Honors PreCalculus Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notes – Unit 1, Day 4

1. **The twelve basic Functions:**

Please see the attached copy of The Twelve Basic Functions on the back. You ARE responsible for knowing the general equation and look of the graphs for ALL TWELVE.

RECALL Functions such as the GREATEST INTEGER FUNCTION. This function works by taking the number inside and ROUNDING DOWN…

Notation: [x] - however, the calculator notation is int(x). Your textbook uses the calculator notation.

Ex: [3.2] means “find the integer that is closest to 3.2 without going over.”

Answer: 3

Ex: [4.7] = \_\_\_\_\_\_

Ex: [2.999999999] = \_\_\_\_\_\_

Negatives are tricky…

Ex: [-2.1] = -3

Ex: [-4.3] = \_\_\_\_\_\_

With the graph… it looks like a staircase because the y values have all been rounded down to nice integers. Please note that one end of each “stair” is an open circle. This is sometimes called the “Step Function.”

1. **Compositions:**

**Ex 1:** If g(x) = x2 – 4, then find the following: [It helps to rewrite the function as g( ) = ( )2 – 4]

a. g(3) = c. g(d + 1) =

b. g(-4) = d. g(2x) =

We will look at multiple functions at one time. We ALWAYS start inside the ( ) – which will be the furthest to the right...

**Ex 2:** f(z) = -z + 4 and h(z) = 2z. Find the following:

1. f(h(3)) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. h(f(-5)) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. h(h(8)) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. (h(f(2)) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTATION: f(g(\_\_)) = (**$f∘g$**)(\_\_\_)**

**Ex 3:** g(x) = x2 + 3 and j(x) = x – 1. Find the following:

1. = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. j(g(j(0))) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A ***Composition Function*** is the result of plugging one function into another.

**Ex4:** Find the composition function, f(g(x)), for f(x) = x + 1 and g(x) = x2.

This really means .

Think of it this way: given f(x) = x + 1, find f(x2). f(x2) = , so f(g(x)) = .

**Ex 5:** f(x) = 3x + 5 and g(x) = x – 2. Find . This means f(g(x)).

Rewrite the problem: f( \_\_\_\_ ) = 3( \_\_\_\_\_ ) + 5. What goes in the blanks?

**Ex 6:** h(x) = x2 – 1 and p(x) = 2x. Find and .

: h( \_\_\_\_) = ( \_\_\_\_ )2 – 1 : p( \_\_\_\_\_\_ ) = 2( \_\_\_\_\_\_\_ )

**Ex 7:** f(x) = 2x2 and g(x) = x + 3. Find the following:

a. f(g(x)) = \_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. f ° g(3) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. (g ° f)(x) = \_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_ d. g(f(-2)) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**When the functions get complicated, finding the DOMAIN of the composition is tricky.**

**Ex:** f(x) = x2 + 1 and g(x) =$\sqrt{x}$

1. Find the domain of f(x): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Find the domain of g(x): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Find f(g(x)): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Find g(f(x)): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Because the domain of g(x) is restricted (it isn’t “all real numbers”), it will restrict your answer for the composition:*

1. Find the DOMAIN of f(g(x)): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (it isn’t “all reals”)
2. **De-composing:**

This is essentially working backwards. I will give you the result of f(g(x)) and you will have to find f(x) and g(x). You can do it!

**Ex:** Decompose: f(g(x)) = $\sqrt{x-1}$ *\*\* Try to think to yourself, “Self, what is the mother function here?” Once you identify that… you have identified f(x). Then ask yourself, “Self, what was plugged into the mother function to produce this result?”*

Answer: mother function would be $\sqrt{x}$, so f(x) = $\sqrt{x}$. g(x) would therefore = x – 1.

**Ex:** f(g(x)) = $\frac{2}{3x+1}$. Find f(x) and g(x).

1. **Implicitly Defined Functions:**

An implicitly defined function is one that in and of itself FAILS the vertical line test, however it can be re-written as 2 separate expressions that are functions individually!

To do these problems, you need to get y by itself as if you were going to graph it in the calculator.

Ex: Rewrite as implicitly defined functions: x2 + y2 = 4.

This is a CIRCLE (not a function).

Process is to get y by itself: y2 = – x2 + 4

 y = $\pm \sqrt{-x^{2}+4}$

So, to graph this in the calculator, we would graph y1 = $\sqrt{-x^{2}+4}$ and y2 = $-\sqrt{-x^{2}+4}$ where individually, those are each functions!

**Ex:** x2 + 2xy + y2 = 1 (hint: factor the left side first)

Graph your answer(s) and see what the original equation represents! \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Ex:** Find the implicitly defined functions for: $x^{2}+\left(y-\sqrt[3]{x^{2}}\right)^{2}=1$.

Graph to see what this equation represents! \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_