

Composition of Functions

The COMPOSITION of f with g is

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

Ex. Given: $f(x) = 2x$, $g(x) = 8x - 6$

means take
 $g(x)$ function
and plug it
into $f(x)$
function

$$f(g(x)) = f(8x - 6) = 2(8x - 6) = \boxed{16x - 12}$$

Now, evaluate $f(g(5))$ two ways ...

$$g(5) = 8(5) - 6 \\ = 34$$

Substitute $\rightarrow f(34) = 2(34)$

$$\boxed{f(g(5)) = 68}$$

Ex. Given: $f(x) = 2x$, $g(x) = 8x - 6$

$$g(f(x)) = g(2x) = 8(2x) - 6 \\ = \boxed{16x - 6}$$

$$f(f(x)) = f(2x) = 2(2x) \\ = \boxed{4x}$$

Ex. Given: $f(x) = x^2 - 2x - 15$, $g(x) = x + 3$

$$f(g(x)) = f(x+3) = (x+3)^2 - 2(x+3) - 15 \\ = x^2 + 6x + 9 - 2x - 6 - 15 \\ = \boxed{x^2 + 4x - 12}$$

$$g(f(x)) = g(x^2 - 2x - 15) = x^2 - 2x - 15 + 3 \\ = \boxed{x^2 - 2x - 12}$$

$$g(g(x)) = g(x+3) = (x+3) + 3 \\ = \boxed{x+6}$$