Algebra: Introduction to Functions
Teaching Ideas

Learning Objective:	To interpret simple expressions as functions with inputs and outputs.
Success Criteria:	• To understand and apply function notation. • To substitute values into a function. • To solve simple equations involving function notation.
Context:	This can be used as an introduction to functions for higher tier students, to be followed with the lessons on composite and inverse functions. Students should be confident in substituting into expressions and solving equations.

Starter

Students answer the substitution and solving questions then rearrange their answers so they are in order of size, from smallest to largest. This will spell out the word 'inverse'.

Main Activities

What Is a Function?

Discuss the meaning and notation related to the word function, using an example from the starter activity. Students can make notes here. They should then move on to the 'Think, Pair, Share' activities, discussing the answer to each question with their partner before sharing with the class.
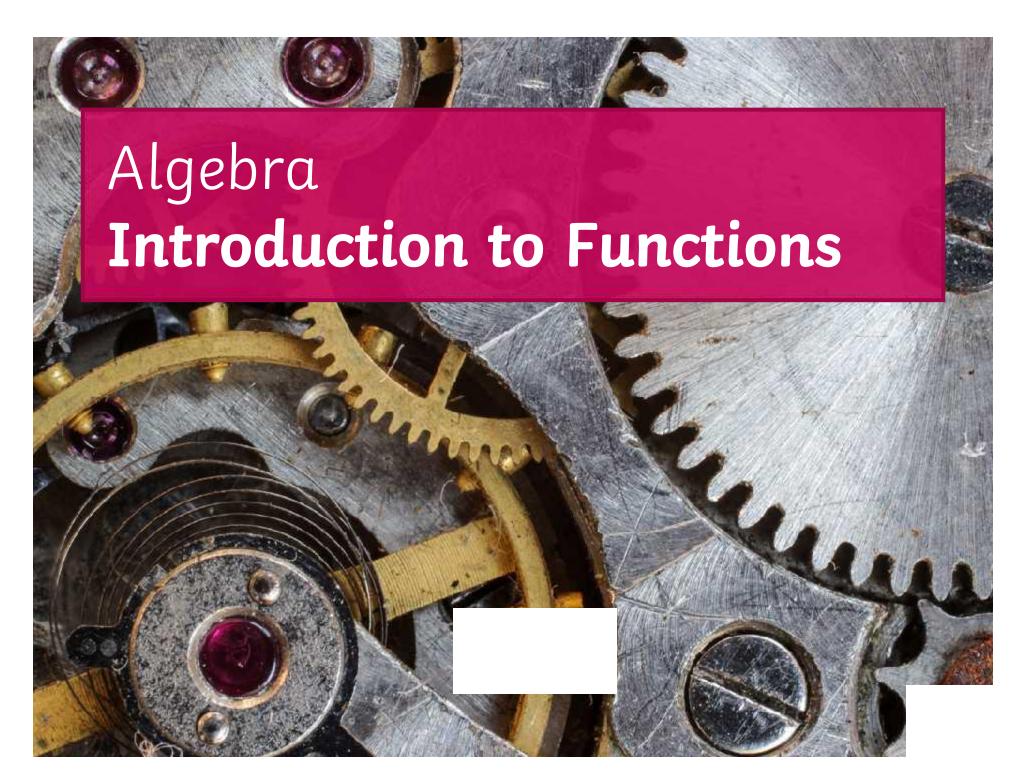
Your Turn!

Students should now work independently on the **Target Board Activity Sheet**. They will need to work out the integer answer to each question before crossing it off from their target board. This will leave two numbers, 1 and 9, for which (as an extension) they should find as many functions relating the two numbers as possible. For example, for the function $f(x) = 2x + 7, f(1) = 9$

Plenary

Lower ability students: Complete the statements WWW (What Went Well) and EBI (Even Better If) to assess their own understanding of the lesson today. If time, this should be discussed with the class and any misconceptions or remaining questions can be answered or made a note of for the next lesson

Higher ability students: Work through the exam style question in pairs, before discussing their answers with the class.

Algebra
Introduction to Functions

Learning Objective

To interpret simple expressions as functions with inputs and outputs.

Success Criteria

- To understand and apply function notation.
- To substitute values into a function.
- To solve simple equations involving function notation.

Starter

Work out the answers to the following problems, then put them in order of size (smallest to largest) to spell out a word. Can you provide a definition for this word?

s $y = 3x + 1$ Find the value of y when $x = 3$.

e $y = x^2$ Find the value of y when $x = -2$.

e $y = 2x^2 - 5$ Find the value of y when $x = 4$.

v $y = 7x - 4$ Find the value of x when $y = 10$.

i $y = x^3 - 9$ Find the value of x when $y = -17$.

n $4x + 1 = -3$ Solve the equation

r $\frac{2}{3}x - 4 = 2$ Solve the equation

Answers

s $y = 3x + 1$ Find the value of y when $x = 3$.   **y = 10**

e $y = x^2$ Find the value of y when $x = -2$.   **y = 4**

e $y = 2x^2 - 5$ Find the value of y when $x = 4$.   **y = 27**

v $y = 7x - 4$ Find the value of x when $y = 10$.   **x = 2**

i $y = x^3 - 9$ Find the value of x when $y = -17$.   **x = -2**

n $4x + 1 = -3$ Solve the equation   **x = -1**

r $\frac{2}{3}x - 4 = 2$ Solve the equation   **x = 9**

inverse This means the opposite. For example, the inverse of adding is subtracting. We use the inverse to help us solve equations.

What Is a Function?

A function is a mathematical rule with an input and an output.
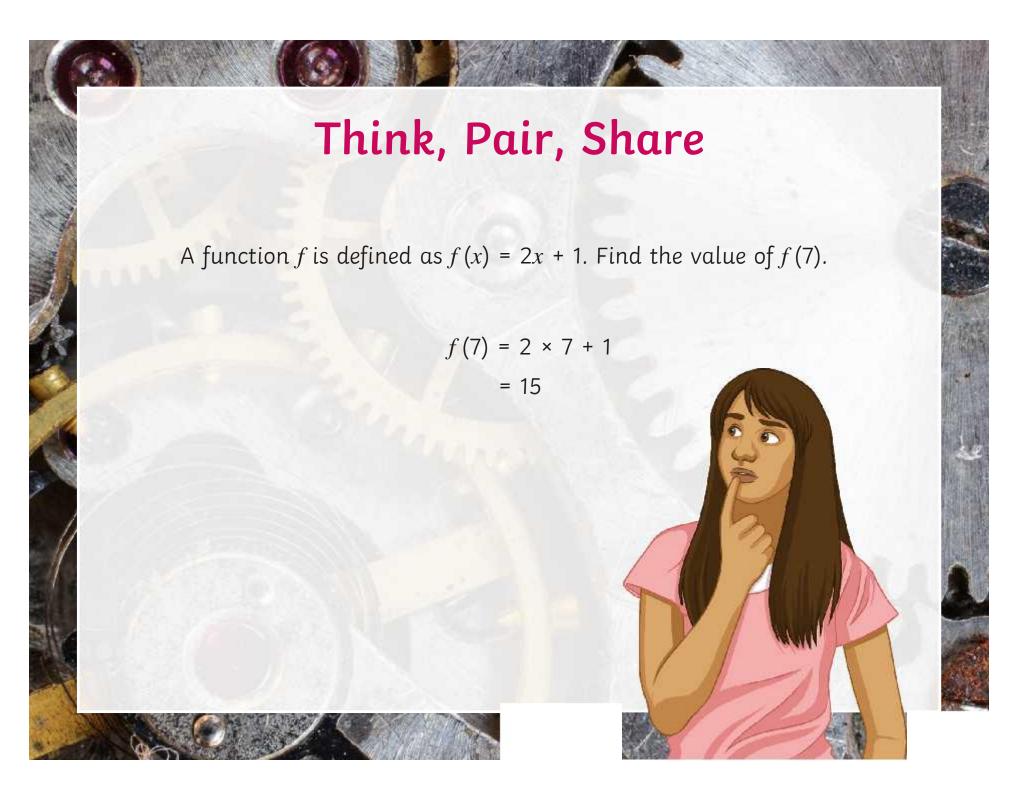
For example, the first task today was:

$y = 3x + 1$ Find the value of y when $x = 3$ ➡   **$y = 10$**
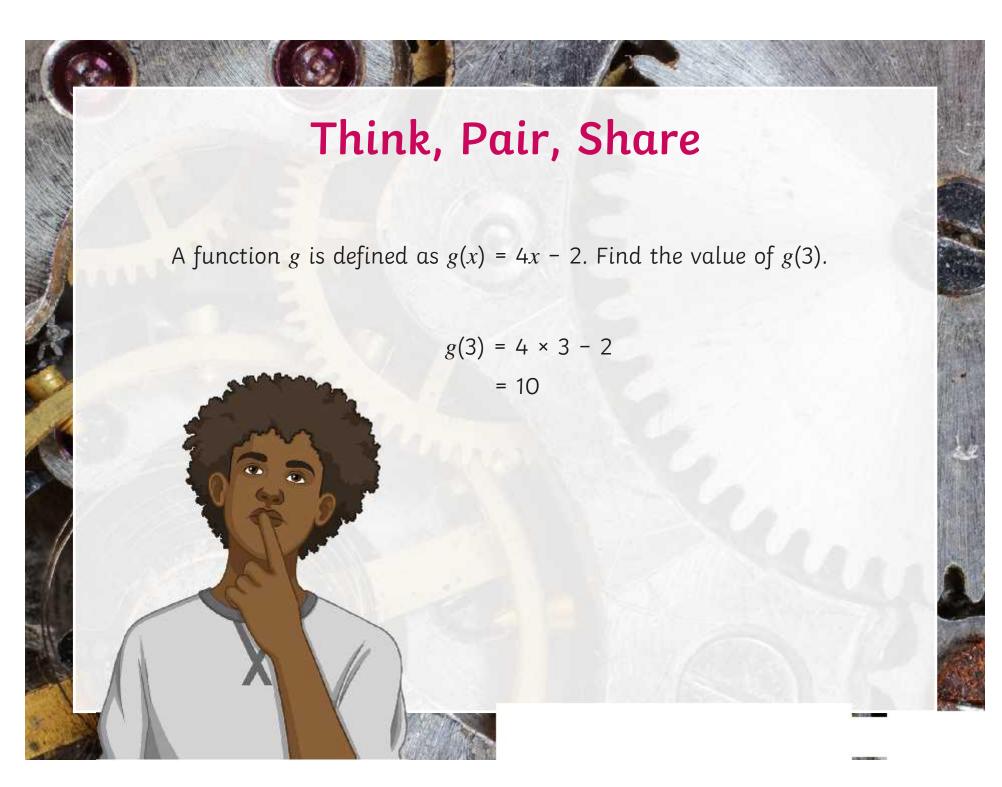
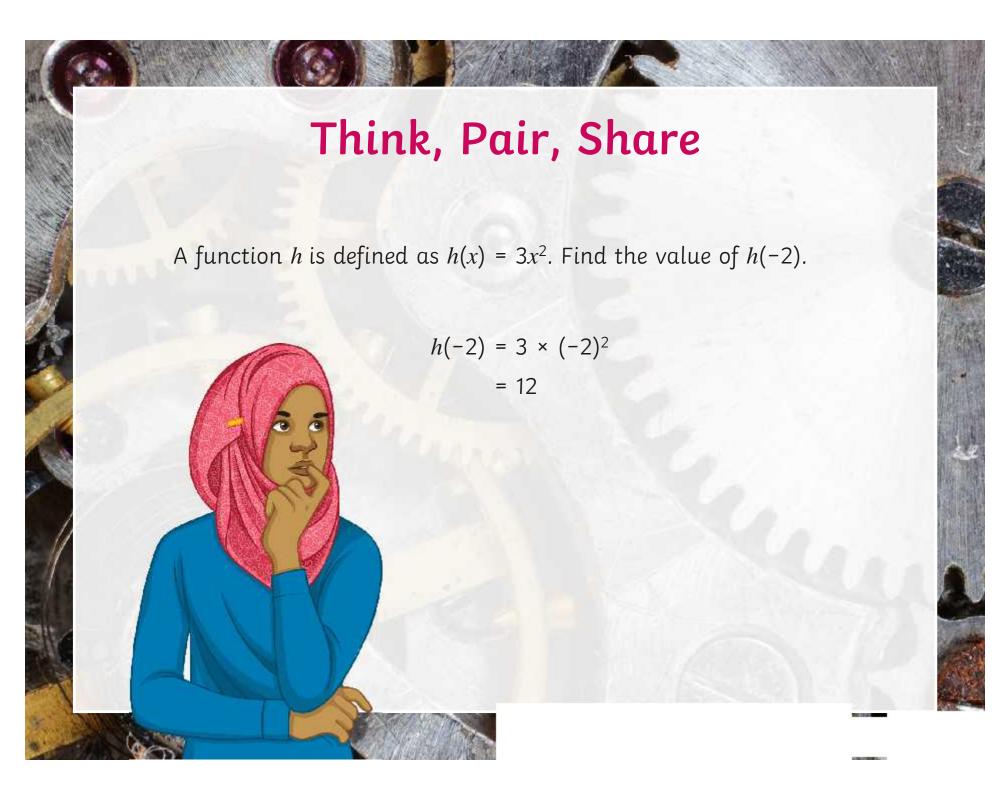This is a function with an input of 3 and an output of 10.

However, we use a special name when referring to functions. It is usually f, but could be g or even h.
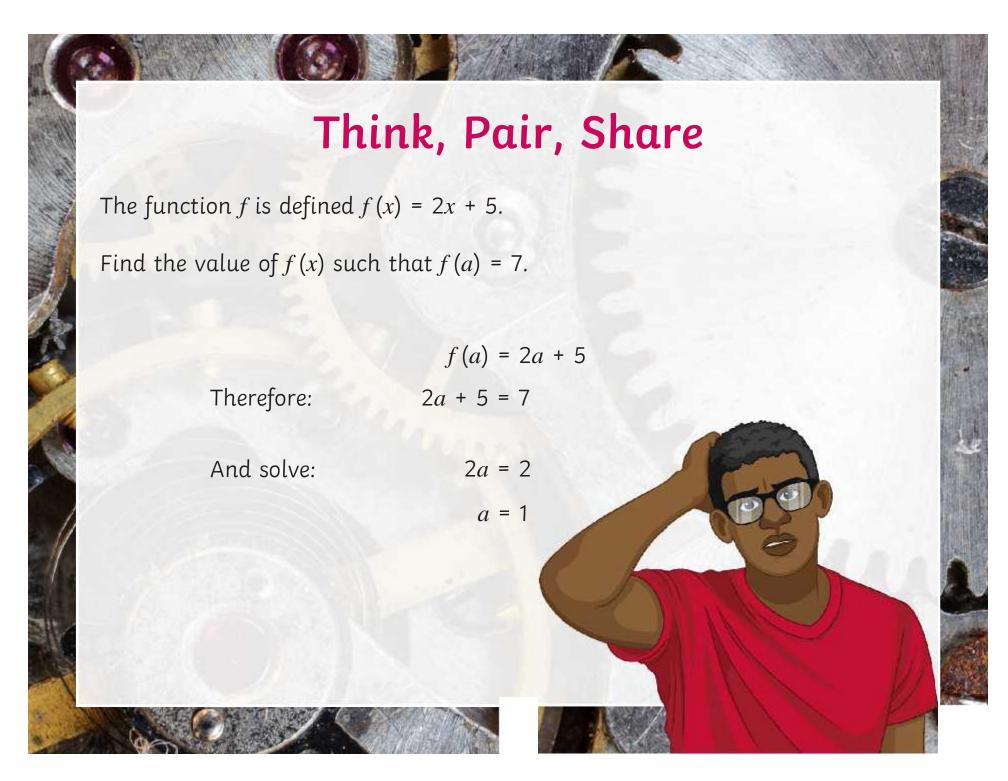
If we choose to call our function f, it becomes $f(x) = 3x + 1$.

Hence, $f(3) = 10$.

Think, Pair, Share

A function f is defined as $f(x) = 2x + 1$. Find the value of $f(7)$.

$$f(7) = 2 \times 7 + 1$$
$$= 15$$

Think, Pair, Share

A function g is defined as $g(x) = 4x - 2$. Find the value of $g(3)$.

$$g(3) = 4 \times 3 - 2$$
$$= 10$$

Think, Pair, Share

A function h is defined as $h(x) = 3x^2$. Find the value of $h(-2)$.

$$h(-2) = 3 \times (-2)^2$$
$$= 12$$

Think, Pair, Share

The function f is defined $f(x) = 2x + 5$.

Find the value of $f(x)$ such that $f(a) = 7$.

$$f(a) = 2a + 5$$

Therefore: $\qquad$ $2a + 5 = 7$

And solve: $\qquad$ $2a = 2$

$$a = 1$$

Your Turn!

Complete the questions on your Target Board.

When you have worked out the answer, cross it off on your target board. You will be left with just two numbers.

How many functions can you find where one of these numbers used as an input gives the other as an output?

Functions **Target Board**

1. The function f is such that $f(x) = 3x - 7$. Find $f(4)$.

2. The function g is such that $g(x) = 5x + 2$. Find $g(-3)$.

3. The function h is such that $h(x) = x^2 + 2x$. Find $h(1)$.

4. The function f is such that $f(x) = 2x + 1$.
   Find the value of x for which $f(x) = 15$.

5. The function g is such that $g(x) = \sqrt{(2x+4)}$. Find $g(6)$.

6. The function h is such that $h(x) = x^2$.
   Find the two values of x for which $h(x) = 64$.

7. The function f is such that $f(x) = 3x + 4$.
   Find the value of a for which $f(a) = a$.

8. The functions g and h are such that $g(x) = 7x - 1$ and $h(x) = 5x - 13$.
   Find the value of x for which $g(x) = h(x)$.

9. The function f is such that $f(x) = x^2$. The function g is such that $g(x) = 12 - 4x$. Find the positive value of x for which $f(x) = g(x)$.
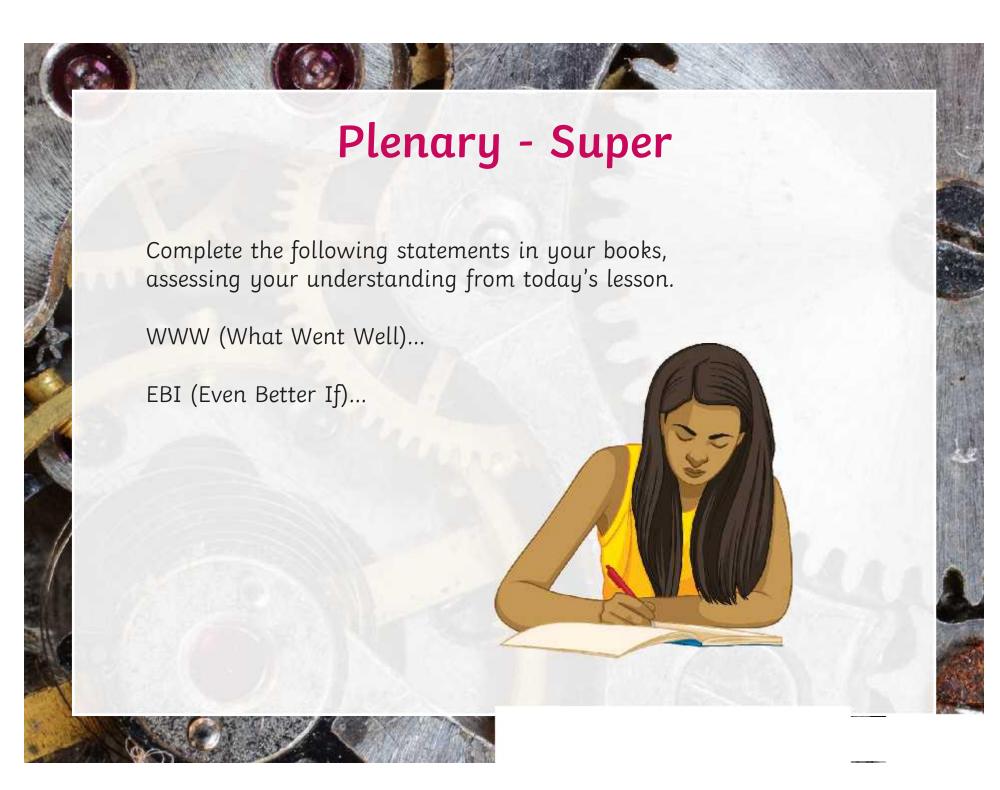
4	2	-8	3
-6	5	1	-2
8	9	7	-13

Answers

1. **5**

2. **−13**

3. **3**

4. **7**

5. **4**

6. **8, −8**

7. **−2**

8. **−6**

9. **2**

The remaining two numbers were 1 and 9.
What functions could you find to relate the two?

For example:
If the function f is defined by $f(x) = 8x + 1$, then $f(1) = 9$.

Plenary - Super

Complete the following statements in your books, assessing your understanding from today's lesson.

WWW (What Went Well)...

EBI (Even Better If)...

Plenary - Stretching

Exam style question:

f is a function such that $f(x) = x^2 + 4x + 7$.

Express $f(x + 2)$ in the form $(x + a)^2 + b$, where a and b are integers.

Hence, find the turning point of the curve $f(x + 2)$.

Answer

$f(x + 2) = (x + 2)^2 + 4(x + 2) + 7$

$f(x + 2) = x^2 + 4x + 4 + 4x + 8 + 7$

$f(x + 2) = x^2 + 8x + 19$

$f(x + 2) = (x + 4)^2 + 3$

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   Find the value of a for which $f(a) = a$.

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−6	5	1	−2
8	9	7	−13