 3} \longrightarrow \boxed{- 5} \longrightarrow \frac{2x+9}{3} - 5$$

(a) Input 12
(b) Input 0

Inputs that are a multiple of 3 are the only values that give outputs that are integer values.

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Substitute decimal value into function machine			
AO1	2	Determine missing operation in function machine			
AO1	3	Write formula for function machine			
AO1	4	Determine function machine for formula			
AO1	5	Determine function machine for pricing model in context			
AO2	6	Explain properties of multiples and odd numbers			
AO2	7	Use function machine for pricing model in context			
AO2	8	Use function machines and expanding brackets to show two expressions are equivalent			
AO3	9	Use function machine to solve a problem			
AO3	10	Determine function machine for coordinate pairs			

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