

6-1B Operations of Functions

composition of functions

composition of functions: when the range of one function is found using the other function as its domain - a function within a function.

$[f \circ g](x) = f \circ g(x) = f(g(x))$ reads "f of g of x" h o g o f

To evaluate composition functions - for $[f \circ g](x)$

- evaluate the function $g(x)$ first.
- use the range of $g(x)$ as the domain of $f(x)$ and evaluate the new value.

Examples: Evaluate the composition $f \circ g(x)$ and $g \circ f(x)$ for the following values below if $f(x) = x + 5$ and $g(x) = 2x - 7$.

1. $f \circ g(5)$

$f(g(5))$

3rd

$g(5) = 2(5) - 7$
 $= 10 - 7$

$g(5) = 3$

$f(3) = 3 + 5$

$f \circ g(5) = 8$

$g(x) = (5, 3)$

$f(x) = (3, 8)$

$f \circ g = (5, 8)$

2. $g \circ f(5)$

$g \circ f = g(f(5))$

$f(5) = 5 + 5$

$f(5) = 10$

$g(10) = 2(10) - 7$
 $= 20 - 7$

$g \circ f(5) = 13$

$f(x) = (5, 10)$

$g(x) = (10, 13)$

$g \circ f = (5, 13)$

Find $f \circ g$ and $g \circ f$ for the following functions. Write your answer as a set of ordered pairs.

1st

$$f(x) = \{(2, 6), (9, 4), (7, 7), (0, -1)\}$$

$$g(x) = \{(7, 0), (-1, 7), (4, 9), (8, 2)\}$$

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

$$(7 \rightarrow 0 \rightarrow -1)$$

$$(-1 \rightarrow 7 \rightarrow 7)$$

$$(4 \rightarrow 9 \rightarrow 4)$$

$$(8 \rightarrow 2 \rightarrow 6)$$

$$f \circ g = \{(7, -1), (-1, 7), (4, 4), (8, 6)\}$$

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

$$2 \rightarrow 6 \rightarrow \text{X}$$

$$9 \rightarrow 4 \rightarrow 9$$

$$7 \rightarrow 7 \rightarrow 0$$

$$0 \rightarrow -1 \rightarrow 7$$

$$g \circ f = \{(9, 9), (7, 0), (0, 7)\}$$

Simplifying Composition Functions

- plug 2nd function into the 1st function.
- simplify the new composition.

Example: Find $f \circ g$ and $g \circ f$ when $f(x) = 3x^2 - x + 4$ and $g(x) = 2x - 1$.

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

$$f(2x-1) = 3(2x-1)^2 - (2x-1) + 4$$

$$= 3(4x^2 - 4x + 1) - 2x + 1 + 4$$

$$= 12x^2 - 12x + 3 - 2x + 5$$

$$f \circ g = 12x^2 - 14x + 8$$

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

$$g(3x^2 - x + 4) =$$

$$2(3x^2 - x + 4) - 1$$

$$6x^2 - 2x + 8 - 1$$

$$g \circ f = 6x^2 - 2x + 7$$



Page 389,390
18 - 48 evens
(skip 36, 38, 40)