Name: _____ Date: _____ Period: _____

2.7 Operations with Functions

You can add, subtract, multiply and divide functions together. You can also add, subtract, multiply or divide outputs of functions.

Operations	Notations	What to Do
Add	$(f+g)(x)$ $f(x)+g(x)$	COMBINE like terms
Subtract	$(f-g)(x)$ $f(x)-g(x)$	write the difference distribute the minus combine like terms
Multiply	gf $g \circ f$ $(g \cdot f)(x)$ $g(x) \cdot f(x)$	distribute or FOIL depending on # of terms.
Divide	$(g \div f)(x)$ $\left(\frac{g}{f}\right)(x)$ $\frac{g(x)}{f(x)}$	write functions as a fraction.

Suppose $f(x) = 2x + 3$ and $g(x) = -4x^2 + 12$ and $h(x) = \frac{6}{x}$. Find the following operations.

1. $f(x) + g(x)$

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

$2x+15-4x^2$

2. $g(x) - f(x)$

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

$-4x^2+12-2x-3$

$-4x^2+9-2x$

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

$h(x) \cdot g(x)$

$\frac{6}{x}(-4x^2+12)$

$\frac{6}{x}\cdot\frac{-4x^2}{1} + \frac{6}{x}\cdot\frac{12}{1}$

$-24x + \frac{72}{x}$

4. $\frac{g(x)}{f(x)}$

$\frac{-4x^2+12}{2x+3}$

5. $(f-g)(x)$

6. $f(x) \cdot g(x)$

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

$-8x^3+24x-12x^2+36$

Note: These problems must be done **without** a calculator.

Sometimes, the problems have a number where x is and that means that they want you to add, subtract, multiply, or divide the outputs of those functions for those values of x. **You should evaluate each function first and then perform the operations** with those outputs.

Suppose $f(x) = x^2 + 1$ and $g(x) = -x + 5$ and $h(x) = \sqrt{x}$

7. Find $f(2) \cdot g(2)$	8. $(h + g)(4)$	9. $\left(\frac{h}{g}\right)(9)$
$f(2) = 2^2 + 1$ $g(2) = -2 + 5$ $f(2) = 5$ $g(2) = 3$ $f(2) \cdot g(2)$ $5 \cdot 3$ 15	$h(4) + g(4)$ $h(4) = \sqrt{4}$ $g(4) = -4 + 5$ $h(4) = 2$ $g(4) = 1$ $2 + 1$ 3	$\frac{h(9)}{g(9)}$ $h(9) = \sqrt{9}$ $g(9) = -9 + 5$ $h(9) = 3$ $g(9) = -4$ $\frac{3}{-4}$

Use your calculator to check. ALPHA TRACE ENTER for function shortcut. 1:Y_1 2:Y_2 ⋮

Composition of Functions

This is the last operation where you put one function inside of another.

Notations: $g(f(x))$ or $(g \circ f)(x)$ Say "g of f of x"

Please know that order matters, so, 90% of the time $g(f(x)) \neq f(g(x))$

Suppose $f(x) = x^2$ and $g(x) = 2x + 3$	
Find $f(g(x))$	Find $g(f(x))$
Suppose $f(x) = -x + 5$ and $g(x) = 3 - 2x$	
Find $f(g(x))$	Find $g(f(x))$

Now with input values...

Suppose $f(x) = 2x + 1$ and $g(x) = x^2$			
a) Find $f(g(3))$	b) Find $g(f(-1))$	c) $g(g(2))$	d) $g(f(5))$

Don't forget to check your answers with the calculator when you have input values.