Math 3   Name: __Key__

Unit 1 Day 8 Notes Cont. – Function Operations   Date:_____

Review: Evaluate each function for the given value of x.

Let f(x) = 3x + 4. Find f(-2).

$f(-2) = 3(-2) + 4$

$= -6 + 4$

$= -2$

Let g(x) = 2x² – 3x + 1, Find 3g(a + 2)

$g(a+2) = 2(a+2)^2 - 3(a+2) + 1$

$= 2(a+2)(a+2) - 3a - 6 + 1$

$= 2(a^2 + 4a + 4) - 3a - 5$

$= 2a^2 + 8a + 8 - 3a - 5$

$= (2a^2 + 5a + 3)3$

$= 6a^2 + 15a + 9$

Part 1: Basic operations with Functions

Operation	Definition	Examples if f(x)= x + 2 and g(x) = 3x
Sum	(f + g)x = f(x) + g(x)	$f(x) + g(x) = x + 2 + 3x$ $= 4x + 2$
Difference	(f – g)x = f(x) – g(x)	$f(x) - g(x) = x + 2 - (3x)$ $= x + 2 - 3x$ $= -2x + 2$
Product	(f • g)x = f(x) • g(x)	$f(x) \cdot g(x) = (x+2)(3x)$ $= 3x^2 + 6x$
Quotient	$\left(\dfrac{f}{g}\right)(x) = \dfrac{f(x)}{g(x)},\ g(x) \neq 0$	$\dfrac{f(x)}{g(x)} = \dfrac{(x+2)}{3x}\ x \neq 0$ $\boxed{\frac{3x=0}{3}\ \frac{0}{3}\ x \neq 0}$

Given f(x) = x² -3x + 1 and g(x) = 4x + 5, find each function.

a) (f + g)(x) $= f(x) + g(x)$

$= x^2 - 3x + 1 + 4x + 5$

$= x^2 + x + 6$

b. (f – g)(x) $= f(x) - g(x)$

$= x^2 - 3x + 1 - 1(4x+5)$

$= x^2 - 3x + 1 - 4x - 5$

$= x^2 - 7x - 4$

Given f(x) = x² + 5x – 1 and g(x) = 3x – 2, find each function.

a) (f • g)(x)

$(x^2 + 5x - 1)(3x - 2)$

	x²	5x	-1
3x	3x³	15x²	-3x
-2	-2x²	-10x	2

$3x^3 + 15x^2 - 3x - 2x^2 - 10x + 2$

$3x^3 + 13x^2 - 13x + 2$

b. $\left(\dfrac{f}{g}\right)(x) = \dfrac{(x^2 + 5x - 1)}{(3x - 2)},\ x \neq \frac{2}{3}$

$\boxed{\frac{3x \neq 0}{+2}\ \frac{+2}{3x = 2}\ \frac{3x}{3} = \frac{2}{3}\ x \neq \frac{2}{3}}$

Composition of Functions—taking the output (y-value) of one function and making it the input (x-value) of another function.

Consider this . . . .

You have a coupon for $25 off at __Hollister__.

There is also a 30% off sale for the __Jeans__ that you want to buy.

↳ .3

Does the order in which these discounts are taken matter?

Original Price	1st Discount 50	2nd Discount	Sale Price
$50	$50 • .3 = $15 ↗ $35	$35 ~ $25 =	$10
$50	$50 – $25 = $25	$25 • .3 = $7.50 $25 - $7.50	$17.50

So . . . . . it is better for the shopper to_____.

Remember . . . . .
   Domain: the set of all input values
   Range: the set of all output values

<u>*Definition of Composition of Functions:*</u> The composition of function f with function g is written
$f \circ g(x) = f(g(x))$.

DOES NOT MEAN MULTIPLICATION

START ON THE INSIDE & WORK YOUR WAY OUT!!!

Let's Watch a Video: http://www.youtube.com/watch?v=S4AEZElTPDo

$f(x) = x^2 + x$ $\qquad\qquad$ $g(x) = 4 - x$

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

$= (4-x)^2 + (4-x)$
$= (4-x)(4-x) + 4-x$

| ×	4	−x
4	16	−4x
−x	−4x	x² |

$= x^2 - 8x + 16 + 4 - x$
$= x^2 - 9x + 20$

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

$= 4 - 1(x^2 + x)$
$= 4 - x^2 - x$
$= -x^2 - x + 4$

I.   Finding a value of a composition given a function

Given $f(x) = x+5$ and $g(x) = x^2 - 2.$ Evaluate each expression.

a. 2nd 1st $f(g(3)) =$
$g(3) = (3)^2 - 2 = 7$
$f(7) = (7) + 5 = 12$

b. $g(f(3)) =$
$f(3) = (3) + 5 = 8$
$g(8) = (8)^2 - 2 = 62$

II.   Finding a composition equation given functions

Given $f(x) = 3x-2$ and $g(x) = -2x +4$

Find $f \circ g(x)$ $f(g(x))$
$= 3(-2x+4) - 2$
$= -6x + 12 - 2$
$= -6x + 10$

Find $g \circ f(x)$ $g(f(x))$
$= -2(3x-2) + 4$
$= -6x + 4 + 4$
$= -6x + 8$

REMEMBER!!!
$f \circ g(x) = f(g(x))$
NOT
$f(x)g(x)$
Composing is NOT MULTIPLICATION!

Function Composition Practice!

1. Find $(f \circ g)(x)$ and $(g \circ f)(x)$ for $f(x) = x + 3$ and $g(x) = x^2 + x - 1$.

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

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

| ×	x	3
x	x²	3x
3	3x	9 |

$= x^2 + 6x + 9 + x + 2$
$= x^2 + 7x + 11$

2. Evaluate $(f \circ g)(x)$ and $(g \circ f)(x)$ for $x = 2$.

$f(g(2)) = (2)^2 + (2) + 2$
$= 4 + 4$
$= 8$

$g(f(x)) = (2)^2 + 7(2) + 11$
$= 4 + 14 + 11$
$= 29$

3. Find $(g \circ h)(x)$ and $(h \circ g)(x)$ if $g(x) = 2x$ $h(x) = x^3 + x^2 + x + 1$

$$= 2(x^3 + x^2 + x + 1)$$
$$= 2x^3 + 2x^2 + 2x + 2$$

$$= (2x)^3 + (2x)^2 + (2x) + 1$$
$$= 8x^3 + 4x^2 + 2x + 1$$

4. If $f(x) = x^2 - x$ and $g(x) = x - 1$, what is $f(g(x))$?

$$= (x-1)^2 - (x-1)$$
$$= x^2 - 2x + 1 - x + 1$$
$$= x^2 - 3x + 2$$

5. A box of laundry detergent sells for $3.25. The price the store pays is determined by   the function $f(x) = x - 1$, where x is the selling price of the detergent. The wholesale   price is determined by $g(x) = x - .75$, where x is the price the store pays. What is the   wholesale price?

APPLICATIONS

6. A store is offering a 10% discount on all items. In addition, employees get a 25% discount.

a. Write a composite function to model taking the 10% discount first.

b. Write a composite function taking the 25% discount first.

c. Suppose you are an employee. Which discount would you prefer taken first?

7. Tyrone Davis has $180 deducted from every paycheck for retirement. He can have these deductions taken before taxes are applied, which reduces his taxable income. His federal income tax rate is 18%. If Tyrone earns $2200 every pay period, find the difference in his net income if he has the retirement deduction taken before taxes or after taxes.