

## Composite Functions

### Aim

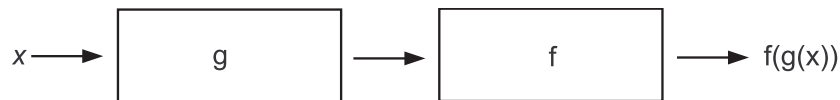
To introduce the idea of composite functions.

### Learning Outcomes

At the end of this section you will be able to:

- Understand the notation used when dealing with composite functions,
- Evaluate composite functions.

Sometimes it is desirable to apply two or more functions, one after the other. The output of one function becomes the input of the next function.



Suppose that  $f(x) = 3x$  and  $g(x) = x + 2$ . To calculate  $f(g(x))$  we let the output of  $g(x)$  become the input of  $f(x)$ . Therefore we get

$$g(x) = x + 2,$$

$$f(g(x)) = f(x + 2) = 3(x + 2) = 3x + 6.$$

What is happening is you are replacing the input of function  $f$  with the output from function  $g$  and then simplifying.

Composite functions can be written as  $f(g(x))$  or as  $f \circ g(x)$ . This can be read as “ $f$  of  $g$  of  $x$ ” or “ $f$  after  $g$  of  $x$ ”.

### Example

Let  $f(x) = 3x$  and let  $g(x) = x - 4$ . Calculate  $f(g(2))$ .

The first step is to calculate  $f(g(x))$ . To do this we replace the input in  $f$  with the output from  $g$ . Therefore

$$g(x) = x - 4,$$

$$\Rightarrow f(g(x)) = f(x - 4) = 3(x - 4) = 3x - 12.$$

We now know what  $f(g(x))$  is and by letting  $x = 2$  we will find the value of  $f(g(2))$ .

$$f(g(2)) = 3(2) - 12 = 6 - 12 = -6.$$

## Related Reading

Croft, A., R. Davison. 2003. *Foundation Mathematics*. 3<sup>rd</sup> Edition. Pearson Education Limited.