

## Composite Function

If  $f$  and  $g$  are functions, the composite function  $f \circ g$  ("f composed with g") is defined by

$$(f \circ g)(x) = f(g(x)).$$

The domain of the composite function consists of numbers  $x$  in the domain of function  $g$  for which  $g(x)$  lies in the domain of function  $f$ .

Example 1: If  $f(x) = \sqrt{x}$  and  $g(x) = x + 1$  find the following:

a)  $(f \circ g)(x)$

b)  $(g \circ f)(x)$

c)  $(f \circ f)(x)$

d)  $(g \circ g)(x)$

## Operations with Function

Operation	Notation	Alternative Notation	Domain	Range
Addition				
Subtraction				
Multiplication				
Division				
Composition				

Example 2: Find the domains and ranges of  $f, g, f + g$  and  $f \cdot g$ .

a)  $f(x) = x$  and  $g(x) = \sqrt{x-1}$

b)  $f(x) = \sqrt{x+1}, g(x) = \sqrt{x-1}$

Example 3: If  $f(x) = x + 5$  and  $g(x) = x^2 - 3$ , find the following:

$f(g(0))$		$g(f(0))$	
$f(g(x))$		$g(f(x))$	
$f(f(-5))$		$g(g(2))$	
$f(f(x))$		$g(g(x))$	

Example 4: If  $f(x) = \sqrt{x}$  and  $g(x) = \frac{4}{x}$ ,  $h(x) = 4x - 8$ , find the following:

$h(g(f(x)))$		$g(f(h(x)))$	
$f(h(g((x))))$		$f(g(h(x)))$	

Example 5: Write the formula for  $f(g(x))$  and  $g(f(x))$  and find the domain and range of each:

a)  $f(x) = \sqrt{x+1}$  and  $g(x) = \frac{1}{x}$ .

b)  $f(x) = x^2$  and  $g(x) = 1 - \sqrt{x}$