

## Composite Functions

Find an expression for  $fg(x)$  for each of these functions:

(a)  $f(x) = x - 1$  and  $g(x) = 5 - 2x$

(b)  $f(x) = 2x^2$  and  $g(x) = x + 3$

(a)  $fg(x) = 4 - 2x$

(b)  $fg(x) = 2(x+3)^2$   
 $= 2x^2 + 12x + 18$

Find an expression for  $gf(x)$  for each of these functions:

(a)  $f(x) = 2x + 1$  and  $g(x) = 4x + 3$

(b)  $f(x) = \frac{3}{x}$  and  $g(x) = 2x - 1$

(a)  $gf(x) = 8x + 7$

(b)  $gf(x) = \frac{6}{x} - 1$

The function  $f$  is such that  $f(x) = 2x - 3$

(i) Find  $ff(2)$

(ii) Solve the equation  $ff(x) = x$

(i)  $f(2) = 1$   $ff(2) = -1$

(ii)  $4x - 9 = x$   $x = 3$

Functions  $f$  and  $g$  are such that

$f(x) = x^2$  and  $g(x) = 5 + x$

(a) Find (i)  $fg(x)$  (ii)  $gf(x)$

(b) Solve  $fg(x) = gf(x)$

(ai)  $fg(x) = (5+x)^2$   
 $= x^2 + 10x + 25$

(a ii)  $gf(x) = 5 + x^2$

(b)  $x^2 + 10x + 25 = 5 + x^2$   
 $x = -2$

The function  $g$  is such that

$g(x) = \frac{1}{1-x}$  for  $x \neq 1$

(a) Prove that  $gg(x) = \frac{x-1}{x}$

(b) Find  $ggg(3)$

(a)  $gg(x) = \frac{1}{1 - \frac{1}{1-x}} = \frac{1}{\frac{-x}{1-x}}$   
 $= \frac{1-x}{-x} = \frac{x-1}{x}$

(b)  $gg(3) = \frac{2}{3}$   $ggg(3) = g(\frac{2}{3})$   
 $= 3$

Functions  $f$ ,  $g$  and  $h$  are such that

$f(x) = 3 - x$

$g(x) = x^2 - 14$  and

$h(x) = x - 2$

Given that  $f(x) = gfh(x)$ , find the values of  $x$ .

$(5-x)^2 - 14 = 3 - x$   
 $x = 8, x = 1$