

## Function machines

### Starter

1. A function machine is defined by  $x \rightarrow \boxed{+4} \rightarrow y$

- (a) Find the value of  $y$  when: (i)  $x = 7$  (ii)  $x = -10$   
 (b) Find the value of  $x$  when: (i)  $y = 9$  (ii)  $y = 3$   
 (c) Write an expression for  $y$  in terms of  $x$ .

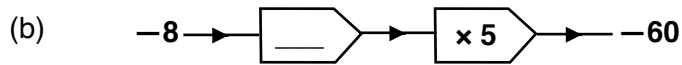
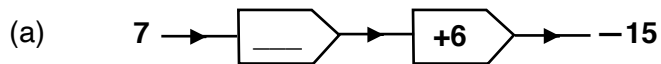
**Working:** (a) (i)  $y = 7 + 4 = 11$   
 (ii)  $y = -10 + 4 = -6$   
 (b) (i)  $x + 4 = 9 \Rightarrow x = 5$   
 (ii)  $x + 4 = 3 \Rightarrow x = -1$   
 (c)  $y = x + 4$

2. A function machine is defined by  $x \rightarrow \boxed{-3} \rightarrow \boxed{\times 2} \rightarrow y$

- (a) Find the value of  $y$  when: (i)  $x = 8$  (ii)  $x = 2$   
 (b) Find the value of  $x$  when: (i)  $y = 16$  (ii)  $y = 24$   
 (c) Write an expression for  $y$  in terms of  $x$ .

**Working:** (a) (i)  $8 \rightarrow \boxed{-3} \rightarrow 8 - 3 = 5 \rightarrow \boxed{\times 2} \rightarrow 5 \times 2 = 10$   
 So  $y = 10$   
 (ii)  $2 \rightarrow \boxed{-3} \rightarrow 2 - 3 = -1 \rightarrow \boxed{\times 2} \rightarrow -1 \times 2 = -2$   
 So  $y = -2$   
 (b) (i) *Reverse the direction, opposite operation.*  
 $8 + 3 = 11 \leftarrow \boxed{+3} \leftarrow 16 \div 2 = 8 \leftarrow \boxed{\div 2} \leftarrow 16$   
 So  $x = 11$   
 (ii)  $12 + 3 = 15 \leftarrow \boxed{+3} \leftarrow 24 \div 2 = 12 \leftarrow \boxed{\div 2} \leftarrow 24$   
 So  $x = 15$   
 (c)  $x \rightarrow \boxed{-3} \rightarrow x - 3 \rightarrow \boxed{\times 2} \rightarrow y = (x - 3) \times 2$   
 $\therefore y = 2(x - 3)$

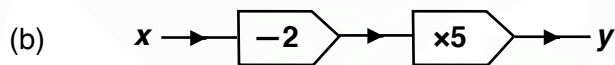
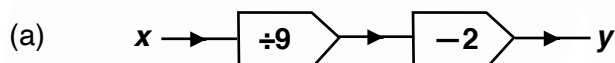
**E.g. 1** Complete these function machines

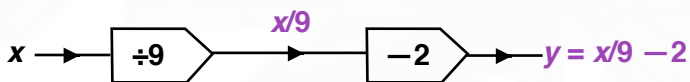


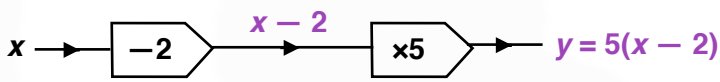
**Working:** (a)  $-15 - 6 = -21$   
 What can be done to get from 7 to  $-21$ ?  
*Either*  $\times (-3)$  since  $7 \times (-3) = -21$   
*or*  $-28$  since  $7 - 28 = -21$   
 So the gap could be  $\times (-3)$  or  $-28$

(b)  $-60 \div 5 = -12$   
 What can be done to get from  $-8$  to  $-12$ ?  
*Either*  $-4$  since  $-8 - 4 = -12$   
*or*  $\times 1.5$  since  $-8 \times 1.5 = -12$   
 So the gap could be  $-4$  or  $\times 1.5$

**E.g. 2** Find a formula for  $y$  in terms of  $x$ :



**Working:** (a)  $x \rightarrow$    
 $\therefore y = \frac{x}{9} - 4$

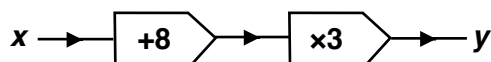
(b)  $x \rightarrow$    
 $\therefore y = 5(x - 2)$

**E.g. 3** Draw a function machine for:

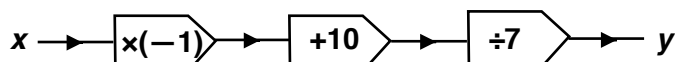
(a)  $y = 3(x + 8)$

(b)  $y = \frac{10 - x}{7}$

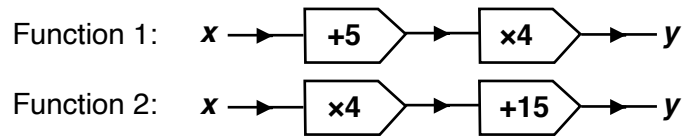
**Working:** (a) We  $+8$  to  $x$  before we multiply by 3



(b) Firstly the function machine multiplies  $x$  by  $-1$ , then it  $+10$  and finally  $\div 7$



**E.g. 4** Decide whether these machines give the same function. If they do not, edit one of the function machines so they are equivalent.



**Working:** Function 1: adds 5 then multiplies by 4  $\therefore y = 4(x + 5)$   
Function 2: multiplies by 4 then adds 15  $\therefore y = 4x + 15$   
By expanding the brackets of Function 1, it will be easier to compare:  
 $y = 4(x + 5) = 4x + 20$   
Function 1:  $y = 4x + 20$   
Function 2:  $y = 4x + 15$   
The difference is that Function 1  $+20$  while Function 2  $+15$   
To make them the same, Function 2 can be changed to  $+20$  rather than  $+15$ .

Alternatively, Function 1 can be changed to  $+\frac{15}{4}$  rather than  $+5$ .

**Video:** [Function machines](#)

[Solutions to Starter and E.g.s](#)

### Exercise

Worksheet: [Language of functions](#) (Answers included on pages 3 and 4)

9-1 class textbook:	Function notation is not included in the OCR GCSE course
A*-G class textbook:	Function notation is not included in the OCR GCSE course
9-1 homework book:	Function notation is not included in the OCR GCSE course
A*-G homework book:	Function notation is not included in the OCR GCSE course