Warm Up

Simplify:

1. $(x^2 + 4) + (x^2 - 3x + 6)$ $= 2x^2 - 3x + 10$

2. $(x - 3)(x + 4)$ $= x^2 + x - 12$

3. $(x^2 + 2x - 15) \div (x - 3)$ $= x + 5$

$$\begin{array}{r|rrr} 3 & 1 & 2 & -15 \\ & & 3 & 15 \\ \hline & 1 & 5 & 0 \end{array}$$

Objective: SWBAT take given functions and find a combination or composite of them

Agenda:

- Warm Up
- Discovery
- Notes
- Examples
- Practice
- Reflection

$(f \circ g)(x)$

$f(g(x))$

$f(4)$

- HW: 6-6 Form G, 13-21, 25

Discovery

Complete the discovery on combining functions. Write everything out! If you need space to work, write on the back.

When you finish, get an Precalculus book and practice with the problems listed at the bottom of the discovery.

$f(g(x)) \stackrel{?}{=} g(f(x))$

no

Notes: Combining functions

If we have two functions, $f(x) = x^2 - 7x + 10$ and $g(x) = x - 5$, how could we get:

addition:
$h(x) = (f + g)(x) = f(x) + g(x)$

subtraction:
$j(x) = (f - g)(x) = f(x) - g(x)$

multiplication:
$k(x) = (f \bullet g)(x) = f(x) \bullet g(x)$

division:
$l(x) = (f \div g)(x) = f(x) \div g(x)$

Notes: Composite Functions

A composite function is a combination of two or more functions in which the output (y-value) of one function becomes the input (x-value) of another.

It is written as either $f(g(x))$ or $(f \circ g)(x)$ and read as "f of g of x."

example:

$f(x) = 3x$, $g(x) = -x^2 - 1$

Substitute $g(x)$ in

$f(g(x)) = f(-x^2 - 1) = 3(-x^2 - 1) = -3x^2 - 3$

plug in to $f(x)$

is it the same as $g(f(x))$? (no)

Notes: Domain of Composite Functions

Steps:

1. Find the domain of the inner & outer function. If the inner function has a restriction, keep it.

2. Find the composite function.

3. Find the values of the inner function that lie within the domain of the outer function.

ex) find $(f \circ g)(x)$ if $f(x) = -4/x$ and $g(x) = x/(x + 2)$

$= \frac{-4}{x}$ $= \frac{x}{x+2}$

$(f \circ g)(x) = f\left(\frac{x}{x+2}\right) = \frac{-4}{\frac{x}{x+2}}$

$= \frac{-4}{1} \cdot \frac{x+2}{x} = \frac{-4x-8}{x}$

$f(x)$: $x \neq 0$ or $(-\infty, 0), (0, \infty)$

$g(x)$: $x \neq -2$ or $(-\infty, -2), (-2, \infty)$

$g(x) \neq 0 \rightarrow \frac{x}{x+2} \neq 0 \rightarrow x \neq 0$

domain: $x \neq -2, x \neq 0$

Examples

If $f(x) = x^2 - 1$, $g(x) = x + 1$, and $h(x) = 2/x$, find each function and its domain:

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

$f(x+1)$

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

$= x^2 + 2x + 1 - 1$

$= x^2 + 2x, (-\infty, \infty)$

2. $(f \circ h)(x)$

3. $(g \circ h)(x)$

$g\left(\frac{2}{x}\right) = \frac{2}{x} + 1$

$(-\infty, 0) \cup (0, \infty)$

(or)

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

Practice

Precalculus: pg. 61 #15-28

Reflection

How is composition of functions similar to and different from arithmetic with functions?