

Functions

- Using operations to make functions
- Applying an operation and its inverse
- How to use algebra to describe rules
- How to use a mapping diagram

Keywords

You should know

explanation 1

1 Here is a function machine.

input \rightarrow $\boxed{\times 5}$ \rightarrow output

a Write the output for each of these input values.

- i** 3 **ii** 11 **iii** 7 **iv** 21

b Write the input for each of these output values.

- i** 20 **ii** 30 **iii** 35 **iv** 120

2 Copy and complete these function machines.

a $\begin{array}{ccc} 4 & & 15 \\ 7 & \rightarrow \boxed{+ \quad \square} & \rightarrow \square \\ \square & & 27 \end{array}$

b $\begin{array}{ccc} 5 & & \square \\ 8 & \rightarrow \boxed{\times \quad \square} & \rightarrow 48 \\ 10 & & \square \end{array}$

c $\begin{array}{ccc} 7 & & \square \\ 14 & \rightarrow \boxed{\div \quad \square} & \rightarrow \square \\ 21 & & 3 \end{array}$

d $\begin{array}{ccc} 10 & & \square \\ \square & \rightarrow \boxed{\square} & \rightarrow 22 \\ n & & n - 8 \end{array}$

explanation 2

3 Draw a function machine for $x \rightarrow x + 10$ using the input values 0, 2, 11 and 17.

4 Draw a function machine for $x \rightarrow 3x$ using the input values 0, 0.5, 2 and 2.5.

5 Draw a function machine for $x \rightarrow 10x$ with output values 0, 10, 30 and 45.

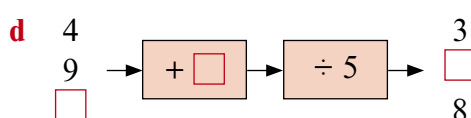
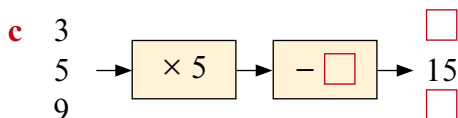
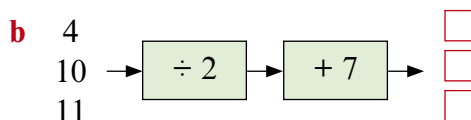
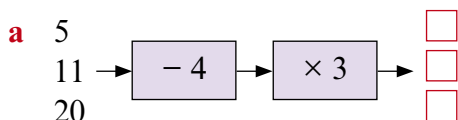
6 Input and output values for some functions are shown below.

Write the rule for each function in the form $x \rightarrow \square$

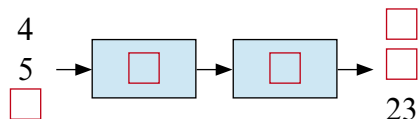
a	$1 \rightarrow 101$	b	$21 \rightarrow 15$	c	$2 \rightarrow 22$	d	$12 \rightarrow 3$
	$2 \rightarrow 102$		$27 \rightarrow 21$		$4 \rightarrow 44$		$16 \rightarrow 4$
	$3 \rightarrow 103$		$30 \rightarrow 24$		$5 \rightarrow 55$		$20 \rightarrow 5$

explanation 3

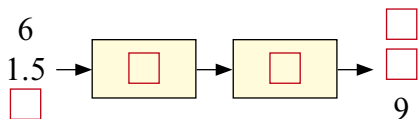
7 Copy and complete these function machines.



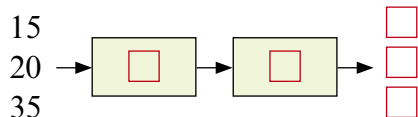
8 Copy and complete this function machine to show $x \rightarrow 2x + 7$.



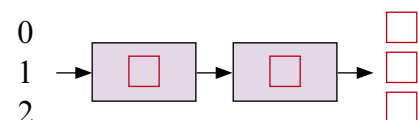
9 Copy and complete this function machine to show $x \rightarrow \frac{x}{3} + 5$.



10 Copy and complete this function machine to show $x \rightarrow \frac{2x}{5}$.



11 Copy and complete this function machine to show $x \rightarrow 4 + 3x$.



12 Information about some functions is shown below.

Copy and complete.

a $10 \rightarrow 2$

$12 \rightarrow 3$

$18 \rightarrow \square$

$x \rightarrow \frac{x}{2} - \square$

b $27 \rightarrow 12$

$36 \rightarrow 16$

$99 \rightarrow \square$

$x \rightarrow \frac{4x}{\square}$

c $5 \rightarrow 5$

$8 \rightarrow 14$

$\square \rightarrow 26$

$x \rightarrow 3x - \square$

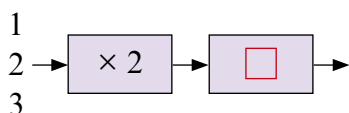
d $0 \rightarrow \square$

$2 \rightarrow 23$

$\square \rightarrow 87$

$x \rightarrow \square x + 7$

13 Copy and complete the function machine to give these outputs:

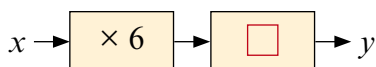


a 1
2
3

b 2
4
6

c 10
20
30

14 Copy and complete the function machine for each value of y .



a $y = x$

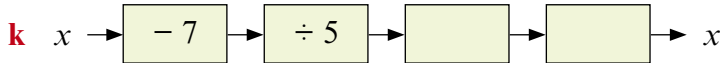
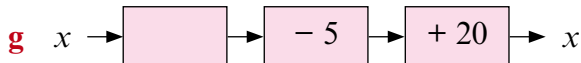
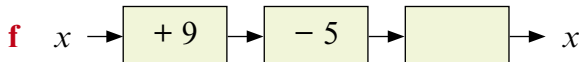
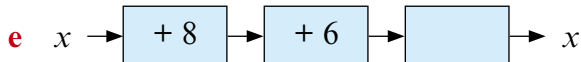
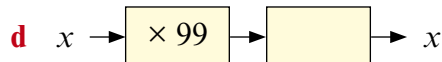
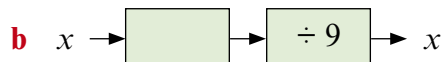
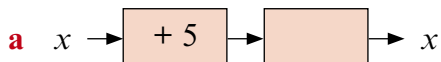
b $y = 2x$

c $y = 3x$

d $y = \frac{x}{2}$

explanation 4

15 Work out the missing operations for these function machines, which have the same input and output.



- 16** Write a simpler version of each function machine, replacing the two operations with one operation.

a $x \rightarrow \boxed{+ 2} \rightarrow \boxed{+ 3} \rightarrow y$

$x \rightarrow \boxed{} \rightarrow y$

b $x \rightarrow \boxed{\times 2} \rightarrow \boxed{\times 3} \rightarrow y$

$x \rightarrow \boxed{} \rightarrow y$

17 $10 \rightarrow \boxed{} \rightarrow \boxed{} \rightarrow \boxed{} \rightarrow \boxed{}$

Use the operations $\times 5$, $- 4$ and $+ 7$ in the function machine.

- a** Make the largest output. **b** Make the smallest output.

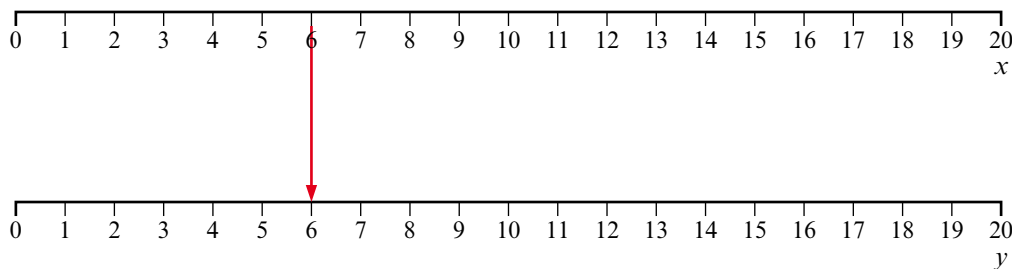
explanation 5

- 18 a** Copy and complete the table of x and y values for this function machine.

$x \rightarrow \boxed{\times 2} \rightarrow \boxed{- 6} \rightarrow y$

x	3	4	5	6	7	8	9	10	11	12	13
y											

- b** Copy and complete this mapping diagram using the values from your table.



- 19** The function with rule $n \rightarrow 3n - 1$ uses the sequence 1, 2, 3, ... as input values. The output values make a new sequence.

- a** Write down the first 10 terms of this new sequence.
b Does the number 239 belong to the new sequence? Explain how you know.
c How many terms of the new sequence are smaller than 50?