Name: _____ Period: _____

5.1 – Operations on Functions/Composition

I can use function notation when adding, subtracting, multiplying and dividing two functions.
I understand what a composition of functions is & can find f(g(x)) & g(f(x)) when given two sets of ordered pairs.
I can find f(g(x)) and g(f(x)) when given functions f(x) and g(x).
I can find the domain and range of a composite function.

Operations on Functions:

$(f+g)(x) = f(x) + g(x)$
$(f-g)(x) = f(x) - g(x)$
$(f \cdot g)(x) = f(x)\,g(x)$
$\left(\frac{f}{g}\right)(x) = f(x)/g(x)$ Domain: $g(x) \neq 0$

Operations of Functions and their Domains

#9 $f(x) = x - 1$ *and* $g(x) = 5x - 2$

Find the functions of $f + g, f - g, fg,$ *and* $\frac{f}{g}$ *and their domains.*

$(f+g)(x) = (x-1) + (5x-2) = 6x-3$
$(f-g)(x) = (x-1) - (5x-2) = -4x+1$
$(fg)(x) = (x-1)(5x-2) = 5x^2 - 7x + 2$
$\left(\frac{f}{g}\right)(x) = \frac{x-1}{5x-2}$ D: $x \neq 2/5$

#11 $f(x) = 3x$ *and* $g(x) = -2x + 6$

Find the functions of $f + g, f - g, fg,$ *and* $\frac{f}{g}$ *and their domains.* (you try)

Composition of Functions

Given two functions f and g, the **composite function** $f \circ g$ is defined by: $(f \circ g)(x) = f(g(x))$
$(g \circ f)(x) = g(f(x))$

Example 1: Compose Functions

For each pair of functions, find $[f \circ g](x)$ *and* $[g \circ g](x)$, if they exist. State the domain and range for each composed function.

$$f = \{(1,8),(0,13),(15,11),(14,9)\}, g = \{(8,15),(5,1),(10,14),(9,0)\}$$

To find $f \circ g$, evaluate $g(x)$ first. Then use the range to evaluate $f(x)$. start with domain from $g(x)$

$f(g(8)) = f(15) = 11$
$f(g(5)) = f(1) = 8$
$f(g(10)) = f(14) = 9$
$f(g(9)) = f(0) = 13$

To find $g \circ f$, evaluate $f(x)$ first. Then use the range to evaluate $g(x)$. start with domain of $f(x)$

$g(f(1)) = g(8) = 15$
$g(f(0)) = g(13) =$ undefined
$g(f(15)) = g(11) =$ undefined
$g(f(14)) = g(9) = 0$

For each pair of functions, find $f \circ g$ and $g \circ f$, if they exist. State the domain and range for each composed function.

you try

17. $f = \{(-8, -4), (0, 4), (2, 6), (-6, -2)\}$
$g = \{(4, -4), (-2, -1), (-4, 0), (6, -5)\}$

19. $f = \{(5, 13), (-4, -2), (-8, -11), (3, 1)\}$
$g = \{(-8, 2), (-4, 1), (3, -3), (5, 7)\}$

Example 2: Compose Functions:

b. $f(x) = 2a - 5, g(x) = 4a$

$[f \circ g](x) = f[g(x)]$ Composition of functions $[g \circ f](x) = g[f(x)]$

$f(4a) = 2(4a) - 5$
$8a - 5$

$g(2a-5) = 4(2a-5)$
$8a - 20$

27. $f(x) = 2x$
$g(x) = x + 5$

$f[g(x)] = f(x+5)$
$= 2(x+5) = 2x + 10$

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

29. $f(x) = x + 5$
$g(x) = 3x - 7$

you try

31. $f(x) = x^2 + 6x - 2$
$g(x) = x - 6$

you try

$f(x) = 5x$, and $g(x) = -2x + 1$, $h(x) = x^2 + 6x + 8$

Find each value,

you try

41. $f[g(-2)]$ $g(-2) = -2(-2) + 1$
$= 5$
$f(5) = 5(5)$
$= 25$

42. $g[h(3)]$