

# Exercise walk-through

## Transformations of Functions ■ 1.12

eXercise

You must be able to

- describe  $g(x) = f(x) + k$  as a **vertical translation** 竖直平移
- describe  $g(x) = f(x + h)$  as a **horizontal translation** 水平平移

## Method — Translations

- $g(x) = f(x) + k$  shifts the graph **vertically** by  $k$  (up if  $k > 0$ ).
- $g(x) = f(x + h)$  shifts the graph **horizontally** by  $-h$  (so  $f(x - 2)$  shifts **right** 2).

## Method — Example

From  $f(x) = x^2$ :  $g(x) = x^2 + 3$  shifts up 3;  $h(x) = (x - 1)^2$  shifts right 1, with vertex at  $(1, 0)$ .

## Practice 2.1 ■ 1 mark

State the transformation given by  $f(x) + 3$ .

## Solution 2.1

### Worked steps

a vertical shift up by 3 **B1**.

## Practice 2.2 ■ 1 mark

State the transformation given by  $f(x - 2)$ .

## Solution 2.2

### Worked steps

a horizontal shift right by 2 **B1**.

## Practice 2.3 ■ 1 mark

Describe the graph of  $g(x) = f(x) + 5$  compared with  $f$ .

## Solution 2.3

## Worked steps

it is the graph of  $f$  shifted up 5 units **B1**.

## Exam-style 3.1 ■ 1 mark

$g(x) = f(x) + k$  is a

- A** horizontal shift
- B** vertical shift by  $k$
- C** reflection
- D** stretch

## Solution 3.1

**A** horizontal shift

**B** vertical shift by  $k$



**C** reflection

**D** stretch

**Worked steps**

**B.**

## Exam-style 3.2 ■ 1 mark

$g(x) = f(x - 4)$  shifts the graph of  $f$

**A** left 4

**B** right 4

**C** up 4

**D** down 4

## Solution 3.2

Method: Translations

A left 4

B right 4



C up 4

D down 4

Worked steps

B.

## Exam-style 3.3 ■ 1 mark

Start from  $f(x) = x^2$ .

(a) Describe  $g(x) = x^2 + 3$ .

(b) Describe  $h(x) = (x - 1)^2$ .

(c) State the vertex of  $h$ .

## Solution 3.3

## Worked steps

(a) shift  $f$  up 3 **B1**. (b) shift  $f$  right 1 **B1**. (c)  $(1, 0)$  **B1**.