

## 5.1 Evaluate Composite Functions

**Composite Functions** – a way of combining two functions

$(f \circ g)(x) = f(g(x))$  This is pronounced “f of g of x” DOES NOT MEAN F TIMES G!!!

$(g \circ f)(x) = g(f(x))$  This is pronounced “g of f of x” DOES NOT MEAN G TIMES F!!

These are not multiplications. The  $(f \circ g)(x)$  means we place the g function into the f function.

The  $(g \circ f)(x)$  means we place the f function into the g function.

EXAMPLE: Given:  $f(x) = 5x - 4$  and  $g(x) = 3x + 1$  find the following:

$(f \circ g)(2)$ ,  $(g \circ f)(-1)$ ,  $(f \circ g)(x)$ ,  $(g \circ f)(x)$ ,  $(f \circ f)(x)$ ,  $(g \circ g)(x)$

a.)  $(f \circ g)(2) = f(g(2))$  First we rewrite this using the definition, replacing x with 2.

b.)  $(g \circ f)(-1) = g(f(-1))$  First we rewrite this using the definition, replacing x with -1.

c.)  $(f \circ g)(x) = f(g(x))$  We use the definition.

d.)  $(g \circ f)(x) = g(f(x))$  We use the definition.

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

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

EXAMPLE: Given:  $f(x) = x + 3$  and  $g(x) = 2x^2 - 1$  find the following:

$$(f \circ g)(-1), (g \circ f)(0), (f \circ g)(x), (g \circ f)(x), (f \circ f)(x), (g \circ g)(x)$$

For this one the process is the same as I described about. I will only show the algebraic steps here.

a.)  $(f \circ g)(-1) = f(g(-1))$

b.)  $(g \circ f)(0) = g(f(0))$

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

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

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

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

EXAMPLE: Given:  $f(x) = 4 - x^2$  and  $g(x) = \frac{-1}{x}$  find the following:  $(f \circ g)(0)$ ,  $(f \circ g)(x)$ ,  $(g \circ f)(x)$ ,  $(f \circ f)(x)$ ,  $(g \circ g)(x)$ . Express all as single fractions in factored form if possible.

$$a.) (f \circ g)(0) = f(g(0))$$

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

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

d.)  $(f \circ f)(x)$

e.)  $(g \circ g)(x)$

EXAMPLE: If  $f(x) = \frac{5}{x-3}$  and  $g(x) = \frac{1}{x}$ , find the domain of  $(f \circ g)(x)$  in set builder notation.

EXAMPLE: Find functions  $f$  and  $g$  so that  $(f \circ g)(x) = H(x)$  given that  $H(x) = (1 + x^2)^3$

EXAMPLE: Find functions  $f$  and  $g$  so that  $(f \circ g)(x) = H(x)$  given that  $H(x) = \sqrt{2x-1} - 4x + 2$

EXAMPLE: Use the given table to evaluate each composition.

$x$	-3	-2	-1	0	1	2	3
$f(x)$	11	9	7	5	3	1	-1
$g(x)$	-8	-3	0	1	0	-3	-8

a.) Find  $(f \circ g)(1)$ .

b.) Find  $(f \circ g)(2)$ .

c.) Find  $(g \circ f)(2)$ .

d.) Find  $(g \circ g)(1)$ .

e.) Find  $(f \circ f)(3)$ .