As outcomes, Year 8 pupils should, for example:

Use vocabulary from previous year and extend to: linear function…

Express simple functions in symbols.
For example:

Generate sets of values for simple functions using a function machine or a spreadsheet. For example:

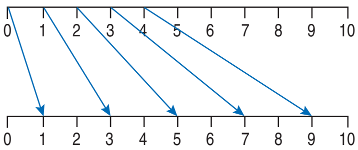
- Use a **spreadsheet** to produce a table of inputs and outputs, e.g. $x \to 2x + 8$ or $y = 2x + 8$.

	A	B
1	x	y
2	1	=A2*2+8
3	=A2+1	=A3*2+8
4	=A3+1	=A4*2+8
5	=A4+1	=A5*2+8
6	=A5+1	=A6*2+8
7	=A6+1	=A7*2+8
8	=A7+1	=A8*2+8

	A	B
1	x	y
2	1	10
3	2	12
4	3	14
5	4	16
6	5	18
7	6	20
8	7	22

Extend to negative and non-integral values.

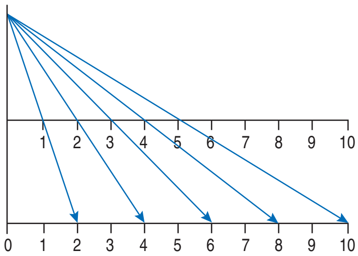
Draw mapping diagrams for simple functions.
For example, $x \to 2x + 1$:



Extend the mapping to include:
- negative integers down to $^{-}10$;
- fractional values.

Know some properties of mapping diagrams.
For example:

- Functions of the form $x \to x + c$ produce sets of parallel lines.
- Mapping arrows for multiples, if projected backwards, meet at a point on the zero line, e.g. $x \to 2x$:

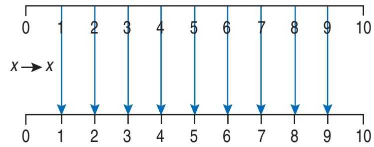


Link to enlargement by a whole-number scale factor (pages 212–13).

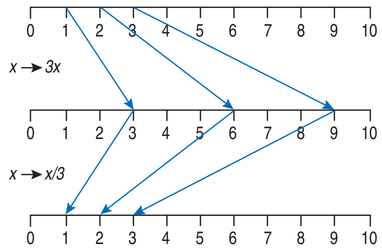
As outcomes, Year 9 pupils should, for example:

Use vocabulary from previous years and extend to: identity function, inverse function, quadratic function… inverse mapping… self-inverse…

Know that $x \to x$ is called the identity function, because it maps any number on to itself, i.e. leaves the number unchanged.



Know that every linear function has an inverse function which reverses the direction of the mapping. For example, the inverse of multiplying by 3 is dividing by 3, and this can be expressed in symbols: the inverse of $x \to 3x$ is $x \to x/3$.

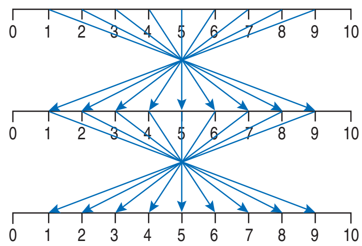


Find the inverse of a linear function such as:

- $x \to 3x + 1$
- $x \to 5x - 4$
- $x \to 2(x - 7)$
- $x \to \frac{x + 8}{10}$
- $x \to \frac{1}{4}x - 5$
- $x \to \frac{1}{2}x + 20$

Know that functions of the form $x \to c - x$ are self-inverse. For example:

- The inverse of $x \to 10 - x$ is $x \to 10 - x$.



Pupils should be taught to:	As outcomes, Year 7 pupils should, for example:

Express functions and represent mappings (continued)

Given inputs and outputs, find the function.
For example:

- Find the rule (single machine):

  2, 1, 7, 4 → [?] → 8, 4, 28, 16

  Multiply the input by 4 or, in symbols, $x \rightarrow 4x$.

- Find the rule (double machine):

  0, 6, 2, 5 → [?] → [?] → 3, 6, 4, 5.5

  Divide by 2 and add 3, or $x \rightarrow x/2 + 3$.

  0, 1, 5, 2 → [?] → [?] → 7, 8, 12, 9

  Different solutions are possible – and the two functions can be replaced by a single function.

Explore inverse operations to find the input given the output.

- Given the output, find the input for a particular machine:

  ? → [subtract 6] → [multiply by 3] → 9, 3, 15, 6

- Define the other machine(s):

  1, 2, 3, 4, 5 → [multiply by 3] → [?] → 1, 2, 3, 4, 5

  1, 2, 3, 4, 5 → [+ 3] → [× 2] → [?] → [?] → 1, 2, 3, 4, 5

Begin to recognise some properties of simple functions.

- A function can sometimes be expressed in more than one way,
  e.g. red number → (red number – 1) × 2
  or red number → red number × 2 – 2

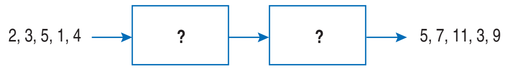
- A function can sometimes be expressed more simply, e.g.
  red number → red number × 3 × 5
  can be simplified to
  red number → red number × 15

- A function can often be inverted, e.g.
  if (red number – 1) × 2 = green number
  then green number ÷ 2 + 1 = red number

Link to inverse operations, equations and formulae (pages 114–15).

As outcomes, Year 8 pupils should, for example:

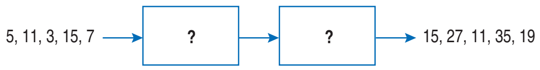
Given inputs and outputs, find the function. Given a linear function, put random data in order and use difference patterns to help find the function.
For example, find the rule:

- 

  Reorganise the data:

Input (x)	1	2	3	4	5
Output (y)	3	5	7	9	11
Difference	2	2	2	2	

  Recognise differences of 2. Try $x \rightarrow 2x + c$.
  From the first entry, find that $c = 1$.
  Check other values.

- 

  Reorganise the data:

Input (x)	3	5	7	11	15
Output (y)	11	15	19	27	35
Difference		4	4	8	8

  Recognise that the first two differences are 4, where x is increasing by 2 each time.
  Try $x \rightarrow 2x + c$. From the first entry, find that $c = 5$.
  Check other values.

Link linear functions to linear sequences, particularly difference patterns (pages 148–51).

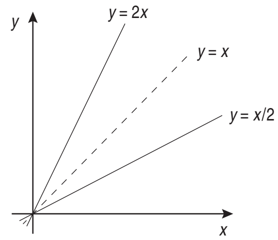
Know some properties of functions produced by combining number operations. For example:

- Two additions, two subtractions, or an addition with a subtraction, will simplify to a single addition or subtraction.
- Two multiplications, two divisions, or a multiplication with a division, will simplify to a single multiplication or division.
- A function may often be expressed in more than one way, e.g.
  $x \rightarrow 2x - 2$ is equivalent to $x \rightarrow 2(x - 1)$.
- Changing the order of two operations will often change the function, e.g.
  $x \rightarrow 3x - 4$ is different from $x \rightarrow 3(x - 4)$.
- The inverse of two combined operations is found by inverting the operations and reversing the order, e.g.
  the inverse of $x \rightarrow 2(x - 1)$ is $x \rightarrow x/2 + 1$.

Link to inverse operations, equations and formulae (pages 114–15).

As outcomes, Year 9 pupils should, for example:

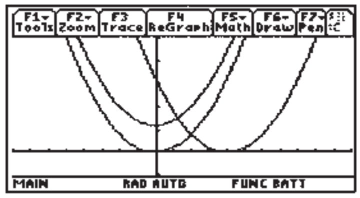
Plot the graph of a linear function, together with its inverse, on paper or using **ICT**. For example:



Observe the relationship between the two graphs: each is the reflection of the other in the line $y = x$.

Know some properties of quadratic functions and features of their graphs. For example:

- The graph is a curve, symmetrical about the vertical line through its turning point.
- The value of the y-coordinate at the turning point is either a maximum or a minimum value of the function.



Link to properties of quadratic sequences (pages 152–3), and plotting graphs of simple quadratic and cubic functions (pages 170–1).