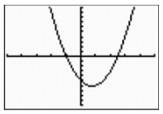
Math-3A HANDOUT 6-1 (Compositions of Functions)

1. Is the following relation a function?

(-2, 5), (5, 6), (-2, 6), (7, 6)

2. Is the following relation a function?



Does the graph of the relation pass the "_____"?

Function Notation $y = f(x)$ "y is a function of x"

'y' equals "math being done to" 'x'

A function is a rule that matches input values to output values.

$f(x) = 2x + 1$

(Input) x	(rule) 2x + 1	(output) y
2	2(2) + 1	5
3	2(3) + 1	7

f(2) = 5

f(3) = 7

Compositions of Functions $f(x) = 2x$ → f(3) = ?

Means: "replace 'x' in the function with a 3.

1. Replace the 'x' with a set of parentheses.

f(3) = 2( )

2. Put the input value '3' into the parentheses.

f(3) = 2(3)

3. Find the output value.

f(3) = 6

Compositions of Functions

$f(x) = x^2 - 3x + 2$ → f(2) = ?

1. Replace the 'x' with a set of parentheses.

$$f(x) = (\ )^2 - 3(\ ) + 2$$

2. Put the input value '2' into the parentheses.

$$f(x) = (\ )^2 - 3(\ ) + 2$$

3. Find the output value.

f(2) = _____

Cool, we found a _____.

$f(x) = x^3 - 1$ $\quad f(-2) = ?$

$f(x) = 2x^{1/2}$ $\quad f(9) = ?$

$f(x) = \dfrac{2(x-4)}{x^2 + x - 20}$ $\quad f(-2) = ?$

$f(x) = 3x - 1$

(Input) x	(rule) 3x - 1	(output) f(x)
2	3(2) - 1	
x^2	3( ) - 1	5
$x + 2$	3( ) - 1	
$3 - 2x$	3( ) - 1	

Your turn: $f(x) = x^2 + 1$
input the expressions

$f(2) = ? \quad = 5$

$f(x^3) = ?$

$f(x+2) = ?$

$f(-2x+3) = ?$

Compositions of Functions

f(x) = 2x and $g(x) = x^2$

Let's use f(x) as the input to g(x) $g(f(x)) = ?$

$g(..) = (..)^2$ 1. Replace the 'x' with a set of parentheses.

$g(2x) = (2x)^2$ 2. Put the input value "2x' into the parentheses.

$g(f(x)) = 4x^2$ 3. Find the output value.

Function "composition"

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

$f(2) = ?$ What does this mean?

"_____"

$f(g(x)) = ?$ What does this mean?

"_____"

"Which means the same as…"

"_____"

Composition of Functions

f(x) = 2x + 1 $\quad$ g(x) = 3x + 2 $\quad$ h(x) = x + 5

$f(g(x)) = ?$

$h(g(x)) = ?$

$h(f(x)) = ?$

$g(h(x)) = ?$

$f(f(x)) = ?$

New Notation for the Composition of Functions

$(f \circ g)(x) = f(g(x))$ "g" plugged into rule "f"

$f(x) = 4x - 1$ $\quad g(x) = -5x + 3$

$(f \circ g)(x) = ?$ $\quad = 4(\quad) - 1$ $\quad = 4(-5x + 3) - 1$

"g" plugged into rule "f" $(f \circ g)(x) =$ _____

$(g \circ f)(x) = ?$ $= -5($_____$)$ $= $ _____

$+ 3$

"f" plugged into rule "g" $(g \circ f)(x) =$ _____

$(f \circ f)(x) = ?$ $= $ _____ $= $ _____

"f" plugged into rule "f" $(f \circ f)(x) =$ _____

$(g \circ g)(x) = ?$ $= $ _____ $= $ _____

"g" plugged into rule "g" $(g \circ g)(x) =$ _____

One more layer!

$f(x) = 3x$ $\quad g(x) = x^2$

$f(g(4))$

4

$g(\quad) = (\quad)^2$

$g(4) = (4)^2$

_____

$f(\quad) = 3(\quad)$

$f($___$) =$ _____

_____