Lesson 1.12-Objective- SWBAT find the compositions of functions.

Kickoff- Given $f(x) = 5x + 1$ and $g(x) = x^2 + x$ find each of the following:

1) $g(f(-1))$ 2) $f(g(3))$

$f(x) = 5(-1)+1 = -4$

$g(-4) = (-4)^2 + (-4) = 12$

$g(3) = 3^2 + 3 = 12$

$f(12) = 5(12)+1$

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① 11 ④ $4x^2 - 40x + 103$

② 17 ⑤ $x^2 + 6x + 9$

③ 0 ⑥ $3x - 4$

④ $j(a(x))$ $j(x) = x^2 + 3$, $a(x) = 2x - 10$

$(2x-10)^2 + 3$

$(2x-10)(2x-10) + 3$

$4x^2 - 20x - 20x + 100 + 3$

$4x^2 - 40x + 103$

Composition of Functions- The application of one function follows that of another.
(Applying one function to another)

Notation: Compositions can be shown as $f(g(x))$ when you have two functions, $f(x)$ and $g(x)$

OR

Compositions can be shown as $(f \circ g)(x)$ *

However, the most important thing is that you complete the INSIDE or RIGHT function first and then continue to the OUTSIDE or LEFT function.

*When there is a # start with the right!

Examples: Given $f(x) = 3x - 2$ and $g(x) = x^2 - 3$ find each of the following:

1) $(f \circ g)(-3)$

$g(-3) = (-3)^2 - 3 = 6$

$f(6) = 3(6) - 2 = 16$

2) $(g \circ f)(2)$

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

$g(4) = (4)^2 - 3 = 13$

3) $g(f(-4))$

$3(-4) - 3 = -14$

$(-14)^2 - 3 = 193$

4) $f(g(6))$

$g(x) = (6)^2 - 3 = 33$

$\rightarrow f(x) = 3(33) - 2 = 97$

5) If $f(x) = 3x + 5$ and $g(x) = x^2 - 2$, find $(f \circ g)(-3)$

$g(-3) = (-3)^2 - 2 = 7$

$f(7) = 3(7) + 5 = 26$

6) If $h(x) = x + 7$ and $j(x) = x^2 - 4$, find $h(j(2))$

$(2)^2 - 4 = 0$

$h(0) = 0 + 7 = 7$

Letters = Left

However, we can also complete compositions of functions without evaluating. To do this, you substitute the INSIDE or RIGHT function for every time you see x in the OUTSIDE or LEFT function.

*Start with the left!

Examples: Given $f(x) = 3x - 2$ and $g(x) = 5x - 3$ find each of the following:

7) $(f \circ g)(x)$

$3(5x-3) - 2$

$15x - 9 - 2$

$15x - 11$

8) $g(f(x))$

$5(3x-2) - 3$

$15x - 10 - 3$

$15x - 13$

9) If $m(x) = 2x^2 + 3$ and $k(x) = x + 7$, find $(k \circ m)(x)$

10) If $a(x) = 4x - 1$ and $b(x) = x^2 - 4$, find $a(b(x))$

Mixed Practice: **Remember if there is a number inside, substitute the number! Otherwise, substitute the function!!

1) If $h(x) = x + 7$ and $j(x) = x^2 - 4$, find $h(j(2))$

2) If $g(x) = 3x$ and $k(x) = x^2 - 2x$, find $(g \circ k)(x)$

3) If $f(x) = 2x - 1$ and $h(x) = x^2 + 1$, find $(h \circ f)(-4)$

4) If $f(x) = x^2$ and $g(x) = 2x - 4$, find $(f \circ g)(x)$