Name: _____

Date: _____

Period: _____

Student Workbook

Composition of Functions

Learning Target: I can evaluate and find composite functions, and determine the domain of a composition.

Vocabulary

Term	Meaning
Composition of Functions	Using the output of one function as the input of another.
$(f \circ g)(x)$	Read "f of g of x" or "f composed with g." Means $f(g(x))$ — apply g FIRST, then f.
Domain of a Composition	The set of x-values for which g(x) is defined AND g(x) fits into the domain of f.

Key Concept: Order Matters!

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

Work from the INSIDE OUT: first find g(x), then plug that result into f.

In general, $(f \circ g)(x) \neq (g \circ f)(x)$ — the order you compose functions usually changes the result!

EXAMPLE 1 — Numeric Composition

Given $f(x) = 2x + 3$ and $g(x) = x^2 - 1$, find $(f \circ g)(2)$.

$g(2) =$ _____ $\rightarrow$ $f($_____$) =$ _____

EXAMPLE 2 — Algebraic Composition (Both Orders)

Using the same f and g from Example 1:

$(f \circ g)(x) = f(g(x)) = f(x^2-1) = 2(x^2-1) + 3 =$ _____

$(g \circ f)(x) = g(f(x)) = g(2x+3) = (2x+3)^2 - 1 =$ _____

Notice these two results are different — that confirms order matters!

COMMON MISTAKE

$(f \circ g)(x)$ is NOT the same as $f(x) \cdot g(x)$! The little circle means composition (plug one function into the other), not multiplication.

Key Concept: Domain of a Composition

EXAMPLE 3

Find the domain of $(f \circ g)(x)$ where $f(x) = \sqrt{x}$ and $g(x) = x - 4$.

$(f \circ g)(x) = \sqrt{(x-4)}$. Need $x - 4 \geq$ _____ $\rightarrow$ $x \geq$ _____ $\rightarrow$ domain: [_____, ∞)

Key Concept: Decomposing a Function

WORKING BACKWARDS

Given a complicated function h(x), you can often write it as f(g(x)) by identifying an "inner" expression g(x) and an "outer" operation f(x).

EXAMPLE 4

Decompose $h(x) = \sqrt{(x + 5)}$ into f(g(x)).

g(x) = _____ f(x) = _____

Guided Practice — Part A: Evaluate Numerically

Given $f(x) = x + 5$ and $g(x) = 3x$:

A1 Find $(f \circ g)(2)$ and $(g \circ f)(2)$.

A2 Using this table, find $(f \circ g)(3)$.

x	1	2	3	4
f(x)	3	5	7	9
g(x)	2	4	1	3

Guided Practice — Part B: Find the Composition Algebraically

Given $f(x) = x^2 + 2$ and $g(x) = x - 1$:

B1 Find $(f \circ g)(x)$.

B2 Find $(g \circ f)(x)$.

Guided Practice — Part C: Domain of a Composition

C1 $f(x) = 1/x$, $g(x) = x + 3$. Find the domain of $(f \circ g)(x)$.

C2 $f(x) = \sqrt{x}$, $g(x) = x - 2$. Find the domain of $(f \circ g)(x)$.

Guided Practice — Part D: Decompose the Function

D1 $h(x) = (x + 3)^2$

D2 $h(x) = 1 / (x - 5)$

BEFORE YOU MOVE ON

Check with a partner: for $(f \circ g)(x)$, did you substitute $g(x)$ into EVERY instance of x in $f(x)$?