Section 4.2: Operations on Functions

Essential Question: What is a composite function?

Given f and g are functions...

1. **Sum** of f and g: $(f+g)(x) =$ $f(x) + g(x)$

2. **Difference** of f and g: $(f-g)(x) =$ $f(x) - g(x)$

3. **Product** of f and g: $(f \cdot g)(x) = f(x) \cdot g(x)$

4. **Quotient** of f and g: $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$, provided $g(x) \neq 0$

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

a) Find the sum
(f + g)(x) = $f(x) + g(x) = (x^2) + (x+1) = \boxed{x^2+x+1}$

b) Find the difference
(f − g)(x) = $f(x) - g(x) = (x^2) - (x+1) = \boxed{x^2-x-1}$

* Distribute Negative Sign

c) Find the product
(fg)(x) = $f(x) \cdot g(x) = (x^2)(x+1) = \boxed{x^3+x^2}$

The Composite Function

- Given functions f and g, denoted $(f \circ g)(x) = f\left(g\left(x\right)\right)$
- Read as "f of g" (the open circle is **NOT** a multiplication symbol)
- x is in the domain of function g and $g(x)$ is in the domain of function f

Example: use the same functions f and g above

Ex2) $(f \circ g)(x) = f\left(g(x)\right) = f(x+1) = (x+1)^2 = (x+1)(x+1)$ FOIL

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

$= \boxed{x^2+2x+1}$

Ex3) $(g \circ f)(x) = g(f(x)) = (x^2)+1$

$= \boxed{x^2+1}$

* Notice ← Different →

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

5) $(f + g)(x) = (x^2+x)+(x+1)$

x^2+2x+1

6) $(f - g)(x) =$

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

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

7) $(f \cdot g)(x) =$

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

$= x^3+x^2+x^2+x = x^3+2x^2+x$

8) $(f \div g)(x) =$

$\frac{x^2+x}{x+1} = \frac{x(x+1)}{x+1} = x$

$x \neq -1$

9) a) $f(g(2)) =$

$g(2) = 2+1 = 3$

$f(3) = 3^2+3 = 9+3$

$= 12$

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

$f(g(x)) = f(x+1) = (x+1)^2+(x+1)$

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

$= x^2+3x+2$

10) a) $(g \circ f)(2) =$

$f(2) = (2)^2+2 = 4+2 = 6$

$g(6) = 6+1 = 7$

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

$f(x) = x^2+x$

$g(f(x)) = g(x^2+x) = (x^2+x)+1$

x^2+x+1

Section 4.2 Summary:

A composite function is plugging a function into a function. The composite of "F of G" is written as $(f \circ g)(x)$ or $f(g(x))$.

what you plug into g first = g(x)
then plug g(x) into function f.